GINNING COMPARISONS OF ULTRA NARROW ROW COTTON WITH COMMERCIAL AND MICRO GIN

Eugene P. Columbus and M. Herbert Willcutt
Mississippi State University
Mississippi State, MS
Tommy D. Valco
Cotton Incorporated
Cary, NC

Abstract

Cotton grown on a Mississippi Delta farm in ultra narrow rows was machine stripped and then ginned in a commercial gin using an experimental machinery sequence and a conventional picker machinery sequence. During ginning some of the seed cotton was saved and ginned in the USDA Micro Gin using USDA stripper and picker machinery sequences. Very few differences were detected in USDA classer data, High Volume Instrument and Advanced Fiber Information System measurements for the various ginning techniques. Neither turnout nor bale value were different for the two machinery sequences in either gin. Only neps were increased by the experimental machinery sequence in the commercial gin.

Introduction

Research on narrow row cotton began around 1953 in Lubbock, TX, and lasted only three years due to problems with weed control (Ray and Hudspeth, 1966). From one test, they reported a 27% reduction in production costs. In 1967, Briggs and Patterson asked the question "Can we (in Arizona) afford to produce cotton selling for $0.20 a pound?" They began looking at narrow row cotton to reduce costs and concluded that their studies indicated narrow rows coupled with higher plant populations had the potential to produce better yields with lower production costs.

Studies on row configuration and plant density continued into the 1970's with the main concern being producing higher yields and reducing production costs. Heilman, et al. (1975) indicated that lint yields were higher for certain cultivars produced on 27 inch rows as compared to 40 inch rows. They also said that one of the studies showed a trend for higher yields for increased plant density.

Harvesting methods of narrow row cotton were also investigated and it appeared that stripper harvesters would probably be used. Luckett, et al. (1975) evaluated two experimental harvesters using cotton grown on rows ranging from 10 to 40 inches. No mention of yield differences were made, but classer's grade, staple length, and other quality factors were not affected. Anderson, et al. (1984) evaluated several varieties, several plant populations, and two row spacings in the Coastal Bend of Texas. They found that the 38 inch row cotton had higher yields than the 20 inch cotton, however, this was the first year that this trend was observed. Economic data indicated that for all plant populations the cotton grown on 38 inch rows returned more money per acre than did the 20 inch row cotton.

Ultra narrow row (UNR) has been the subject of several studies in the 1990's, this system refers to cotton planted in 7.5 to 15 inch rows. A three year study in Arkansas, Vories, et al. (1999) showed higher seed cotton yields when compared to 38 inch row cotton, however, lower gin turnout reduced a portion of the increased yields. Micronaire was the only High Volume Instrument (HVI) measurement that was significantly lower for the UNR cotton compared to the conventional cotton. Advanced Fiber Information System (AFIS) indicated more visible foreign matter, higher short fiber content, and more neps in the UNR cotton than the conventional cotton. Production costs were also higher for the UNR cotton, however, this was due to a seed treatment that the conventional cotton did not receive.

Field demonstrations of UNR cotton were conducted at several locations in Georgia during 1998 using row spacing of 7, 8, 10, 30, and 36 inch rows, Bader, et al. (1999). At one location the 7 and 10 inch out produced the 36 inch cotton by 80 and 452 lb/ac of lint, respectively. The UNR yielded more than the conventional cotton at the other sites but not as dramatic. Bader, et al. (2000) again looked at UNR in Georgia and found that 10 inch row cotton had a higher yield than 36 inch row in a non-irrigated test. However, in a second test 20 inch row cotton yielded more lint than 10, 30 or 36 inch cotton.

Anthony, et al. (1999) ginned UNR cotton from 10 areas across the Midsouth and Southeast that was grown on row widths that ranged from 7.5 to 38 inches. They found that lint turnout at the gin ranged from 29.8 to 34.9% for the UNR and conventional grown cotton, respectively. Another finding was that marketing classifications including foreign matter for UNR stripped cotton was not different from conventionally produced spindle-harvested cotton.

Purpose

Data from the above studies seem to indicate differences in yield and quality can be expected from growing narrow row cotton. Thus it seems that if one could obtain additional yields growing narrow row cotton without sacrificing lint quality, which translates to price differences, this practice would have merit. The purpose of the tests reported herein was to look at the ginning differences in UNR cotton both at a commercial and small-scale gin.

Materials and Methods

Hood Big Gin Test

Delta and Pine Land 425RR® cotton was planted for these two tests on 10 inch rows at Hood Brothers Farm, Perthshire, MS, and harvested with a finger stripper. Eleven modules were stripped and stored on the gin yard for about two weeks before ginning using two sequences of equipment in the gin. Sequence 1 included a module feeder, feed control, tower drier, cylinder cleaner, stick machine, tower drier, cylinder cleaner, extractor-feeder, gin stand, and split lint cleaners. Sequence 2 included a module feeder, feed control, jet drier, tube density separator, cylinder cleaner, experimental stick machine (New Products and Innovations, 1999), tower drier, inclined cleaner, stick machine, tower drier, cylinder cleaner, extractor-feeder, gin stand, and split lint cleaners. Samples were taken during ginning to determine initial and feeder apron moisture and foreign matter contents as well as lint moisture, AFIS and HVI determinations. Samples were also taken from every third bale per module to gin in the USDA Micro Gin.

Micro Gin Test

As each module was being ginned at the Hood Gin, three samples (30 - 45 lb each) were taken at three times from the module feeder to be the second part of the study. This seed cotton was ginned in the Micro Gin at Stoneville, MS, using the USDA recommended machinery sequences for stripper harvested and for picker harvested cottons. Sequence 1 (stripper cotton) included a feeder control, tower drier (125° F), cylinder cleaner, stick machine, tower drier (100° F), trashmaster, stick machine, extractor-feeder, gin stand and two lint cleaners. Sequence 2 (picker cotton) included a feed control, tower drier (125° F), cylinder cleaner, stick machine, tower drier (100° F), trashmaster, extractor-feeder, gin stand, and two lint cleaners. This part of the experiment was ginned two months after the "Hood Big Gin Test," therefore, they should be the same moisture content. Thus, it was decided not to take feeder apron moisture samples but we visually watched it using the moisture meter mounted in the hopper above

Reprinted from the *Proceedings of the Beltwide Cotton Conference*
Volume 2:1365-1369 (2001)
National Cotton Council, Memphis TN

the feeder. Samples were taken during ginning to determine initial and feeder apron foreign matter contents as well as lint moisture, AFIS and HVI determinations.

The data was subjected to SAS PROC GLM® (2000) for analysis and mean separation was performed using the Student's T test at the 0.05 level of probability.

Results and Discussion

Hood Big Gin Test

Analysis of variance for the initial conditions and lint moisture are shown in Table 1. The cotton for this test was machine stripped and placed in modules about two weeks prior to ginning, therefore, it was felt that the moisture levels were fairly consistent. Initial and feeder apron foreign matter and lint moisture contents were not statistically different for the two machinery treatments. Table 2 contains the analysis of variance for classer staple, micronaire, HVI measurements, bale value, and turnout measurements. Only yellowness and HVI length showed a significant difference as a result of the gin machinery treatments. Analysis of variance for the AFIS measurements are shown in Table 3. Only neps per gram and immature fiber content were affected significantly by the machinery treatments.

After the initial and feeder apron moisture contents were determined, it appeared that our assumption that there were no differences was correct, Table 4. Initial moisture content was 10.9 and 11.2% while feeder apron moisture was 8.3 and 8.1% for the conventional and experimental machinery treatments, respectively. Initial foreign matter was 23.7 and 24.7% and foreign matter at the feeder apron was 9.3 and 8.7% for the conventional and experimental machinery treatments. Lint moisture was 5.1 and 5.2% for the two treatments with the very small difference being the rainy weather that was occurring during the ginning of the experimental machinery portion of the test.

Means for classer staple, HVI measurements, turnout, and bale value are shown in Table 5. Classer staple was 33.9 and 34.2 32nd of an inch for the conventional and experiment gin machinery treatments, respectively. Micronaire readings were identical at 4.3 for both treatments. Strength was almost the same for the experimental machinery treatment 25.1 gm/tex versus 24.9 gm/tex for the conventional treatment. Turnout was very close for the two treatments, 25.9 to 25.6% for the conventional and experimental machinery, respectively. Bale value was extremely close for both treatments, $278.79 for the conventional machinery and $278.31 for the experimental machinery. Reflectance was only 0.6 Rd points different for the two treatments with the conventional machinery being lower (74.3 Rd). While the analysis of variance indicated a significant difference in yellowness +b, the values were very close at 8.2 and 8.0 for the conventional and experimental treatments, respectively. Length was significantly longer for the experimental treatment, 106.6 hundredth of an inch verses 105.2 hundredth of an inch for the conventional treatment. Uniformity for both treatments were almost identical at 80.4 and 80.5 for the conventional and experimental machinery treatments, respectively.

Table 6 contains the means for the AFIS measurements. Nep content was higher for the experimental machinery, 386.8 neps/gm while the conventional machinery treatment resulted in 350.1 neps/gm. Short fiber content was very close at 9.9 and 9.8% for the conventional and experimental machinery treatments. Visible foreign matter content was higher for the conventional machinery, though not statistically, 2.38% versus 2.02% for the experimental machinery. Immature fiber content was statistically higher for the experimental machinery (7.07%) while the conventional machinery had 6.83%, which is probably not a meaningful difference.

Micro Gin Test

Analysis of variance for the measured parameters are shown in Table 1. The cotton for this test was machine stripped about two and a half months prior to ginning this test, therefore, it was felt that the moisture levels were fairly consistent. Initial moisture, foreign matter, and lint moisture contents were not statistically different for the two machinery treatments. Feeder moisture contents were monitored electronically and stayed in the 5% range. Feeder apron foreign matter was significantly different for the two gin treatments. Table 2 contains the analysis of variance for classer staple, HVI, bale value, and turnout measurements. Only strength showed a significant difference as a result of the gin machinery treatments. Analysis of variance for the AFIS measurements are shown in Table 3. None of the parameters were affected significantly by the machinery sequences.

Initial moisture contents was 10.9 and 10.6% for the machine stripped and machine picked sequences, respectively, Table 4. Initial foreign matter content was 23.8 and 24.4% while feeder apron foreign matter was 7.8 and 9.9% for the machine stripped and machine picked sequences, respectively. This reduction in foreign matter at the feeder apron for the machine stripped treatment was due to the addition of a second stick machine in the sequence. Lint moisture was 5.2 and 5.2% for the two treatments.

Means for classer staple, HVI measurements, turnout, and bale value are shown in Table 5. Classer staple was 35.7 and 35.9 32nd of an inch machine stripped and machine picked gin sequences, respectively. Micronaire readings were identical at 4.3 for both treatments. Strength was almost the same for the machine stripped sequence 28.3 gm/tex versus 28.6 gm/tex for the machine picked sequence. Turnout was very close for the two machinery sequences, 25.9 to 25.8% for the stripper and picker machinery sequences, respectively. Bale value was close for both treatments, $290.22 for the stripper machinery and $288.36 for the picker machinery. Reflectance was only 0.2 Rd points different for the two treatments with the stripper machinery being higher (74.1 Rd). Yellowness +b values were close at 8.0 and 7.9 for the stripper and picker machinery sequences, respectively. Length was only 0.5 hundredths of an inch longer for the picker machinery treatment than the stripper sequence (111.0 hundredth of an inch). Uniformity for both treatments were identical at 80.5.

Table 6 contains the means for the AFIS measurements. Nep content was higher for the stripper machinery sequence, 292.5 neps/gm while the picker machinery treatment resulted in 284.5 neps/gm, however, as stated earlier this was not significant. Short fiber content was very close at 7.4 and 7.2% for the stripper and picker machinery sequences, respectively. Visible foreign matter content was 2.99% for the stripper machinery while it was 3.19% for the picker machinery sequence. Immature fiber content was 6.03% for the stripper sequence and 5.98% for the picker machinery sequence.

Summary and Observations

Cotton grown on ultra narrow rows was machine harvested with a finger stripper equipped with a bur extractor, placed into eleven modules, then ginned in a commercial gin using an experimental machinery sequence and a conventional picker machinery sequence. During ginning, some of the seed cotton was saved and ginned in the USDA Micro Gin using USDA stripper and picker machinery sequences.

Only yellowness, HVI length, neps and immature fiber content were significantly affected by the machinery treatments in the commercial gin. For these data, the experimental machinery sequence had better readings for yellowness and HVI length while the conventional machinery had better readings for neps and immature fiber content. Only feeder apron foreign matter content was significantly affected by the machinery sequences for the cotton ginned in the Micro Gin. Feeder apron foreign matter was lower

for the cotton ginned with the stripper machinery sequence than the other treatment.

Acknowledgments

The authors would like to sincerely thank Hood Brothers Farm, Perthshire, MS, for producing the cotton, for the use of their cotton gin and their gracious assistance and patience in completing this project. Appreciation is also extended to personnel of the USDA, Cotton Ginning Research Unit, Stoneville, MS, for their help in ginning a portion of the project. Also, appreciation is extended to Cotton Incorporated for funding.

References

Anthony, W. Stanley, William D. Mayfield, and Thomas D. Valco. 1999. Results of 1998 ginning studies of ultra narrow cotton. Proceedings Cotton Production Research Conferences, National Cotton Council, Memphis, TN. pp. 1484-1488.

Bader, Michael J., S. Wesley Smith, Rick Reed, Richard McDaniel, Lannie L. Lanier, and Chuck Ellis. 1999. UNR farm trials in Georgia 1998. Proceedings Cotton Production Research Conferences, National Cotton Council, Memphis, TN. pp. 1482-1484.

Bader, Michael J., Phillip M. Roberts, and Glendon H. Harris. 2000. UNR cotton studies conducted in Georgia 1999. Proceedings Cotton Production Research Conferences, National Cotton Council, Memphis, TN. pp. 436-437.

Briggs, Robert E. and Lloyd L. Patterson. 1969. Narrow row spacing of cotton. Proceedings Cotton Production Research Conferences, National Cotton Council, Memphis, TN. pp. 102-103.

Darwin, J. Anderson, Harvey L. Buehring, and Mark R. Walmsley. 1984. Narrow (20") and conventional (38") row spacing comparison of five commerically available short season cotton varieties in the coastal bend of Texas. Proceedings Cotton Production Research Conferences, National Cotton Council, Memphis, TN. pp. 125-126.

Heilman, L. N., L. N. Namken, and R. V. Cantu. 1975. Yield and fiber properties as affected by cultivar, row configuration, and plant population. Proceedings Cotton Production Research Conferences, National Cotton Council, Memphis, TN. pp. 87-91.

Luckett, K. E., Gordon Tupper, and Warren Garner. 1997. Evaluation of once-over harvesters in the Mississippi Delta. Proceedings Cotton Production Research Conferences, National Cotton Council, Memphis, TN. pp. 114. (Abstract)

New Products and Inovations. 1999. Ultra Narrow Row Cotton Ginning Equipment. Cotton Gin and Oil Mill Press, Vol. 100 No. 4.

Ray, L. L. and E. B. Hudspeth. 1966. Narrow row cotton production. Texas A&M Univ., Texas Agr. Exp. Sta. Current Research Report No. 66-5.

SAS User's Guide: Statistics. 2000. SAS Institute Inc., Cary, NC.

Vories, E. D., R. E. Glover, and K. J. Bryant. 1999. A three-year study of UNR cotton. Proceedings Cotton Production Research Conferences, National Cotton Council, Memphis, TN. pp. 1480-1482.

Table 1. Analysis of variance for foreign matter and lint moisture contents for the tests conducted in Hood Gin and Micro Gin.

		Mean squares for			
Source of variation	Degrees of freedom	Initial moisture	Initial foreign matter	Feeder foreign matter	Lint moisture
Test conducted in Hood Big Gin					
Gin equipment	1	–[1]	16.89ns	5.22ns	0.01ns
Error	9		121.21	11.30	0.14
Test conducted in Micro Gin					
Gin equipment	1	1.90ns	155.6ns	210.9**	0.02ns
Error	30	6.48	144.2	6.70	0.04

ns Denotes nonsignificance at the 5% probability level.
* Denotes significance at the 5% probability level
** Denotes significance at the 1% probability level.
[1] Initial and feeder moisture samples taken at Hood gin were not statistically analyzed.

Table 2. Analysis of variance for classer staple, HVI measurements, turnout, and bale value for the tests conducted in Hood Gin and Micro Gin.

		Mean squares for				
Source of variation	Degrees of freedom	Classer staple	Mike	Strength	Turnout	Bale value
Test conducted in Hood Big Gin						
Gin equipment	1	3.09ns	3.22ns	0.94ns	0.15ns	4.48ns
Error	9	0.68	4.89	0.66	0.47	99.16
Test conducted in Micro Gin						
Gin equipment	1	1.33ns	3.52ns	5.74*	0.24ns	166.5ns
Error	30	0.55	3.92	1.10	0.56	84.16

ns Denotes nonsignificance at the 5% probability level.
* Denotes significance at the 5% probability level
** Denotes significance at the 1% probability level.

Table 2. Continued.

		Mean squares for			
Source of variation	Degrees of freedom	Reflect-ance	Yellow-ness	HVI length	HVI uniformity
Test conducted in Hood Big Gin					
Gin equipment	1	7.00ns	122.17*	49.03*	0.18ns
Error	9	1.87	12.38	6.59	0.45
Test conducted in Micro Gin					
Gin equipment	1	2.30ns	16.33ns	12.00ns	0.01ns
Error	30	1.07	30.50	4.74	0.39

ns Denotes nonsignificance at the 5% probability level.
* Denotes significance at the 5% probability level
** Denotes significance at the 1% probability level.

Table 3. Analysis of variance for AFIS measurements for the tests conducted in Hood Gin and Micro Gin.

Source of variation	Degrees of freedom	Mean squares for Neps per gram	Short fiber content	Visible foreign matter	Immature fiber content
Test conducted in Hood Big Gin					
Gin equipment	1	33418.7**	0.53ns	3.02ns	1.35*
Error	9	1772.1	0.99	0.67	0.23
Test conducted in Micro Gin					
Gin equipment	1	3088.0ns	2.06ns	1.79ns	0.10ns
Error	30	4435.9	1.10	0.75	0.32

ns Denotes nonsignificance at the 5% probability level.
* Denotes significance at the 5% probability level
** Denotes significance at the 1% probability level.

Table 4. Means for foreign matter and moisture contents for the tests conducted in Hood Gin and Micro Gin.

Gin equipment[1] [2]	Initial moisture, %[3]	Initial foreign matter, %	Feeder moisture, %[3]	Feeder foreign matter, %	Lint moisture, %
Test conducted in Hood Gin					
Conventional	10.9	23.7a[4]	8.3	9.3a	5.1a
Experimental	11.2	24.7a	8.1	8.7a	5.2a
Test conducted in Micro Gin					
Sequence 1	10.9a	23.8a	5.6	7.8b	5.2a
Sequence 2	10.6a	24.4a	5.5	9.9a	5.2a

[1] Conventional = USDA recommended machinery; Experimental = machinery manufactured by Vandergriff/American (New Products and Innovations, Cotton Gin and Oil Mill Press, 1999)
[2] Sequence 1 (stripper cotton) included a feeder control, tower drier (125º F), cylinder cleaner, stick machine, tower drier (100º F), trashmaster, stick machine, extractor-feeder, gin stand and two lint cleaners. Sequence 2 (picker cotton) included a feed control, tower drier (125º F), cylinder cleaner, stick machine, tower drier (100º F), trashmaster, extractor-feeder, gin stand, and two lint cleaners.
[2] Initial and feeder moisture samples taken at Hood gin were not statistically analyzed and feeder moisture at Micro Gin was electronically monitored.
[3] Means not followed by the same letter are significantly different at the 5% level of probability.

Table 5. Means for classer staple, HVI measurements, turnout, and bale value for the tests conducted in Hood Gin and Micro Gin.

Gin equipment[1,2]	Classer staple, 32nd in.	Mike, index	Strength, gm/tex	Turnout, %	Bale value, $
Test conducted in Hood Gin					
Conventional	33.9a[3]	4.3a	24.9a	25.9a	278.79a
Experimental	34.2a	4.3a	25.1a	25.6a	278.31a
Test conducted in Micro Gin					
Sequence 1	35.7a	4.3a	28.3a	25.9a	290.22a
Sequence 2	35.9a	4.3a	28.6a	25.8a	288.36a

[1] Conventional = USDA recommended machinery; Experimental = machinery manufactured by Vandergriff/American (New Products and Innovations, Cotton Gin and Oil Mill Press, 1999)
[2] Sequence 1 (stripper cotton) included a feeder control, tower drier (125º F), cylinder cleaner, stick machine, tower drier (100º F), trashmaster, stick machine, extractor-feeder, gin stand and two lint cleaners. Sequence 2 (picker cotton) included a feed control, tower drier (125º F), cylinder cleaner, stick machine, tower drier (100º F), trashmaster, extractor-feeder, gin stand, and two lint cleaners.
[3] Means not followed by the same letter are significantly different at the 5% level of probability.

Table 5. Continued.

Gin equipment[1,2]	Reflectance, Rd	Yellowness, +b	HVI length, hundredth of an inch	HVI uniformity, index
Test conducted in Hood Gin				
Conventional	74.3a[3]	8.2a	105.2b	80.4a
Experimental	74.9a	8.0b	106.6a	80.5a
Test conducted in Micro Gin				
Sequence 1	74.1a	8.0a	111.0a	82.5a
Sequence 2	73.9a	7.9a	111.5a	82.5a

[1] Conventional = USDA recommended machinery; Experimental = machinery manufactured by Vandergriff/American (New Products and Innovations, Cotton Gin and Oil Mill Press, 1999)
[2] Sequence 1 (stripper cotton) included a feeder control, tower drier (125º F), cylinder cleaner, stick machine, tower drier (100º F), trashmaster, stick machine, extractor-feeder, gin stand and two lint cleaners. Sequence 2 (picker cotton) included a feed control, tower drier (125º F), cylinder cleaner, stick machine, tower drier (100º F), trashmaster, extractor-feeder, gin stand, and two lint cleaners.
[3] Means not followed by the same letter are significantly different at the 5% level of probability.

Table 6. Means for AFIS measurements for the tests conducted in Hood Gin and Micro Gin.

Gin equipment[1,2]	Neps per gram, wt/gm	Short fiber content,%	Visible foreign matter,%	Immature fiber content,%
Test conducted in Hood Gin				
Conventional	350.1b [3]	9.9a	2.38a	6.83a
Experimental	386.8a	9.8a	2.02a	7.07b
Test conducted in Micro Gin				
Sequence 1	292.5a	7.4a	2.99a	6.03a
Sequence 2	284.5a	7.2a	3.19a	5.98a

[1] Conventional = USDA recommended machinery; Experimental = machinery manufactured by Vandergriff/American (New Products and Innovations, Cotton Gin and Oil Mill Press, 1999)

[2] Sequence 1 (stripper cotton) included a feeder control, tower drier (125º F), cylinder cleaner, stick machine, tower drier (100º F), trashmaster, stick machine, extractor-feeder, gin stand and two lint cleaners. Sequence 2 (picker cotton) included a feed control, tower drier (125º F), cylinder cleaner, stick machine, tower drier (100º F), trashmaster, extractor-feeder, gin stand, and two lint cleaners.

[3] Means not followed by the same letter are significantly different at the 5% level of probability.