# THE IMPACT OF HIGH SPEED ROLLER GINNING ON YARN QUALITY

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## ABSTRACT

Recent advances in cotton ginning technology have resulted in increases in the speed, throughput, and overall economics of roller ginning to make it competitive with conventional saw ginning. The present study was aimed at determining if the improvements in fiber quality, i.e. longer fibers with higher length uniformity and less short fiber actually translated into improved yarn spinning process and product quality. The study involved three ginning protocols on the same seed cotton: high speed roller ginning with no lint cleaning and conventional saw ginning with both one and three lint cleaning steps. Four different spinning treatments were included: carded ring, combed ring, carded compact, and combed compact spinning. The expected improvements in fiber length characteristics successfully translated into improvements in yarn quality for all four spinning treatments. Finally, for the first time, it was demonstrated that high speed roller ginning has a significant economic advantage over conventional saw ginning in that it has the potential of eliminating the costly combing process while producing yarns have quality similar to combed yarns.

## INTRODUCTION

There are two methods used to gin seed cotton including saw ginning and roller ginning. Saw ginning which is rather aggressive with a rapid throughput is used for ginning upland cottons (of medium length and fineness). Roller ginning, which is gentler and much slower, has historically be used with extra long staple (ELS) cottons such as Pima and the Gizas. Hughs and Lalor (1990) demonstrated that gentler and slower roller ginning produced fiber of better quality for several different cultivars. However, since roller ginning had a much lower production rate, it was reasoned that any advantage to improving the quality of the upland cotton would be erased by the economics of production. Building on the fact that Gillum (1985) achieved high roller ginning rates with Pima without damaging the fiber, Gillum and Armijo (2000) embarked on a project to redesign the roller gin so that it could effectively gin upland cottons in a way that was economically equal to saw ginning but could still yield superior fiber quality especially relative to length, length uniformity, and neps. Armijo and Gillum (2007) modified a conventional roller gin stand so that it would run at high speed. In doing this they increased the frequency of the ginning roller and rotary knife, increased the force between the ginning roller and stationary knife, experimented with a spray system but actually used air to cool the roller (which is currently used in the field), and modified the seed-cotton feeder for increased throughput. When ginning upland cotton, the high-speed roller gin stand ginned at a rate comparable to saw ginning. The high-speed roller gin stand had the same horsepower requirement of a saw gin stand. Roller ginning, when compared to saw ginning, produced upland fiber that was about one staple length longer, had less short fiber and neps, had higher turnout, but contained more foreign matter in the lint and cottonseed. The purpose of this study was to evaluate the product and process quality of the same cotton subjected to different ginning treatments so as to understand the have the phenomenon of high speed roller ginning affected various types of ring spinning. Finally, besides considering the impact on yarn quality we will also consider preliminary results relative to the practicality and possible economic advantages of high speed roller ginning.

## MATERIALS AND METHODS

The candidate variety chosen was Acala 1517-99 grown in the Mesilla Valley of New Mexico. Ginning treatments discussed in this paper were carried out at the ARS Southwestern Cotton Ginning Research Laboratory, Mesilla Park, New Mexico. They included:

- High Speed Roller Gin [HSRG(0)] (Consolidated Stand) followed by zero lint cleaning and no seed-cotton drying.
- High Capacity Saw Ginning [HCSG(1)] (46 saw cut down Double Eagle stand) followed by one lint cleaner and preceded by two stages of seed-cotton drying at 350º F for each stage.
- High Capacity Saw Ginning [HCSG(3)] (46 saw cut down Double Eagle stand) followed by three stages of lint cleaning and preceded by two stages of seed-cotton drying at 350º F for each stage.

It should be noted that this project was originally done to produce differing levels of short fiber to determine the effects of short fiber and micronaire on textile processing so the drying temperature was somewhat excessive. All seed cotton was processed through two 6-cylinder inclined cleaners and one stick machine for pre-cleaning regardless of gin stand used or drying temperature.

The cotton for each lot was processed through the opening and cleaning line at the Cotton Quality Research Station (CQRS), USDA-ARS, Clemson, SC at a throughput rate of 100 lbs/hr. The processing equipment consisted of three tandem opening hoppers, an Axi-Flo opener/cleaner, a GBRA hopper, an RN coarse cleaner, a RST multi-roll cleaner, a DX de-duster, and a DK-803 card (all from Truetzschler; Monchengladbach, Germany). In the case of ring spinning, after carding, six cans of 70 grain sliver were processed through a Rieter RSB 951 breaker drawing frame (Rieter; Winterthur, Switzerland) to form 60 grain sliver. This was then taken to a Rieter RSB 51 frame with leveled finisher drawing that produced 55 grain sliver. This was then creeled to a Zinser 660 Roving frame producing 1.0 hank roving. The roving bobbins were creeled onto a Zinser 321 ring spinning set to produce 30/1 Ne yarn with 4.1 TM. In the case of rotor spinning, after carding, six cans of 70 grain sliver were processed through a Rieter RSB 51 frame with leveled finisher drawing that produced 55 grain sliver. Alternatively, breaker sliver was formed into a comber lap using the Whitin Super Lapper. The lap was then combed on a Saco-Lowell CA

Comber. Raw cotton was characterized on the Uster 900 HVI and AFIS Pro. Processed fiber, sliver, and roving studied on the AFIS Pro. Ring and rotor yarns were sampled and studied with the Uster UT-5 and Statimat M.

## Results

HVI fiber properties resulting from the three ginning treatments are given in Table I. It is quite obvious that the high speed roller ginned cotton with no lint cleaning [HSRG (0)] is the trashier of the three treatments. This is confirmed by having the highest values of particle area, count, and leaf grade while exhibiting the lowest values for brightness and highest for yellowness. As was found in earlier studies, HSRG (0) has significantly longer staple and higher length uniformity. In addition, the micronaire for HSRG (0) appears to be somewhat higher than for the other saw ginning treatments. This might be a result of the fact that it is significantly trashier.

**Table I.** HVI fiber properties for the three ginning treatments

| ID | MIKE | RD | +B | %AREA | COUNT | LEAF | UHM | UNIF | STR |
|---|---|---|---|---|---|---|---|---|---|
| HSRG(0) | 4.34 | 77.68 | 7.45 | 1.04 | 85.00 | 5.00 | 1.22 | 84.95 | 29.38 |
| HCSG(1) | 4.15 | 79.65 | 8.13 | 0.26 | 35.25 | 2.75 | 1.15 | 81.68 | 31.20 |
| HCSG(3) | 4.14 | 81.05 | 8.18 | 0.10 | 12.75 | 2.00 | 1.10 | 80.10 | 29.00 |

Analysis of samples of raw fiber from the three ginning treatments using the AFIS Pro yielded the results shown in Tables II and III. Table II delineates fiber nep and length results for the three ginning treatments. As would be expected, saw ginning with additional lint cleaning results in large increases in nep counts, decreases in mean fiber length L(w) and upper quartile length UQL (w) – based on weight as well as the upper five percent length L5%(n) based on number. As should be expected, short fiber content, SFC (w), nearly doubles and then triples with increasing saw ginning and lint cleaning.

**Table II.** AFISPro nep and length results for the three ginning treatments.

| Sample | Neps per Gm | L(w) [in] | L(w) CV [%] | UQL (w) [in] | SFC (w) [%] | L5% (n) [in] |
|---|---|---|---|---|---|---|
| **HSRG(0)** | 195 | 1.10 | 32.6 | 1.30 | 5.5 | 1.48 |
| **HCSG(1)** | 302 | 0.96 | 37.7 | 1.20 | 10.8 | 1.36 |
| **HCSG(3)** | 459 | 0.91 | 39.9 | 1.14 | 13.0 | 1.31 |

You will find that Table III includes data on the non-lint content and maturity of the samples as measured with AFIS Pro. The amounts of dust and trash count, and visible foreign matter percent (**VFM)** more than double going from each step of diminished cleaning going from **HCSG (3)** to **HCSG (1)** to **HSRG (0).** Although the differences in seed coat neps (**SCN**) are not nearly as great between the three treatments the amounts diminish with the level of lint cleaning. Both the fineness (**Fine**) and maturity diminish (**Mat Ratio**) with lint cleaning and the immature fiber content (**IFC**) increases which is consistent within itself and also with HVI micronaire.

**Table III.** AFISPro results for overall trash contents and fineness and maturity for the three ginning treatments.

| Sample | Dust Cnt/g | Trash Cnt/g | VFM [%] | SCN (Cnt/g) | Fine [mTex] | IFC [%] | Mat Ratio |
|---|---|---|---|---|---|---|---|
| **HSRG(0)** | 1154 | 145 | 3.23 | 40 | 171 | 3.7 | 0.98 |
| **HCSG(1)** | 587 | 82 | 1.83 | 32 | 160 | 5.2 | 0.93 |
| **HCSG(3)** | 241 | 37 | 0.69 | 26 | 159 | 6.0 | 0.90 |

HVI and AFIS utilize machine vision and electro-optics to measure the non-lint particles of trash in cotton. In Table IV we include measurements made gravimetrically using the Shirley Analyzer ( ) on the three ginning treatments. The non-lint percent decreases with increasing degrees of lint cleaning at a rate approximately equal to that seen with the AFIS VFM. However, the VFM values are about half of the **Non-Lint (%).** Card Mat represents samples of the treated cottons collected at the input to the card.

**Table IV.** Results from measurements of trash from the treated samples made with the Shirley Analyzer.

| Sample | Process | Non-Lint (%) | Invisible (%) |
|---|---|---|---|
| **HSRG (0)** | Raw Stock | 6.86 | 1.56 |
| **HCSG (1)** | Raw Stock | 2.78 | 1.42 |
| **HCSG (3)** | Raw Stock | 1.11 | 1.25 |
| | | | |
| **HSRG (0)** | Card Mat | 1.87 | 0.77 |
| **HCSG (1)** | Card Mat | 1.01 | 0.72 |
| **HCSG (3)** | Card Mat | 0.77 | 0.68 |

The study included eight different spinning treatments: both 22/1's and 30/1's count yarns were processed into carded ring, combed ring, carded compact, and combed compact, respectively. Results from the 22/1's ring yarns produced from both carded and combed stock are shown in Table V. Data are included for breaking strength and elongation, irregularity (percent CV), the number of defects per thousand meters (includes thick and thin places and neps), and the Uster hairiness index. It can be seen that for, all three treatments ginning treatments, the effect of combing the stock before ring spinning results in increases in the corresponding yarn breaking strengths and elongations while lowering while significantly lowering the irregularity, number of defects and yarn hairiness. On closer inspection, breaking strengths and elongations decrease with the degree of lint cleaning. The maximum strength and elongation was associated with high speed roller ginned cotton with no lint cleaning. Yarn CV, defects, and hairiness all increase with the degree of lint cleaning with the minimum values resulting for the high speed roller ginned cotton with no lint cleaning.

**Table V.** Yarn quality factors for all three ginning treatments from 22/1's ring yarns produced from both carded and combed stock.

| **Sample** | **Process** | **Strength (g/tex)** | **Elong. (%)** | **Irr. C.V. (%)** | **Defects/ km** | **H (hairiness)** |
|---|---|---|---|---|---|---|
| HSRG (0) | Carded Ring | 18.98 | 6.37 | 13.37 | 107 | 5.25 |
| HCSG (1) | Carded Ring | 17.75 | 6.01 | 14.53 | 166 | 5.59 |
| HCSG (3) | Carded Ring | 17.18 | 5.93 | 15.41 | 273 | 5.84 |
| | | | | | | |
| HSRG (0) | Combed Ring | 20.69 | 6.51 | 10.77 | 12 | 4.92 |
| HCSG (1) | Combed Ring | 19.57 | 6.33 | 11.12 | 20 | 5.1 |
| HCSG (3) | Combed Ring | 19.05 | 6.18 | 11.22 | 14 | 5.27 |

In addition to ring spinning the effects of the three ginning treatments were also evaluated with compact spinning. Results for 22/1's count yarns from this portion of the test are shown in Table VI. The general experience with compact spinning is that it results in increased yarn strength along with marked reductions in CV, defects and hairiness. This was confirmed in this case since yarn strength was increased by at least 2 g/tex for both carded and combed yarns. There were similar improvements in CV, yarn defects and hairiness for both carded and combed yarns. As was the case for ring spinning, there remain some deleterious effects from the harsher saw ginning treatments. However, the combing process tends to make the yarns less sensitive to the differences in ginning treatments.

**Table VI.** Yarn quality factors for all three ginning treatments from 22/1's compact yarns produced from both carded and combed stock.

| Sample | Process | Strength (g/tex) | Elong. (%) | Irr. C.V. (%) | Defects/ km | H (hairiness) |
|---|---|---|---|---|---|---|
| HSRG (0) | Carded Compact | 21.14 | 6.57 | 11.52 | 23 | 3.89 |
| HCSG (1) | Carded Compact | 20.73 | 6.69 | 12.30 | 33 | 3.84 |
| HCSG (3) | Carded Compact | 19.78 | 6.36 | 12.48 | 49 | 4.24 |
| | | | | | | |
| HSRG (0) | Combed Compact | 22.45 | 6.73 | 9.96 | 12 | 3.72 |
| HCSG (1) | Combed Compact | 22.59 | 6.76 | 10.18 | 20 | 3.59 |
| HCSG (3) | Combed Compact | 21.08 | 6.33 | 10.23 | 14 | 3.70 |

Results from the 30/1's ring yarns produced from both carded and combed stock are shown in Table VII. In general, as finer yarns are produced, the tenacity decreases slightly and yarn quality, i.e. evenness, defects, and hairiness increase. Comparing the data from Table V with the present Table VII this is indeed the case. Likewise, as was the case for the 22/1's yarn, the quality of the yarn deteriorates somewhat as we compare high speed roller ginning with saw ginning and lint cleaning.

**Table VII.** Yarn quality factors for all three ginning treatments from 30/1's ring yarns produced from both carded and combed stock.

| Sample | Process | Strength (g/tex) | Elong. (%) | Irr. C.V. (%) | Defects/ km | H (hairiness) |
|---|---|---|---|---|---|---|
| HSRG (0) | Carded Ring | 18.27 | 6.12 | 15.35 | 444 | 4.73 |
| HCSG (1) | Carded Ring | 17.13 | 5.77 | 16.56 | 542 | 5.08 |
| HCSG (3) | Carded Ring | 15.86 | 5.62 | 17.74 | 896 | 5.35 |
| | | | | | | |
| HSRG (0) | Combed Ring | 19.49 | 6.19 | 12.19 | 35 | 4.35 |
| HCSG (1) | Combed Ring | 18.83 | 6.04 | 12.79 | 49 | 4.37 |
| HCSG (3) | Combed Ring | 17.31 | 5.51 | 12.87 | 49 | 4.77 |

Results from the 30/1's compact spun yarns produced from both carded and combed stock are shown in Table VIII. As was the case with Table VI, as the finer yarns are produced, the tenacity decreases slightly and yarn quality, i.e. evenness, defects, and hairiness increase. As was the case for the 30/1's ring yarn, the quality of the compact yarn deteriorates somewhat as we compare high speed roller ginning with saw ginning and lint cleaning.

**Table VIII.** Yarn quality factors for all three ginning treatments from 30/1's compact yarns produced from both carded and combed stock.

| Sample | Process | Strength (g/tex) | Elong. (%) | Irr. C.V. (%) | Defects/ km | H (hairiness) |
|---|---|---|---|---|---|---|
| HSRG (0) | Carded Compact | 20.59 | 6.48 | 13.03 | 234 | 3.56 |
| HCSG (1) | Carded Compact | 19.54 | 6.03 | 13.68 | 177 | 3.63 |
| HCSG (3) | Carded Compact | 19.23 | 6.15 | 14.61 | 303 | 3.83 |
| | | | | | | |
| HSRG (0) | Combed Compact | 21.93 | 6.59 | 10.90 | 20 | 3.05 |
| HCSG (1) | Combed Compact | 21.44 | 6.45 | 11.23 | 15 | 3.16 |
| HCSG (3) | Combed Compact | 20.48 | 6.18 | 11.36 | 23 | 3.26 |

Thus far we have been able to track the changes in yarn properties as a function of ginning treatments and fiber processing in terms of numerical values of the specific yarn parameters. We will now consider how these numerical values relate to similar yarns that have been produced throughout the world by using the Uster Statistics. Over the last several decades Zellweger Uster Technologies (now Uster Technologies) has collected fiber and yarn quality data from the world-wide textile industry. This data base now constitutes a benchmark to allow rating of textile products being produced by the industry. The UT-5 is programmed such that the parameters it measures (as seen above) are presented along with their Uster statistic. The statistics are presented as percentages relative to historical production data. In this system any grade between 25% and 50% is considered good and any grade less than 25 is premium.

A summary of the Uster Statistics for 22/1's spun from carded and combed stock into ring yarn and from combed stock into compact spun yarn is included in Table IX. Statistics are not available for compact carded ring yarns. This includes stats for strength, CV, cumulative defects, hairiness, and finally a composite score which comprises an average of these four factors with strength being given a weight of two. In general, the values for all parameters increase with the degree of cleaning which indicates a decrease in value. This is consistent with the trends of the composite scores. Note that combing the stock prior to compact spinning tends to equalize HSRG (0) with HCSG (1). Of the 36 individual statistics given in Table IX, 16 were in the premium range (<25) and another 16 were (>25 and <50).

**Table IX.** Uster Statistics for 22/1's ring yarns spun from carded and combed stock and from combed stock spun into compact yarns.

| Sample | Process | Strength | Irr. C.V. | Defects | H (hairiness) | Composite Score |
|---|---|---|---|---|---|---|
| HSRG (0) | Carded Ring | 28 | 25 | 22 | 17 | 26 |
| HCSG (1) | Carded Ring | 46 | 28 | 14 | 20 | 31 |
| HCSG (3) | Carded Ring | 55 | 46 | 30 | 29 | 43 |
| | | | | | | |
| HSRG (0) | Combed Ring | 28 | 18 | 4 | 26 | 21 |
| HCSG (1) | Combed Ring | 43 | 27 | 9 | 35 | 31 |
| HCSG (3) | Combed Ring | 52 | 29 | 6 | 44 | 37 |
| | | | | | | |
| HSRG (0) | Combed Compact | 51 | <5 | 3 | 29 | 27 |
| HCSG (1) | Combed Compact | 48 | 16 | 2 | 19 | 27 |
| HCSG (3) | Combed Compact | 68 | 19 | <5 | 27 | 36 |

A summary of the Uster Statistics for 30/1's spun from carded and combed stock into ring yarn and from combed stock into compact spun yarn is included in Table X. As was the case for Table IX, the values for all parameters increase with the degree of cleaning which indicates a decrease in value. This is consistent with the trends of the composite scores. Note that the values for the carded and combed ring yarns tend to be higher for the 30/1's yarns tend to be somewhat larger than for the 22/1's, while for some reason the values for the 30/1's combed and compact spun yarns tend to be lower than for the similar 22/1's yarns. Of the 36 individual statistics given in Table X, 16 were in the premium range (<25) and another 13 were classified as good(>25 and <50).

**Table X.** Uster Statistics for 30/1's ring yarns spun from carded and combed stock and from combed stock spun into compact yarn.

| Sample | Process | Stren. | Irr. C.V. | Defects | H (hairiness) | Composite Score |
|---|---|---|---|---|---|---|
| HSRG (0) | Carded Ring | 40 | 25 | 33 | <5 | 28 |
| HCSG (1) | Carded Ring | 56 | 53 | 35 | 14 | 43 |
| HCSG (3) | Carded Ring | 76 | 80 | 54 | 24 | 62 |
| | | | | | | |
| HSRG (0) | Combed Ring | 48 | 27 | 9 | 22 | 31 |
| HCSG (1) | Combed Ring | 59 | 43 | 17 | 23 | 40 |
| HCSG (3) | Combed Ring | 82 | 45 | 17 | 45 | 54 |
| | | | | | | |
| HSRG (0) | Combed Compact | 25 | <5 | <5 | <5 | 10 |
| HCSG (1) | Combed Compact | 31 | 35 | 6 | 14 | 23 |
| HCSG (3) | Combed Compact | 43 | 42 | 16 | 23 | 33 |

The process of producing combed yarn is probably the single most tedious and expensive of all the steps in spinning. Many ends of breaker drawn sliver are pieced together to form sliver laps which are then creeled to a combing device which removes shorter fiber to yield slivers containing mostly the longer fibers allowing them to be processed into finer and stronger yarns. Obviously this adds significant costs to the process and as a result, combing of cotton has virtually disappeared from the United States. We have seen that high speed roller ginning yields cotton which is longer and has less short fibers and, as we have seen above, superior than the saw ginned cotton.

As we discussed earlier, one of the concerns with high speed roller ginning is the cleanliness of the cotton. As seen from Table IV, there is considerably more non-lint content in the HSRG(0) than in HCSG(1) or HCSG(3). The question here is whether the reduction in the amount of noils (basically short fibers and neps) in the HSRG(0) lot is sufficient to offset the percentage weight of additional trash present. Considering the results reported in Table XI the seven percent difference in weight due to the HSRG(0) cotton more than offsets by a factor of two the three percent difference in weight of the trash reported in Table IV.

**Table XI.** Results for percent noil removal by the combing process for the three ginning treatments.

| Sample | Process | Noils Removed (%) |
|---|---|---|
| HSRG (0) | Combing | 14.5 |
| HCSG (1) | Combing | 21.9 |
| HCSG (3) | Combing | 22.2 |

The question arises as to how the high speed roller ginned cotton [HSRG(0)] processed into carded yarn would match up with the same cotton saw ginned [HCSG(1)] that was combed prior to ring spinning. To answer this question the yarn quality results for **carded** ring {HSRG(0)] were analyzed assuming Uster statistics for **combed** yarns. These values are compared with combed ring [HCSG(1)] for 22/1's yarn in Table XII. Results for HSRG(0) are still good with three of the four parameters remaining less than 50 and a composite score of 43. Results for HCSG(1) are better but not that much better. Its composite score is 31 with all four parameters scoring less than 50 and defects less than 25 (premium). The biggest different between the two processes based upon Uster statistics for combed yarns is in irregularity CV.

**Table XII.** Results for carded ring spun HSRG (0) using Uster statistics for combed yarn and compared with actual combed HCSG (1) ring spun into 22/1's yarns.

| Sample | Process | Strength | CV | Defects | Hairiness | Composite Score |
|---|---|---|---|---|---|---|
| HSRG (0) | Carded Ring | 27 | 82 | 40 | 41 | 43 |
| HCSG (1) | Combed Ring | 43 | 27 | 9 | 35 | 31 |

Yarn quality results for **carded** ring {HSRG(0)] analyzed assuming Uster statistics for **combed** yarns are compared with combed ring [HCSG(1)] for 30/1's yarn in Table XIII. Results for HSRG(0) are good with two of the four parameters remaining less than 50 and a composite score of 48 as compared with the 43 for the 22/1's yarn. Results for HCSG(1) are better but not that much better. Its composite score is 40 with two parameters scoring less than 25 (premium) and one less than 50. As was the case with the 22/1's, the biggest different between the two processes based upon Uster statistics for combed yarns is in irregularity CV. Based on the data summarized in Tables XII and XIII it seems as though there is a potential to use high speed roller ginning to successfully bypass the combing process and still produce cardedyarns with reasonable combed yarn quality.

**Table XIII.** Results for carded ring spun HSRG (0) using Uster statistics for combed yarn and compared with actual combed HCSG (1) ring spun into 30/1's yarns.

| Sample | Process | Strength | CV | Defects | Hairiness | Composite Score |
|---|---|---|---|---|---|---|
| HSRG (0) | Carded Ring | 40 | 90 | 69 | 47 | 48 |
| HCSG (1) | Combed Ring | 59 | 43 | 17 | 23 | 40 |

## SUMMARY AND CONCLUSIONS

The purpose of this study was to determine the impact of high speed roller ginning on the product and process quality of the same cotton subjected to different ginning treatments as it relates to various types of ring spinning. Besides considering the impact of the ginning on yarn quality we will also consider preliminary results relative to the practicality and possible economic advantages of high speed roller ginning.

Summing up our results, analysis of the properties of the ginned lint confirmed previous studies in that compared to the conventional saw ginning procedures, high speed roller ginning yielded fiber with increased length and length uniformity, lower short fiber content, there was no difference in fiber strength, but the high speed roller ginned cotton was trashier and was somewhat coarser and slightly more mature. Saw ginning with one lint cleaner removed more than half the trash while additional lint cleaning (three cleaners) removed more than half again as much trash. The ginning treatments were tested with four different ring spinning protocols and at two yarn counts (22/1's and 30/1's) and these included: carded ring, combed ring, carded compact, and combed compact. The yarn quality results are consistent for all four spinning treatments and both yarn counts in that the maximum strength and elongation was associated with high speed roller ginned cotton with no lint cleaning while the yarn evenness (CV), defects, and hairiness all increased with the degree of lint cleaning with the maximum values resulting for saw ginning with three lint cleaners.

The Uster statistics were used to get a better evaluation of the relative yarn qualities resulting from the various treatments. All of the treatments yielded very good to excellent statistics for the resulting yarns. Evaluation factors included yarn strength, evenness, defects, and hairiness. In all cases the high speed roller ginned cottons yielded yarns that were the best for each class and had either premium or near premium scores.

Finally, two approaches were tried to estimate the potential economic impact the high speed roller ginning. The first issue addressed was the excess trash remaining after the ginning. This concern was answered to a degree by the significant savings in material based on the great difference in noils removed from the high speed roller ginned versus saw ginning. These difference were between seven and eight percent which far outstrips the issue of differences in trash amounts. The second issue is that we demonstrated that for both of the yarn counts tested, there is a potential to substitute high speed roller ginned cotton that has been simply carded prior to spinning with the saw ginned and lint cleaned cotton that was combed. This shows the potential of getting paid premium prices for specialty yarns while having big savings in the processing steps.

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## REFERENCES


Armijo, C.B. and M.N. Gillum, 2007. High speed roller ginning of upland cotton. Applied Engineering in Agriculture, Vol. 23(2): 137-143.

ASTM. 1995. D 2812-95. Standard test method for non-lint content of cotton. Philadelphia, Pa.: American Society for Testing and Materials.

Gillum, M. N. 1985. High speed roller ginning. Transactions of the ASAE 28(3): 959-968.

Gillum, M. N., and C. B. Armijo. 2000. Optimizing the frequency of the rotary knife on a roller gin stand. Transactions of the ASAE 43(4): 809-817.

Hughs, S. E., and W. F. Lalor. 1990. Fiber and yarn effects of roller versus saw ginning. In Proc. Beltwide Cotton Production Research Conf., Cotton Ginning Conf., 542-543. Memphis, Tenn.: National Cotton Council of America.