IMPACT OF GIN SAW TOOTH DESIGN ON TEXTILE PROCESSING

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Abstract

Toothed gin saws have been used to separate cotton fiber from the seed for over 200 years. There have been many saw tooth designs developed over the years. Most of these designs were developed by trial and error. A complete and scientific analysis of tooth design has never been done. It is not known whether the optimum saw tooth design has been found, particularly for modern upland varieties. Initial laboratory ginning evaluations of some modern gin saw teeth has shown differences between designs in ginning rate, raw fiber length and length uniformity measurements, and textile processing quality. This is a preliminary report to document these differences with the goal of optimizing the design of gin saw teeth.

The gin stand used for testing was a Continental Double Eagle (Continental Eagle Corp., Prattville, AL) that has been cut down to 46 saws. Four “different” sets of 16-inch diameter, commercially available replacement saws, were obtained from suppliers other than Continental, and along with the standard Continental saw set, were used for the five test saw sets in the ginning test The noticeable difference between saw sets, prior to running the test, was that the number of teeth per saw varied from 328 to 352.

Testing of the five gin saws was replicated three times resulting in a total of 60 ginning lots. Each ginning lot was processed through the same seed cotton cleaning with no drying used on any of the ginning lots. The seed cotton was ginned on the 46 saw gin stand, followed by one lint cleaner, and the bale press. The gin stand was operated so as to maintain the same motor horsepower for each ginning lot throughout the test. Seed cotton and ginned lint samples were taken for quality analysis. The ginned lint lots were baled and sent to the USDA, ARS, Clemson Pilot Spinning Plant, Clemson, SC, for further fiber analysis and textile processing.

Most of the raw fiber HVI and AFIS properties were not significantly affected by the saw treatments. However, HVI length and length uniformity were significantly different among saw treatments. An unexpected difference is shown in Table 1 with the average ginning rate in terms of pounds of seed cotton processed through the gin stand per minute. Many of the saw treatments were significantly different from each other and varied from a low of 66 to a high of 89 pounds of seed cotton per minute. The saw with the highest ginning rate had the fewest number of teeth. The saw with the second highest ginning rate had the same number of teeth, 352, as did the saw with the lowest ginning rate.

Table 1. Average Gin Saw Processing Performance*

Saw Number	Number of Teeth per Saw	Pounds seed-cotton per minute
1	352	65.8 d
2	328	89.2 a
3	330	70.2 c
4	352	78.8 b
5	352	80.1 b

*Means followed by a different letter are significantly different at the 5% level by Duncan’s new multiple-range test.

The ginned fiber was then processed into both open end and ring spun yarns. There were very few significant differences among saw treatments for the open end yarn but there were several significant differences for the ring spun yarn. Table 2 shows some of the more important ring spun yarn differences with ends down being one of the more important to the spinner. Ends down are a measure of spinning efficiency with the lower the number the higher the efficiency which equates to higher productivity. The indication that gin saw tooth design may significantly affect spinning efficiency at the textile mill is an important reason to optimize gin saw tooth design. Research is currently being done to further understand how gin saw tooth design affects ginned fiber quality and textile processing quality factors.

Table 2. Average Ring Spun 20/1 Yarn Quality Averages*

Saw Number	Ends Down, #/1000 hr	Singles Strength, CV	Yarn Neps/1000 yd
1	29.5 b	10.6 c	898 b
2	87.0 a	11.9 a	1070 a
3	51.8 ab	11.7 ab	1042 a
4	66.5 ab	11.2 bc	1054 a
5	32.8 b	11.1 c	931 b

*Means followed by a different letter are significantly different at the 5% level by Duncan's new multiple-range test.

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