

## **PERFORMANCE OF THE ROLLER-GIN ROTARY KNIFE**

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### **Abstract**

An experiment was run to determine the optimum number of blades and frequency (or knife rate) of the rotary knife on a roller gin stand. Four rotary knife designs were tested: 2-, 3-, 4-, and 6-blade. (The most common rotary knife design is a 6-blade configuration.) Each knife design was run at the following knife rates: 14.5, 18.2, 24.2, 36.3, and 72.8 strokes per second. Within each knife rate, the seed cotton feed rate to the gin stand was increased at predetermined levels, and a carryover sample taken at each level. The feed rate was increased until the rotary knife stopped due to either too high a power level or too high a torque level being obtained at the motor driving the rotary knife. A lint sample was taken at the both the starting and ending level of feed rate. Lint cleaning included two Aldrich beater/air jet cleaners. The criteria used for determining the optimum knife design included any damage to the seed or fiber, and differences in ginning rate.

With respect to seed properties on samples taken at a feed-rate level 5 percentage points below the point at which the rotary knife stopped, moisture content and linters content were significantly different at the 5% level due to the number of blades, and foreign matter content, oil content, linters content, and grade index were significantly different due to knife rate. Seed foreign matter content averaged 1.3, 1.2, 1.2, 1.2, and 0.7%, and grade index averaged 119, 119, 119, 119, and 117 for knife rates 14.5, 18.2, 24.2, 36.3, and 72.8 strokes per second, respectively. Seed linters content averaged 1.5, 1.2, 1.2, and 1.2% for the 2-, 3-, 4-, and 6-blade design, respectively, and 1.0, 1.1, 1.2, 1.1, and 2.2 for knife rates 14.5, 18.2, 24.2, 36.3, and 72.8 strokes per second, respectively. Overall, foreign matter content in the seed decreased as knife rate increased, and seed linters decreased as the number of blades increased and seed linters increased as the knife rate increased.

With respect to fiber properties on samples taken just before the rotary knife stopped, foreign matter content was significantly different due to the number of blades, and foreign matter content, HVI length, HVI color, and color reflectance were significantly different due to knife rate. Lint foreign matter content averaged 2.5, 2.3, 2.1, and 2.0% for the 2-, 3-, 4-, and 6-blade design, respectively, and 1.7, 2.0, 2.2, 2.4, and 2.9% for knife rates 14.5, 18.2, 24.2, 36.3, and 72.8 strokes per second, respectively. HVI length averaged 140.8, 139.7, 139.6, 140.2 and 138.0 100-in. for knife rates 14.5, 18.2, 24.2, 36.3, and 72.8 strokes per second, respectively. Overall, lint foreign matter content in the lint decreased as the number of blades increased, and increased as the knife rate increased. Also, fiber length decreased as knife rate increased.

Ginning rate, calculated on data obtained just before the rotary knife stopped, was significantly different only due to knife rate. Ginning rate averaged 1.66, 2.03, 2.33, 2.53, and 2.01 bales per hour for knife rates 14.5, 18.2, 24.2, 36.3, and 72.8 strokes per second, respectively. The highest ginning rate was obtained when ginning at a knife rate of 36.3 strokes per second.