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ESTIMATING THE IMPACT OF COMPUTERIZED GIN PROCESS CONTROL TECHNOLOGY

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Abstract

A revolutionary innovation was introduced into the ginning industry on a commercial basis in the mid-1990s. From the initial beta testing conducted at just a few sites, the technology currently is installed in over eighty gins. This paper attempts to estimate the impact adoption of this technology has had on the cotton industry at the producer, gin, and textile mill levels. Published reports on impacts at each level are used to synthesize an estimate for these impacts. There are several estimates available for impacts at the producer level, but no published data are available for the gin and textile mill levels. Based on the data available, the net effect at the producer level appears to be approximately eight dollars per bale.

Introduction

Computerized gin process control was introduced into commercial application in the mid 1990s. Since that time, the technology has been modified and refined to meet specific needs. When this technology was introduced, the standard machine sequence in a gin was dryer, cylinder cleaner, stick machine, dryer, cylinder cleaner, extractor-feeder, gin stand, two saw-type lint cleaners, and bale press. Under this process, cotton fiber was typically dried to approximately 3-4 percent moisture. The computerized process control initially focused on the dryer, stick machine and lint cleaners. More recently, the process also includes moisture restoration prior to bailing. This paper attempts to estimate the impact of this technology at the producer, gin, and industry levels. The methodology used here is to assimilate published estimates for various segments of the industry into a "consensus" impact estimate for the industry. Only direct and measurable impacts are included here, but secondary and indirect impacts are recognized. In fact, these impacts may be larger than the primary direct impacts.

Previous Work

There have been a number of published reports on various aspects of computerized gin process control. Most of the early reports dealt with the development of the technology. Representative of these papers is the one by W. Stanley Anthony published by the American Society of Agricultural Engineers in 1990. This paper described the computerized process control system and outlined how the system operated. Subsequently, Anthony has presented several updates at the Beltwide Cotton Conferences (Anthony, 1998, Anthony and Byler, 1994).

Similarly there have been a number of published reports on the impact of a computerized gin process control on various segments of the cotton industry. One of the first of this type of study was an examination of the financial feasibility of such a system (Hudson, Ethridge, and Brown). This study was completed in the early stages of commercialization of the process. Consequently, much of the analysis was based on test results and relationships gleaned from previous research. Results indicated that a majority of the savings attributable to the process control could be attributed to the dryer portion of the system. The overall conclusion of the study was that the computerized process control system was a viable investment best suited to the mid-south and southwest where dryer fuel and weight loss reductions are more substantial.

The study by Hudson, Ethridge, and Brown assumed the elimination of one lint cleaner with the process control system that resulted in a 9.2 pound increase in bale weight. They further assumed that this would be done on 50 percent of the bales processed, thus resulting in an average increase in bale weight of 4.6 pounds. Reduction in drying contributed fuel savings and also increased bale weight by about 6.7 pounds. This study assumed that a reduction in cleaning would lead to a one leaf grade reduction. The value of this reduction was subtracted from the savings noted above to yield a net savings of $5.92 per bale in the mid-south and $5.61 per bale in the southwest, based on market prices at the time of the study. Use of loan values to calculate savings resulted in lower estimates.

The importance of the gin process control to the cotton industry was discussed in an article by Anthony and Byler. This article outlined the potential fiber quality improvements that might result from employing the technology. Computer simulation models were used to estimate potential monetary returns from process control. These models estimated that bale values could be increased form $6.86 to $23.38 per bale.

Since Zellweger Uster acquired the rights to the computerized gin control process from the USDA in 1996 several articles by company representatives on the technology have been published in the Beltwide proceedings as well as elsewhere. A few of

the articles published in the Beltwide proceedings will be cited here to illustrate the kind of results reported by the company. An article by Ghorashi summarized results from the first year (1997) of beta testing for IntelliGin®. This article noted that all segments of the industry benefited from employing the technology. Growers benefit because of the higher turnout made possible through the control process. Ginners benefit because of increased efficiencies in the ginning process derived from employing the technology. Spinners benefited because of the higher quality cotton produced by the control process. Finally, the whole cotton industry benefits because the technology helps bridge the gap between the producer and textile mill. This study reported a net savings from employing the gin process control technology of $13.25 per bale. Gains in value resulted from two seed cleaners (5 pounds/bale), moisture (12.5 pounds/bale), and one lint cleaner (10 pounds/bale). There was a loss in grade from 31-1 to 41-4 that resulted in a $6.00 per bale decline in value. A loan value for lint of $0.5245 was used in the calculations.

Improvements in fiber quality from the gin process control technology, known commercially as IntelliGin®, were reported in 1999 (Yankey). While the paper above cited results from the beta sites installed in 1997, this article reported results of tests conducted during the 1998 ginning season. The test results reported consisted of turnout, AFIS Neps, Short Fiber Content, Upper Quartile Length, HVI Staple Length, and HVI Strength. From the five test sites, use of the gin process control system increased turnout by an average of 18.5 pounds per bale. The range in turnout reported ranged from a low of 7.7 pounds to 33.5 pounds per bale. Use of the system reduced nep levels and increased the upper quartile length by one full staple length. HVI measures were compared against classing office means. In the case of staple length, the IntelliGin® system had a smaller percentage of lower staple cotton and a higher percentage of higher staple cotton than the classing office average. Strength results were similar with a lower proportion of the IntelliGin® processed cotton in the lower strength categories and a higher percent in the higher strength categories. These results were reported to hold even in the case where gins used only one lint cleaner, instead of the traditional two.

A follow-up report was published in 2001 outlining improvements to the IntelliGin® system (Yankey and Mayfield). This article did not report specific results, but did indicate that the incorporated improvements were focused on maximizing the value of the cotton for the producer.

In addition to the above reports, the author obtained data from the manufacturer. These data report results of tests conducted at several gins across the cotton belt in 2002. These data show a consistent increase in value of cotton processed through IntelliGin®. Test results were obtained by ginning cotton with the IntelliGin® system on and off. Quality measures and turnout data were obtained under both conditions. Based on these data, turnout increased approximately 9.3 pounds per bale and there was a shift in the distribution of staple length so there was a higher percent of cotton with a longer staple in cotton processed with the IntelliGin® system on. There was also a shift in the leaf grade distribution so that there was a higher proportion of the cotton with a higher leaf grade under the IntelliGin® system. The net effect of these changes, however was positive with an average increase in loan value of $5.85 per bale. When combined with the increased pounds, the total increase in value was $11.08 per bale.

Estimating Impact

Using the above information, estimates were made of the impact use of the gin process control technology has had on the producer, ginner, and industry. First, at the producer level, all the reported data suggest that use of the technology will generate increased value. The increased value comes from two sources, improved turnout and quality. Improved turnout is derived from less processing and drying. Based on the studies cited above, an increase in turnout of 10-15 pounds per bale appears to be a reasonable expectation. Quality changes with the system are generally composed of both positive and negative components. On the positive side, use of the system appears to shift the distribution of grades to more longer staple cotton. On the negative side, there is generally an increase in leaf grade due to less cleaning. The net effect of quality changes ranged from about $3 - $6 per bale, based on current loan values. Changes in leaf grade generally caused a negative change of about $2 per bale. These negative changes were offset by positive shifts in other quality factors. Taken together, the change in weight and quality account for about $11 per bale more for cotton processed through the IntelliGin® system. There is a per bale charge for using the system. If we assume the charge is $3 per bale, then the net would average about $8 more per bale at the producer level.

Another aspect of impact at the individual producer level is the “spill-over” effect of the technology. There is anecdotal evidence to suggest that gins have reduced the amount of drying and processing since the introduction of the IntelliGin® system into commercial production. If this is true, then the impact would go well beyond the per bale number cited above times the number of bales processed through the process control system

At the gin level, employment of the process control hardware and software requires an investment. Presumably, savings generated by employing the process control system would pay for the system. Savings would be derived from the reduced processing and resulting reduction in fuel usage. Data on reductions in fuel use are not currently available. The study by Hudson et al. estimated that fuel for drying would be reduced by half. Assuming the gin process control system could save half the

normal ginning process dryer fuel, then savings would be approximately $0.50 per bale for natural gas. Electricity costs for ginning are considerably more variable across the cotton belt. Therefore a given percentage reduction would have varying impacts across the belt. Energy savings on lint cleaners were estimated to be $0.16 by Hudson et al.

The typical gin setup is three seed cotton cleaners, a dryer temperature of 200 degrees Fahrenheit, two lint cleaners and a final moisture content of about three percent. A gin with the IntelliGin® system would include two seed cleaners, a dryer temperature of 100 degrees, one lint cleaner, and a final moisture content of 5.5 percent (Ghorashi). These differences in setup imply savings to the gin, but no data are currently available.

Impacts at the textile mill are more difficult to estimate than at the gin level. No data are available to quantify the potential impact spinning cotton processed on the IntelliGin® system might have on the textile industry. Results reported in a paper by Mace at the 2002 Beltwide suggest the impact would be positive. He reports on a study designed to determine the impact of processing cotton with reduced fiber neps and short fiber content while possessing increased strength and length with increased trash. Results reported by Mace include: 1) larger sized trash particles were easier to remove during opening and carding; 2) improved fiber properties in the bales translated into higher quality finished sliver; and 3) improved single-end yarn strength from IntelliGin® cotton on all spinning systems. No monetary value was placed on these characteristics by the textile industry.

Summary

In summary, the adoption of the gin process control technology has exerted a positive impact on the ginning industry. At the producer level, available data suggests that the system increases the pounds of cotton in each bale and improves quality characteristics of the cotton. In addition, there is some evidence to suggest that gin operations in general have been modified, at least in part, due to the introduction of the gin process control technology. To the extent that this is true, additional positive impacts can be attributed to the technology. At the gin level, the system offers the potential for reducing energy requirements for ginning. Gins must make an investment in the hardware and software required to implement the gin process control technology. In addition there is a per bale charge for using the technology. Part of the payback is in the form of instant feedback on quality aspects of the cotton being ginned as it moves through the process. Finally, at the textile mill level, available data suggests that cotton processed through the gin process control technology offers positive characteristics to the textile industry.

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