Cost/Trade-Offs of Stripper Mounted Bur Extractors from the Cotton Industry Perspective

Jeannie Nelson
Sukant K. Misra*
Blake K. Bennett
Department of Agricultural and Applied Economics, Texas Tech University, Lubbock, TX 79409-2132
Alan Brashears
U.S. Department of Agriculture - Agricultural Research Services, Rt. 3, Box 215, Lubbock, TX 79401

ABSTRACT

This study provides estimates of cost/trade-offs of stripper mounted bur-extractors from the producer, ginner, and the overall cotton industry perspective. Results indicated that cotton producers incur net savings of about $6.00 per bale as a result of using a bur-extractor in the harvesting process. It was also determined that gins incur a net loss of about $3.00 per bale of cotton by processing bur-extracted cotton. The overall cotton industry was thus found to experience savings of about $3.00 per bale when a bur-extractor is used in the harvesting process.

INTRODUCTION

Harvested cotton contains a mixture of lint, seed, and foreign matter such as burs, sticks, leaves, hulls, and non-plant materials such as sand and rocks. The cotton cleaning process to remove this foreign matter has been conventionally limited to the gin plant and textile mill. This cleaning process has subsequently been broadened to include cleaning in the harvesting stage. Research to develop a bur-extractor to remove foreign matter in cotton during stripper harvesting was initiated as early as 1927 (Kirk et al., 1970).

Eighty-five percent of the cotton produced in Texas is currently stripper harvested and is, therefore, available to be harvested using a portable, stripper mounted bur-extractor (Glade et al., 1996). About twenty-five percent of cotton in Texas is currently bur-extracted (McPeek, 1997).

Producers are currently being charged a uniform price per hundred weight of harvested cotton to have cotton ginned. In other words, producers can have bur-extracted cotton, which contains more lint cotton per hundred weight of harvested cotton, ginned for the same price as non-bur-extracted cotton, which contains less lint cotton per hundred weight of harvested cotton. This implies that producers who use bur-extractors could incur savings in ginning charges at the cost of ginners.

However, gins may also experience savings when a bur-extractor is used by producers. Since bur-extracted cotton contains less foreign matter, gins providing transportation

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* Corresponding Author

of modules from the field to the gin plant are likely to save in transportation cost. Further, bur-extractors may be altering operating costs of gins by affecting the ginning rate, drying efficiency, and/or cleaning efficiency. The gin plant may incur savings in trash disposal costs, since with bur-extracted cotton there is less trash to collect and dispose of. The wear and tear on gin machinery and its components may be reduced as a result of the gin plant processing bur-extracted cotton. The potential for different equipment configurations in the gin plant due to the use of bur-extracted cotton may also result in further savings.

Currently, there is a lack of information regarding the costs and savings of bur-extractors to the producer, the gin plant, and for the cotton industry. The objectives of this study are to provide estimates for the cost effectiveness of bur-extractors to producers, the costs and benefits of bur-extractors to gins, and the net cost/savings for the overall industry. This knowledge should benefit producers and gins that use bur-extractors and process bur-extracted cotton, as well as the cotton industry as a whole.

METHODS AND PROCEDURES

Producer and Ginner Surveys

The ownership and maintenance costs of a bur-extractor were calculated by surveying several local producers and an area implement company. A survey was also administered to twenty-three gin plants in the Southern High Plains of Texas to obtain information about the costs and savings incurred by gins due to processing bur-extracted cotton. In response to the survey questions, the participating gins provided estimates of costs in terms of ginning charges and savings in transportation costs, labor and energy, maintenance and repair, and trash disposal costs. The costs and savings reported by participating gins were averaged and presented in the form of dollars per bale.

Producer Cost of Owning and Operating a Bur-Extractor

Survey results as well as secondary data were used to calculate producer costs of owning and operating a bur-extractor. The average size of a cotton farm in Texas, the number of planted acres of non-irrigated and irrigated upland cotton, and the number of bales harvested in the Southern High Plains of Texas during the 1996 year were obtained from the Texas Agricultural Statistics (1996). Average cotton yield per planted acre in the Southern High Plains was calculated by dividing the number of harvested bales of upland cotton by the number of planted acres of upland cotton. The average yield was then multiplied by the average cotton farm size to find the total number of bales produced on a typical farm.

To determine the cost of owning and operating a bur-extractor over a ten-year life, a present value of the maintenance cost (PV_M) associated with a bur-extractor was determined by using the following equation:

$$PV_M = \sum_{t=0}^{9} \frac{CM_t}{(1+i)^t} \qquad (1)$$

where CM_t is the cost of maintenance and repairs on the bur-extractor in time t, and i is the interest rate, assumed to be 10.5 percent (Norwest Bank Texas), for a farm loan. This present value was then divided by 10 to obtain an average maintenance cost per year of

operating a bur-extractor. This average maintenance cost was then added to the average per-year cost of a bur-extractor (total cost of a bur-extractor divided by 10) to obtain the per-year average cost of owning and operating a bur-extractor. The total cost of the initial investment of the bur-extractor and maintenance and repair costs was divided by the total number of bales produced on the typical cotton farm to determine the cost per bale that is incurred by the producer.

Savings (Loss) in Ginning Charges for Producers (Gins)

The savings incurred by producers as a result of the use of bur-extractors is primarily due to the current pricing structure of gins in the Southern High Plains of Texas. Because producers are currently charged a uniform price per hundred weight of harvested cotton, the effective ginning charge for a bale of bur-extracted cotton amounts to be less than non-bur-extracted cotton. Thus, the producer's savings in ginning charges are equal to the ginner's loss in ginning charges.

To estimate the magnitude of loss to gins (savings for producers) in ginning charges for bur-extracted cotton, gin survey participants were asked to provide information such as turnout percentage for non-bur-extracted and bur-extracted cotton and ginning charges, in dollars per hundred weight of harvested cotton. Several steps were undertaken to determine the effective ginning charges, in a uniform unit of dollars per bale, for non-bur-extracted and bur-extracted cotton. First, the number of pounds of non-bur-extracted and bur-extracted seed cotton required to make one bale of lint cotton was determined. This was accomplished by dividing the average weight of a bale of lint cotton (480 pounds) by the non-bur-extracted and bur-extracted turnout percentage, respectively. Effective ginning charges were then calculated by multiplying the number of pounds of non-bur-extracted and bur-extracted seed cotton required to make one bale of lint cotton by the uniform ginning charge reported by ginners. The difference in effective ginning charges was used as an estimate of both the net loss to gins and the savings to producers in ginning charges per bale of lint cotton.

Possible Gin Savings Due to Processing Bur-Extracted Cotton

It was determined from the survey that gin plants may be incurring savings in the areas of transportation of modules, equipment and equipment components, labor and energy, bypassed machinery, and trash disposal due to processing bur-extracted cotton.

Savings in Transportation Cost of Modules

Modules containing bur-extracted cotton contain a lower percentage of trash to lint cotton than non-bur-extracted modules. Given that the transportation cost is generally borne by gins in the Southern High Plains of Texas, savings in the transportation cost of harvested cotton may be incurred by gins as a result of processing bur-extracted cotton. The module transportation cost per bale, for non-bur-extracted and bur-extracted cotton was calculated by dividing the transportation cost per module by the average number of non-bur-extracted and bur-extracted bales of cotton transported per module, respectively. The saving to gins was calculated by taking the difference in the transportation cost of non-bur-extracted and bur-extracted modules.

Labor and Energy Savings

Assuming there is a steady flow of harvested cotton delivered to the gin plant, which enables continuous operation of the gin, it is possible that gins may be able to shorten the ginning season by processing bur-extracted cotton faster than non-bur-extracted cotton.

This was estimated by taking the difference in the number of days required to process the same number of bales of bur-extracted and non-bur-extracted cotton. If gins experience a reduction in ginning season days due to processing bur-extracted cotton, then it is possible that gins may incur a reduction in labor and energy costs. Labor cost savings were calculated by multiplying the labor cost per day by the number of reduced ginning season days. Savings in energy cost were calculated by taking into account the cost of energy per bale and the additional number of days and volume of cotton that the gin would have processed if the cotton was not bur-extracted.

Gin Equipment and Equipment Components Savings

Gin plants may potentially incur savings in maintenance and repair costs of gin equipment due to processing bur-extracted cotton. Total savings in maintenance and repair of gin equipment were calculated by adding all individual savings for each piece of equipment, as reported by each survey respondent. Total savings, for each gin plant, in maintenance and repair were standardized to a per bale basis by dividing the total savings by the number of bur-extracted bales processed.

Savings in Energy due to Bypassed Machinery

Less foreign matter in bur-extracted cotton may possibly decrease the amount of cleaning required. Energy savings due to reduced gin machinery use were estimated using the following equations:

$$K = (A * V) / 100 \quad (2)$$

$$MC = K * KR \quad (3)$$

$$CS = MC / GR \quad (4)$$

where K is the number of kilowatts, A is the amps of the motor that runs that piece of machinery, V is the voltage of the specific machine, MC is the dollar per hour required to operate the motor of that specific piece of machinery, KR is the rate per kilowatt charged by the gin plant's electric company, CS is the per bale cost savings incurred by the gin due to ginning bur-extracted cotton, and GR is the number of bales per hour that can be ginned.

Trash Disposal Cost Savings

Gins may also incur savings in trash disposal costs when processing bur-extracted cotton. The difference in trash disposal costs per bale for non-bur-extracted and bur-extracted cotton was used as an estimate for potential savings in trash disposal cost. To determine the trash disposal cost per bale for non-bur-extracted and bur-extracted cotton, the weight of an average bale of lint cotton was first divided by the non-bur-extracted and bur-extracted turnout percentages, respectively. This was then multiplied by the percentage of total matter consisting of trash and the trash disposal cost per pound of harvested cotton required to make one bale of cotton lint.

Determination of Cost/Savings to the Industry

A net loss or savings was determined for the cotton industry as a whole by calculating the difference in the net loss or savings that was incurred by cotton producers and gin plants as a result of the use of bur-extractors in the cotton harvesting process.

RESULTS AND IMPLICATIONS

Sample Characteristics

A non-stratified sample of local producers were contacted to identify costs associated with owning and operating a bur-extractor. An area implement company was then consulted to assure the accuracy of the information provided by the local producers. A sample of twenty-three gins were surveyed to collect information pertaining to the costs and benefits incurred due to processing bur-extracted cotton. The sample included both cooperatives and individually owned gins. All of the responding gins processed bur-extracted and non-bur-extracted cotton and irrigated and dryland cotton. The proportion of bur-extracted cotton processed by the responding gins ranged from 4 to 89 percent. The average number of total bales processed by the responding gins was about 34,615 bales per season. The average number of bales of bur-extracted and non-bur-extracted cotton processed by the responding gin plants was about 14,281 and 20,334, respectively (Table 1). The average ginning rates for bur-extracted and non-bur-extracted cotton were about 28.5 and 25 bales per hour, respectively. The average turnout percentages for bur-extracted and non-bur-extracted cotton were about 28 and 22 percent, respectively.

Table 1. Sample Characteristics of Responding Gin Plants.

Characteristics	Average	Standard Deviation	Maximum	Minimum
Total Bales	34615.39	19425.08	71329	5800
BE Bales*	14281.26	11409.29	41000	543
NBE Bales**	20334.17	14021.66	51329	2320
BE Ginning Rate (bales/hr.)	28.50	7.30	40	15
NBE Ginning Rate (bales/hr.)	24.95	6.09	36	13.5
BE Turnout Percentage	28.12	1.33	30	25
NBE Turnout Percentage	22.13	1.64	25	18

* BE indicates Bur-Extracted

** NBE indicates Non-Bur-Extracted

Producer Costs of Owning and Operating a Bur-Extractor

The producer-incurred ownership cost is comprised of an initial investment of $11,000 for a new bur-extractor with a ten-year expected life. Assuming that the bur-extractor will have no salvage value at the end of the ten-year period, the straight-line depreciation cost per year of the bur-extractor is $1,100. The repairs to the bur-extractor include: replacing all top saws at a cost of $500 every two years, replacing all bottom saws at a cost of $500 every four years, replacing one and one-half of all brushes each year at a cost of $180, replacing two belts per year at a cost of $100, replacing four bearings per year at a cost of $160, and replacing one and one-half reclaimer brushes every year at a cost of $75. The summation of the initial investment expense and the present value for maintenance on a bur-extractor yields a total cost of $15,712.62 for using and maintaining a bur-extractor during harvest. The straight-line depreciation cost per year of owning and operating a bur-extractor is $1,571.26.

The average size of a Texas cotton farm in 1996 was about 630 acres (Texas Agricultural Statistics, 1996). The number of acres of non-irrigated and irrigated upland cotton that were planted and the number of bales of non-irrigated and irrigated upland cotton

that were harvested in the Southern High Plains was 2,800,000 acres and 2,235,000, respectively (Texas Agricultural Statistics, 1996). An average of about 0.80 bales of upland cotton was produced per planted acre of cotton in the Southern High Plains of Texas. The total number of bales produced on a typical Texas cotton farm was found to be about 504 bales. Therefore, the cost per bale incurred by the typical producer as a result of using a bur-extractor in the harvesting process of cotton was determined to be about $3.12 per bale.

Savings (Loss) in Ginning Charges for Producers (Gins)

The average ginning charge of the responding gins was $1.95 per hundred weight of harvested cotton. Survey results indicated that the average ginning rate for bur-extracted cotton was about 28.5 bales per hour and 25 bales per hour for non-bur-extracted cotton. The average turnout percentage for bur-extracted and non-bur-extracted cotton was about 28.12 and 22.13 percent, respectively. Thus, the "effective" ginning charge was calculated to be about $40.28 per bale for bur-extracted cotton and $49.21 per bale for non-bur-extracted cotton, which translates to a loss to gins (savings to producers) of about $8.93 per bale as a result of using a bur-extractor in the harvesting process.

Gin Savings Due to Processing Bur-Extracted Cotton Transportation of Modules

Survey results indicated that the average transportation cost per module from the producer's field to the gin plant in 1996 was about $41.44 per module (Table 2). The average distance that these modules were hauled in 1996 was approximately 22 miles and there was an average of 11.13 bales and 8.37 bales of bur-extracted cotton and non-bur-extracted cotton per module, respectively. Thus, while it is costing ginners about $4.95 to transport a bale of non-bur-extracted cotton, the module transportation cost for bur-extracted cotton is about $3.72 per bale. This results in possible transportation cost savings to gins of about $1.23 per bale when a bur-extractor is used during the stripper harvesting of cotton (Table 2).

Table 2. Module Transportation Characteristics and Costs of Responding Gin Plants.

Characteristics	Average	Standard Deviation	Maximum	Minimum
Transportation Cost ($/module)	41.44	15.38	66	7
Distance (miles)	22.12	15.13	80	6
No. BE Bales/Module	11.13	1.27	14.2	9
No. NBE Bales/Module	8.37	0.69	9.3	7
Transportation Cost for BE Cotton ($/bale)	3.72			
Transportation Cost for NBE Cotton ($/bale)	4.95			
Transportation Cost Savings ($/bale)	1.23			

Note: BE indicates Bur-Extracted and NBE indicates Non-Bur-Extracted Cotton.

Gin Equipment and Equipment Components

About 83 percent of the participating gin managers reported savings in the mainte-

nance and repair of gin equipment, which included the green boll trap, automatic feed control, dryers, incline machine, stick and bur machine, conveyor/distributor, extractor/feeder, gin stand, lint cleaners, and bale press due to ginning bur-extracted cotton. Results indicated that gins save about $0.50 per bale in maintenance and repair of gin equipment due to processing bur-extracted cotton (Table 3).

About 91 percent of the participating gin managers reported savings in the repair and replacement of gin equipment components as a result of ginning bur-extracted cotton. Results of the survey indicated that gins save about $0.71 per bale in repair and replacement of gin equipment components due to processing bur-extracted cotton (Table 3). These gin equipment components included tinwork on pipes, elbows, and ductwork, fans, cyclones, and saws.

Bypassed Machinery

About 57 percent of responding gin managers indicated that while a majority of them are not currently bypassing any equipment, it is possible to bypass some cleaning equipment when ginning bur-extracted cotton. If some cleaning equipments are bypassed, gins may incur savings in energy expenses due to the motor of those equipments not being in operation. From this study, it was found that gins may incur energy savings of about $0.09 per bale when bypassing some machinery (Table 3). The specified bypassed equipment, by surveyed gin managers, included the second stick and bur machine, incline cleaner, and the third lint cleaner. All gin plants are unique in that they have different configurations of gin equipment. Therefore, each gin must decide the specific equipment(s) in its unique gin setup, if any, that should be bypassed.

Table 3. Savings in Gin Equipment, Equipment Components, and Bypassed Machinery Due to Processing Bur-Extracted Cotton.

Characteristics	Average	Standard Deviation	Maximum	Minimum
Equipment:				
Total Equipment Savings ($)	6737.27	12010.62	53600	0
Equipment Savings/Bale ($/bale)	0.50	0.65	2	0
Components:				
Savings in Tinwork ($)	7820	4485.05	15000	1750
Savings in Fans ($)	4954.56	3559.88	10000	1000
Savings in Cyclones ($)	7908.33	12684.23	33500	450
Savings in Saws ($)	3649.90	3283.30	10000	-1500
Total Equipment Components Savings ($)	18006.65	18928.87	70125	0
Equipment Components Savings/Bale ($/bale)	0.71	0.68	3	0
Bypassed Machinery:				
Energy Savings in Bypassed Machinery ($)	455.46	310.23	1096.48	201.89
Energy Saving in Bypassed Machinery ($/bale)	0.09	0.08	0.28	0.02

Labor and Energy

Sixty-five percent of the participating gins indicated that they were able to process bur-extracted cotton at a faster rate than non-bur-extracted cotton. Results indicated that gins can process about 3.5 bales per hour more of bur-extracted cotton than non-bur-extracted cotton. This is mainly due to more lint cotton and less foreign matter being processed per hundred weight of bur-extracted seed cotton. Thus, if it is assumed that a gin plant is processing 100 percent of bur-extracted cotton, then the ginning season could potentially be shortened and savings in labor and energy could be experienced. Survey results indicated that the average reduction in ginning season days was about 6.75 days. As a result of this reduction in ginning season days, gins may save an average of about $1.89 per bale in labor costs and $1.09 per bale in energy costs. These savings are incurred only when the gin plant processes 100 percent bur-extracted cotton.

Trash Disposal

Survey results indicated that 100 percent of the responding gin managers noticed a decrease in gin trash of about 459 pounds (from 783 to 324 pounds) per bale as a result of ginning bur-extracted cotton (Table 4). Gins do not use a standard practice to dispose of gin trash. While some gins sell a portion or all of their gin trash, others pay to dispose it. Thus, a net trash disposal cost was first calculated for each responding gin and then an average was calculated over all gins. Results indicated that the responding gins incurred a net cost of about $2.15 per ton to dispose of a ton of gin trash. Given that gins generate about 459 pounds less of gin trash by processing bur-extracted cotton, it was estimated that gins could decrease gin trash disposal costs by $0.45 per bale (Table 4).

Table 4. Gin Trash Disposal Characteristics.

Characteristics	Average	Standard Deviation	Maximum	Minimum
Trash per gin (tons)	11505.91	8845.33	32098	300
Trash from BE cotton (lbs/bale)	323.96	16.15	363.62	303.01
Trash from NBE cotton (lbs/bale)	782.55	58.87	959.49	690.84
Gin trash disposal cost ($/ton)	-2.15	2.16	0	-9.89
Gin trash disposal cost savings ($/bale)	0.45	0.44	1.95	0

Net Cost/Saving to the Industry

While producers are incurring a cost of about $3.12 per bale as a result of owning and operating a bur-extractor, they are saving about $8.93 per bale due to being charged a uniform price per hundred weight of bur-extracted and non-bur-extracted seed cotton. Thus, producers are incurring net savings of about $5.81 per bale as a result of using a bur-extractor in the harvesting process of cotton.

Results further indicated that gins incur a net loss due to ginning bur-extracted cotton. Gins incur a revenue reduction of about $8.93 per bale in ginning charges. They are incurring savings in the areas of transportation of modules ($1.23 per bale), trash disposal ($0.45 per bale), gin equipment ($0.50 per bale), gin equipment components ($0.71 per bale), energy ($1.09 per bale), labor ($1.89 per bale), and bypassed machinery ($0.09 per bale). Therefore, gins are incurring a net loss of about $2.97 per bale as a result of processing bur-extracted cotton (Table 5).

Table 5. The Savings and Costs for Gin Charges and Gin Equipment Due to Bur-Extracted Cotton.

Areas of Gin Plant	Savings ($/bale)		Costs ($/bale)	
	Average	Standard Deviation	Average	Standard Deviation
Ginning Charge			8.93	3.37
Module Transportation	1.23	0.79		
Trash Disposal	0.45	0.44		
Equipment	0.50	0.65		
Equipment Components	0.71	0.68		
Current Cost/Savings	2.89		8.93	
Current Net Cost/Savings			-6.04	
Energy	1.09			
Labor	1.89			
Possible Cost/Savings	5.87			
Possible Net Cost/Savings			-3.06	
Bypassed Machinery	0.09	0.20		
Total	5.96		8.93	
Net Total			-2.97	

The net savings for the industry as a whole can be determined by calculating the difference in the net savings that is incurred by the producers ($5.81) and the net loss incurred by the gin plants ($2.97). Therefore, the industry is experiencing net savings of about $2.84 per bale due to the use of a bur-extractor in the harvesting process (Table 6).

Table 6. Costs, Savings, and Net Results for the Producer, Gin, and Industry.

	Costs ($/bale)	Savings ($/bale)	Net Savings ($/bale)
Harvesting Stage	3.12	8.93	5.81
Ginning Stage	8.93	5.96	-2.97
Industry	12.05	14.89	2.84

SUMMARY AND CONCLUSION

It was found in this study that producers who use bur-extractors in the harvesting process incur net savings of about $6 per bale. Further, it was determined that gins incur a net loss of about $3 per bale due to processing bur-extracted cotton. Therefore, the industry is incurring net savings of about $3 per bale due to producers using a bur-extractor in the harvesting process and gins processing bur-extracted cotton.

If gins decide to increase ginning charges for bur-extracted cotton to avoid this net loss of about $3 per bale, ginning charges may increase by about $0.14 per hundred weight of seed cotton. With this scenario, producers would incur net savings of about $3

per bale and gins would break even (zero net loss or savings). However, the industry would continue to incur net savings of about $3 per bale due to producers using a bur-extractor in the harvesting process. This analysis is based on information pertaining to a typical cotton farm and an average size gin in the Southern High Plains of Texas. Therefore, attempts to apply the results of this study to individual scenarios should be exercised with caution.

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