ECONOMIC COMPARISON OF ALTERNATIVE COTTON HARVESTING SYSTEMS

Jeannie Nelson and Sukant Misra
Department of Agricultural and Applied Economics
Texas Tech University
Lubbock, TX
Alan Brashears
USDA-ARS
Lubbock, TX

Abstract

This study provides cost estimates of alternative cotton harvesting methods, including four, six, eight, and two individual four-row stripper and equipment combinations without and with bur-extractors and two, four, and six-row picker and equipment combinations, and compares those with the costs of custom harvesting to determine the least cost harvesting system by size of cotton operation in Texas. In the case of stripper and equipment combination without bur-extractors, the alternative with the minimum harvesting cost was the four-row stripper up to 1,700 acres and the eight-row stripper for a farm size over 1,800 acres. For stripper and equipment combinations with bur-extractors, the harvesting cost was minimized by the four-row stripper up to 1,100 acres and the eight-row stripper for farm sizes of 1,200 acres or more. The harvesting cost of the six-row stripper without or with a bur-extractor was never minimum. For picker and equipment combinations, the two-row picker had the lowest average cost of the three picker alternatives up to 1,000 acres. The four-row picker had the minimum average cost from 1,100 to 1,700 acres, while the six-row picker had the minimum average cost beginning at about 1,800 acres.

Introduction

Cotton has consistently ranked as a leading cash crop in Texas. Texas led the United States in 1997 in the production of Upland cotton and ranked second in the nation in the production of American Pima cotton (TDA homepage). Texas has eight distinct regions consisting of over one hundred counties in which cotton is produced. Stripper harvesting is primarily used in the High Plains, Rolling Plains, Central Blackland, Coastal Bend, and Winter Garden regions. Picker harvesting mainly occurs in the Upper Gulf Coast, Rio Grande Valley, and El Paso/Trans-Pecos regions.

Eighty-five percent of the cotton produced in these eight regions is currently stripper harvested, while the remaining 15% is machine picked (Glade et al., 1996). Picker harvested cotton consists mainly of cotton lint and seed, with a relatively small amount of foreign matter. The stripper harvested cotton contains much more foreign matter, such as burs, sticks, leaves, hulls, and non-plant materials such as sand and rocks with the cotton lint and seed. Therefore, bur-extractors are currently being adopted into the stripper harvesting method by an increasing number of producers. McPeek (1997) found that about 25% of cotton in Texas is currently harvested with the use of a bur-extractor. The use of a bur-extractor helps to remove foreign matter in cotton during stripper harvesting. According to Bennett et al. (1995), the bur-extractor, when incorporated into the harvesting process, reduces bur and stick percentage in cotton by about 70% and 29%, respectively. Bennett et al. (1997) found that investment in bur-extractors for a Texas producer was profitable for all irrigated and most dryland cotton production situations with an operation of at least 750 acres.

Currently, there are three types of strippers (four-row, six-row, and eight-row) and pickers (two-row, four-row, and six-row) that are most commonly used to harvest cotton in Texas. Each of the three types of cotton strippers can also be equipped with bur-extractors. Additional equipment, such as a boll buggy and a module builder, are usually used in combination with the stripper and picker harvesting machines. Both of these pieces of equipment require the use of a tractor of at least 90 horsepower. The combination of equipment most commonly used with a four-row stripper and two-row picker are a module builder and a tractor. The combination of a straight-tongue boll buggy, a module builder, and two tractors are usually used with a six-row stripper and four and six-row pickers. The eight-row stripper is generally used with a swing-tongue boll buggy, a module builder, and two tractors.

Producers have many cotton harvesting alternatives to choose from. However, the harvesting costs associated with each alternative are not available. There is currently a need for information on performance rates and ownership costs of alternative cotton harvesting methods. This information would help producers make informed choices among alternative harvesting systems and custom harvesting given their individualized production scenarios. The objective of this study was to determine the least cost stripper and picker harvesting system by size of cotton operation in Texas.

Methods and Procedures

Data regarding investment costs, maintenance costs, and performance rates corresponding to each size of cotton stripper and picker and the additional harvesting equipment were collected from cotton producers, harvesting equipment owners, equipment dealers, and custom cotton harvesters. This information was obtained through in-person and telephone interviews. Data gathered consisted of purchase costs, maintenance costs per season, fuel costs, fuel consumption, labor costs, performance rates, useful life, and salvage value for each harvesting machine. The data gathered from respondents were averaged for each harvesting machine and were used in this analysis.

The collected information was categorized by the size of the harvesting machine. Data regarding stripper harvesting equipment were organized into eight main categories of strippers, including four-row, four-row with a bur-extractor, six-row, six-row with a bur-extractor, eight-row, eight-row with a bur-extractor, two individual four-row, and two individual four-row with bur-extractors. Picker harvesting data were organized into three categories, including two-row, four-row, and six-row. The fixed costs, variable costs, total costs, and average costs of owning and operating each machine were calculated using the gathered information for cotton operation sizes ranging from 500 to 2,500 acres.

The cotton harvesting costs were separated into fixed and variable costs. The fixed costs associated with cotton harvesting consisted of equal amortized annual payments of the purchase cost of the machine, accrued interest, depreciation, and other ownership costs, including taxes, housing, and insurance. The variable costs of cotton harvesting included the maintenance costs of the equipment per season and the cost of fuel and labor per day used by each machine.

Fixed Cost Estimates

The investment cost was determined assuming that the equipment was purchased with liability. The investment cost was calculated by amortizing the purchase cost into equal annual payments with the estimated salvage value used as the future value. For the purpose of this study, the purchase cost was amortized using an annual interest rate of 10% for 7 years. The salvage value was assumed to be 45% of the original purchase cost. Therefore, the annual amortized investment cost accounted for the purchase cost of the equipment as well as any accrued interest and depreciation over the specified period of time.

According to the American Society of Agricultural Engineers (1998), other ownership costs, including taxes, housing, and insurance can be estimated as 1%, 0.75%, and 0.25%, respectively, of the purchase cost. Therefore, a total of 2% of the purchase cost can be used to estimate the taxes, housing, and insurance costs of a piece of equipment. The annual fixed cost was calculated by summing the annual amortized investment cost and the estimated annual cost of taxes, housing, and insurance. The annual fixed cost was calculated for each size of stripper and picker, as well as each piece of additional harvesting equipment.

Variable and Total Cost Estimates

Seasonal maintenance cost estimates for the strippers, pickers, and additional harvesting equipment were obtained from cotton harvesting equipment owners and dealers. It was assumed that the life of each cotton harvesting equipment is 7 years. Therefore, the maintenance cost estimates were based on regular repairs anticipated for 7 years. The cost of operating the cotton harvesting equipment over a 7 year period was determined by calculating the present value of the maintenance cost using the following equation:

$$PV_{MC} = \sum_{t=1}^{n} \frac{MC_t}{(1+i)^t} \quad [1]$$

where PV_{MC} is the present value of the maintenance cost of the equipment over its life, MC is the maintenance cost per year, t is time, *i* is the interest rate, and n is the life of the equipment in years. The average interest rate of farm loans were assumed to be 10% (American State Bank, 1999, personal communication). It was assumed that each piece of equipment (strippers, pickers, and additional harvesting equipment) would be used each season, therefore there would be maintenance costs each year.

The number of acres harvested in one hour varied according to the number of row units of each stripper and picker. As a result, the number of days required for each machine to harvest a specific number of acres also varied. The number of days, D, was determined using the following formula:

$$D = A / (H * P) \quad [2]$$

where A is the number of cotton acres to be harvested, H is the average number of hours worked in one day, and P (performance rate) is the number of acres each size of stripper and picker could harvest in one hour.

The total cost of each cotton harvesting machine (strippers, pickers, boll buggy, module builder, and tractor) which combined the fixed and variable costs corresponding to each machine, was calculated using the following equation:

$$TC = FC + (PV_{MC} + ((L+F)*D)) \quad [3]$$

where TC is the total cost per year associated with each piece of harvesting equipment, FC is the fixed cost per year associated with each machine, PV_{MC} is the annual present value of the maintenance cost over the life of the machine, L is the cost of labor per day, F is the cost of fuel per day, and D is the number of days required for a specific number of acres to be harvested by each size of stripper or picker. Harvesting equipment dealers and owners implied that an average of 20 percent of a tractor's annual use is used in the harvesting process of cotton. Therefore, only 20 percent of the tractors' fixed and variable costs were accounted for when calculating the tractor(s) total cost in this study. The total cost was determined for the equipment configuration associated with each size of stripper and picker. This was accomplished by summing the total costs of the equipment components associated with each stripper and picker. The total cost of each equipment configuration was calculated using the following equation:

$$TC = TC_{S\ or\ P} + TC_{BB} + TC_{MB} + TC_{T(s)} \quad [4]$$

where $TC_{S\ or\ P}$ is the total cost of the stripper or picker, TC_{BB} is the total cost of the boll buggy (straight or swing-tongue), TC_{MB} is the total cost of the module builder, and $TC_{T(s)}$ is the total cost of the tractor(s) used to run the boll buggy and/or module builder. If a boll buggy was not used in the harvesting process, the total cost for the boll buggy was assumed to be zero.

Average Cost Estimates

Segarra et al. (1990) indicated that cotton lint yield reductions occur when harvest is delayed. The reductions in yield are expected to increase at an increasing rate as the harvesting of the cotton is delayed. The model used to estimate the percentage of cotton lint yield (Segarra et al., 1990) was:

$$Y = 0.93944 - 0.005971 * W^2 \quad [5]$$

where Y is the percentage of cotton lint yield and W is the week number during the harvesting season. According to Segarra et al. (1990), harvesting in the Southern High Plains usually occurs during the months of November, December, and January. The yield remaining after lint reductions, Y_{end}, was calculated using the following equations:

$$Y_{end} = Y_{begin} * Y \quad [6]$$

where Y_{begin} is the yield prior to any lint loss and Y is the percentage of cotton lint yield remaining. The 1997 Texas average lint yields of 480 pounds per stripper harvested acre and 815 pounds per picker harvested acre (Texas Agricultural Statistics, 1997), were used for Y_{begin} due to a lack of a better estimate.

The average cost of owning and operating the equipment configuration associated with each size of stripper or picker was calculated for farm sizes ranging from 500 to 2,500 acres. The average total cost, which combined the fixed and variable costs corresponding to each equipment configuration, was calculated using the following equation:

$$AC = TC / (Y_{end} * A) \quad [7]$$

where AC is the average cost per pound of lint associated with owning and operating each equipment configuration, TC is the total cost of each combination of equipment per year, Y_{end} is the yield per acre in pounds remaining after lint reductions, and A is the number of acres to be harvested. The average costs for the equipment configuration associated with each size of stripper or picker were then compared with each other and with the custom harvesting charges to determine the most cost effective method of harvesting given a certain number of acres.

Results

Fixed Cost Estimates

The purchase cost, investment cost, THI (taxes, housing, and insurance), and fixed cost for each component of the equipment configurations associated with each size of stripper and picker are presented in Tables 1, 2, and 3.

Stripper Fixed Cost Estimates

The total investment costs over the life of the equipment configurations associated with the four, six, eight, and two individual four-row strippers without a bur-extractor were $148,843, $188,983, $193,406, and $289,612, respectively (Table 1). The addition of a bur-extractor to the harvesting process increased the investment cost of each stripper and equipment combination by approximately $13,601 over the life of the machinery. Therefore, the equipment combinations associated with the four, six, eight, and two individual four-row strippers with bur-extractors had investment costs of $162,444, $202,584, $207,008, and $316,814, respectively, over the life of the machinery (Table 2).

After accounting for taxes, housing, and insurance, the equipment configurations for the four, six, eight, and two individual four-row strippers without bur-extractors had fixed costs per year of $21,648, $27,486, $28,129, and $42,120, respectively (Table 1). The fixed costs per year for equipment combinations associated with the four, six, eight, and two individual four-row strippers with bur-extractors were about $23,626, $29,464, $30,108, and $46,078, respectively (Table 2).

As the stripper size, without and with a bur-extractor, increased from a four-row to a six-row, the fixed costs of the equipment increased by approximately $40,866 over the life of the stripper or $5,838 per year. The fixed costs of the equipment increased by an additional $4,500 over the life of the stripper ($643 per year) as the stripper size increased from a six-row to an eight-row, without and with a bur-extractor (Table 1). The fixed costs over the life of the equipment associated with two individual four-row strippers without and with bur-extractors were $97,946 and $111,801, respectively, higher than the costs associated with the eight-row stripper (Tables 1 and 2).

Picker Fixed Cost Estimates

The total investment costs over the life of the equipment configurations associated with the two, four, and six-row pickers were $169,463, $278,555, and $366,629, respectively (Table 3). After accounting for taxes, housing, and insurance, the equipment configurations for the two, four, and six-row pickers had fixed costs per year of $26,715, $43,839, and $58,014, respectively (Table 3). As the picker size increased from a two-row to a four-row, the fixed costs of the equipment increased by approximately $119,862 over the life of the stripper or $17,124 per year. The fixed costs of the equipment increased by an additional $99,229 over

the life of the picker ($14,176 per year) as the picker size increased from a four-row to a six-row (Table 1).

Variable Cost Estimates

The variable costs per day associated with stripper and picker harvesting were constant across the stripper and picker sizes. The two variable costs accounted for in this study were the cost of fuel and labor. Data gathered from the industry indicated that each size of stripper and picker operates an average of 10 hours per day and uses about 50 gallons of diesel per day. Therefore, assuming that the equipment operates 10 hours per day, the price of diesel was $0.60 per gallon, and a minimum wage of $5.15 per hour was paid for labor, the cost of fuel and labor for each machine were about $30 and $51.50 per day, respectively.

The variable costs varied according to the number of days required to harvest a given number of acres. Survey results indicated that the number of acres that each stripper and picker size was capable of harvesting in one hour, which directly affected the number of days required to harvest a given number of acre, increased as the size of the stripper and picker successively increased (Tables 1, 2, and 3). However, the stripper without a bur-extractor was capable of harvesting approximately 1 acre per hour more than a stripper with a bur-extractor (Tables 1 and 2).

Stripper Variable Cost Estimates

The present values of the maintenance costs over the lives of the equipment configurations associated with the four, six, eight, and two individual four-row strippers without bur-extractors were $5,218, $6,541, $7,577, and $7,993, respectively (Table 1). The equipment configurations associated with the four, six, eight, and two individual four-row strippers with bur-extractors had present values of maintenance costs of $10,313, $11,637, $12,672, and $18,184, respectively, over the lives of the machinery (Table 2). The present value of the equipment maintenance cost increased by about $1,323 and $1,036 as the stripper size increased from a four-row to a six-row and from a six-row to an eight-row, respectively (Table 1 and 2). The present value of the maintenance cost of the two individual four-row strippers was about $416 and $5,512 higher than that of the eight-row stripper, without and with bur-extractors, respectivley. The addition of the bur-extractor into the harvesting process increased the present value of the maintenance cost over the life of the four, six, and eight-row strippers by about $5,095. When a bur-extractor was added to the two individual four-row strippers, the present value of the maintenance cost increased by about $10,191 over the life of the machinery.

Picker Variable Cost Estimates

The present values of the maintenance costs over the lives of the equipment configuration associated with the two, four, and six-row pickers were about $24,052, $45,318, and $66,296, respectively (Table 3). The present value of the equipment maintenance cost increased by about $21,266 and $20,978 as the picker size increased from a two-row to a four-row and from a four-row to a six-row, respectively (Table 3).

Average Cost Estimates

The average cost analysis was separated into three categories; strippers without and with bur-extractors and pickers. Figures 1 and 2 present the average cost estimates for the four, six, eight, and two individual four-row strippers without and with a bur-extractor, respectively, by the size of the operation. Figure 3 displays the average cost estimates of the two, four, and six-row pickers by the size of the operation in Texas. For the purpose of this analysis, average yields of 480 pounds per acre of stripper harvested cotton and 815 pounds per acre of picker harvested acre were assumed.

Stripper Alternatives without Bur-Extractors

The four-row stripper and equipment combination without a bur-extractor exhibited the minimum average cost between the four stripper alternatives until 1,700 acres (Table 4). At this point, the average cost was about 5.01 ¢/lb of lint. The eight-row stripper and equipment combination without a bur-extractor became the least expensive of the four alternatives of stripper harvesting starting at about 1,800 acres, where the average cost was 4.93 ¢/lb of lint (Table 4 and Figure 1).

Assessing average costs of strippers individually, it was observed that the harvesting cost of a four-row stripper and its associated equipment could

reach a minimum of 4.98 ¢/lb of lint at 1,800 acres (Table 4). Similarly, the six-row stripper and equipment combination could reduce the cost of harvesting to about 5.28 ¢/lb of lint at 2,200 acres, and an eight-row stripper and equipment combination could reduce the harvesting cost to about 4.14 ¢/lb of lint when used to harvest 3,000 acres (not reported in Table 4). It should, however, be recognized that it may not be feasible to arrive at these minimum costs because they are invariably associated with an extended harvesting season, which would expose the crop to potential weather related yield and quality damages.

Stripper Alternatives with Bur-Extractors

The average costs of stripper and equipment combinations with bur-extractors ranged from 0.78 to 2.73 ¢/lb of lint higher than stripper and equipment combinations without bur-extractors (Tables 4 and 5). The four-row stripper and equipment combination with a bur-extractor had the lowest average cost of the three stripper alternatives of about 7.60 ¢/lb of lint up to 1,100 acres. The eight-row stripper and equipment combination had the minimum average cost of about 7.34 ¢/lb beginning at about 1,200 acres (Figure 2).

When the average costs of strippers were evaluated individually, it was found that a minimum average cost of 7.24 ¢/lb of lint occurred at about 1,400 acres for the four-row stripper and equipment combination (Table 5). Likewise, the six-row stripper and equipment combination could reach a minimum average cost of 7.05 ¢/lb of lint at about 1,800 acres (Table 5), and a minimum average cost of about 5.22 ¢/lb of lint could be attained when an eight-row stripper is used to harvest 2,500 (Table 5). Again, the number of days it would require to operate the equipment configurations at their minimum average costs may not be practicable.

Picker Alternatives

The two-row picker and equipment combination had the lowest average cost of the three picker alternatives of about 7.40 ¢/lb of lint up to 1,000 acres (Table 6). The four-row picker and equipment combination had the minimum average cost from 1,100 to 1,700 acres, where the average costs ranged from 7.51 to 6.09 ¢/lb of lint, respectively. Similarly, the eight-row stripper and equipment combination had the minimum average cost beginning at about 1,800 acres. The average cost at this point was 5.86 ¢/lb of lint (Figure 3).

When the average costs of pickers and their associated equipment configuration were evaluated individually, it was found that a minimum average cost of 7.38 ¢/lb of lint occurred at about 900 acres for the two-row picker and equipment combination (Table 6). Likewise, the four-row picker and equipment combination could reach a minimum average cost of 6.02 ¢/lb of lint at about 1,900 acres (Table 6), and a minimum average cost of about 4.40 ¢/lb of lint could be attained when a six-row picker and equipment combination is used to harvest 3,500 acres (not reported in Table 6). It should be again noted that it is unrealistic to extend harvesting over such a large number of days, thus, it is not likely that the harvesting costs can be reduced to their minimum levels.

Comparison of Stripper and Picker Ownership with Custom Harvesting

Stripper Ownership

The custom harvesting charges were found to be 7.00 and 8.00 ¢/lb of lint without and with a bur-extractor, respectively (1992 Custom Rates Statistics and personal communication with current custom harvesters). Results indicated that the average cost of the four stripper and equipment combinations without and with bur-extractors became competitive with the custom harvesting charge at around 900 and 1,000 acres, respectively (Tables 4 and 5 and Figures 1 and 2). Therefore, it could be implied that custom harvesting is less expensive than buying a stripper and equipment combination without and with a bur-extractor up to 900 and 1,000 acres, respectively.

Picker Ownership

The custom picker harvesting charges were found to be 13.00 ¢/lb of lint (1992 Custom Rates Statistics and personal communication with current custom harvesters). Results indicated that the average cost of the two-row picker and equipment combination became competitive with the custom harvesting charge at around 500 acres, four-row at 600 acres, and six-row at 700 acres (Table 6 and Figure 3). Therefore, custom harvesting is less expensive than buying a picker and equipment combination at least up to

500 acres.

The producers' decision to have a crop custom harvested or to purchase harvesting machinery is not always dependent on minimum cost estimates alone. From the time the crop is ready to be harvested until it is actually harvested, there is a possibility of the crop experiencing yield reductions and damage due to weather. Many producers choose to pay the additional cost to purchase a harvesting equipment combination in order to avoid dependence on custom harvesters and a possible delay in harvesting.

Conclusion

This study estimated the ownership and maintenance costs associated with cotton harvesting machinery, including the four, six, eight, and two individual four-row strippers, without and with bur-extractors, the two, four, and six-row pickers, boll buggy, module builder, and tractor(s). These cost estimates were then compared with one another to determine the least expensive method of cotton harvesting given a specific number of acres. A typical Texas cotton producer (with a yield of 480 pounds per stripper harvested acre and a farm size of 639 acres) would minimize the cost of harvesting by investing in a four-row stripper without or with a bur-extractor at 9.48 ¢/lb or 11.08 ¢/lb of lint, respectively. If an average yield of 815 pounds per picker harvested acre and the Texas average farm size of 639 acres were assumed, the harvesting cost would be minimized with the ownership of a two-row picker and equipment combination, which would be about 8.64 ¢/lb of lint.

The six-row stripper and equipment combination was not found to be cost effective for the farm sizes considered in this study. This is mainly due to the performance rate benefit of the eight-row stripper and equipment combination outweighing the small difference in investment costs between the two stripper and equipment combinations. The minimum harvesting cost between the four stripper and equipment combinations without bur-extractors went from the four-row at 1,700 acres to the eight-row at 1,800 acres. Similarly, the four-row stripper and equipment combination with a bur-extractor was the least expensive alternative up to 1,100 acres. The eight-row stripper and equipment combination with a bur-extractor then became the most inexpensive alternative at 1,200 acres. For picker and equipment combinations, the two-row picker and equipment combination had the lowest average cost of the three picker alternatives up to 1,000 acres. The four-row picker and equipment combination had the minimum average cost from 1,100 to 1,700 acres, while the six-row picker and equipment combination had the minimum average cost beginning at about 1,800 acres.

Further, a comparison of the estimated harvesting cost with the costs of custom harvesting indicated that having a crop custom stripper harvested was less expensive until the farm size reached 900 acres for stripper and equipment combinations without bur-extractors and 1,000 acres for stripper and equipment combinations with bur-extractors. Custom picker harvesting was found to be less expensive than owning a two-row picker and equipment combination until 500 acres. However, when a crop is custom harvested, there is the possibility that the harvesting process could be delayed, which could result in unusual yield and quality damage due to weather. Therefore, many producers might be willing to pay the additional cost to purchase a stripper and equipment combination in order to avoid a delay in harvesting.

This study fills a critical void by providing estimates for cotton harvesting costs for both stripper and picker alternatives that are currently unavailable. However, the results should be used with caution because, for a lack of a better option, all reported estimates are based on the Texas average yield of 480 pounds per acre of stripper harvested cotton and 815 pounds per acre of picker harvested cotton. It is obvious that the results of this study are not applicable to production (scenarios that are different from what was considered in this study). However, it should be recognized that this study provides a simple method that can be employed by cotton producers in various parts of the United States to determine the cost of harvesting given individualized production scenarios.

Acknowledgements

The authors would like to thank Terry Ervin, Phil Johnson, and Kal Chakraborty for their assistance with this article. This research was

supported by Cotton Incorporated. Texas Tech University, College of Agricultural Sciences and Natural Resources Pub. T-1-522 (CER 00-5).

References

American Society of Agricultural Engineers. ASAE EP496.2, Agricultural Machinery Management, 1998 Agricultural Engineers Yearbook, St. Joseph, Michigan, p. 353.

Bennett, B.K., S.K. Misra, A. Brashears, and T.L. Dowty. 1995. Effect of
bur-extractor on trash in seed cotton and fiber quality for different harvest dates. p.649-652. *In* J. Armour and D. Richter (ed.) Proc. Beltwide Cotton Conf., San Antonio, TX. 4-7 Jan. 1995. Natl. Cotton Council Am., Memphis TN.

Bennett, B.K., S.K. Misra, and A. Brashears. 1997. Cost/benefit analysis of bur-extractors in cotton harvesting. P. 189-198. Journal of Agribusiness.

Glade, E.H. Jr., M.D. Johnson and L.A. Meyer. 1996. Cotton ginning charges, harvesting practices, and selected marketing costs, 1994/95 season. Washington, D.C.: USDA Econ. Research Service. No.918.

McPeek, B.D. 1997. Optimum organization of the cotton ginning industry in
the Texas southern high plains. Unpublished M.S. Thesis. Texas Tech University. Lubbock, TX.

Segarra, E., W. Keeling, and J.R. Abernathy. 1990. Analysis and evaluation of the impacts of cotton harvesting dates in the southern high plains of Texas. p.386-390. *In* J.M. Brown and D. Richter (ed.) Proc. Beltwide Cotton Conf., Las Vegas, NV. 9-14 Jan 1990. Natl.Cotton Council Am., Memphis, TN.

TDA homepage, Texas Department of Agriculture. Available online at: http://www.agr.state.tx.us/. Accessed May 1999.

Texas Agricultural Statistics. 1997. Texas Agricultural Statistics Service. U.S. Department of Agriculture and Texas Department of Agriculture.

U.S. Department of Agriculture. 1993. 1992 Custom Rates Statistics. Austin, TX: Texas Department of Agriculture and Texas Agricultural Statistics Service.

Table 1. Cost Estimates for Equipment Configurations Associated with Stripper Harvesting Alternatives without Bur-Extractors.

	4-row	6-row	8-row	2-4 Row
Purchase Cost ($)				
Stripper (w/out BE)	102,000	113,000	116,000	204,000
Boll Buggy	0	13,300	14,300	13,300
Module Builder	20,600	20,600	20,600	20,600
Tractor(s) 20% of PC	12,000	24,000	24,000	24,000
Total Purchase Cost	134,600	170,900	174,900	261,900
Investment Cost ($)				
Stripper (w/out BE)	112,793	124,957	128,274	225,586
Boll Buggy	0	14,707	15,813	14,707
Module Builder	22,780	22,780	22,780	22,780
Tractor(s) 20% of IC	13,270	26,539	26,539	26,539
Total Investment Cost	148,843	188,983	193,406	289,612
Total THI[1] ($)				
Stripper (w/out BE)	2,040	2,260	2,320	4,080
Boll Buggy	0	266	286	266
Module Builder	412	412	412	412
Tractor(s) 20% of THI	240	480	480	480
Total THI	2,692	3,418	3,498	5,238
Fixed Cost ($)				
Stripper (w/out BE)	114,833	127,217	130,594	229,666
Boll Buggy	0	14,973	16,099	14,973
Module Builder	23,192	23,192	23,192	23,192
Tractor(s) 20% of FC	13,510	27,019	27,019	27,019
Total Fixed Cost	151,535	192,401	196,904	294,850
Annual Fixed Cost ($/yr)				
Stripper (w/out BE)	16,405	18,174	18,656	32,808
Boll Buggy	0	2,139	2,300	2,139
Module Builder	3,313	3,313	3,313	3,313
Tractor(s) 20% of AFC	1,930	3,860	3,860	3,860
Total Fixed Cost	21,648	27,486	28,129	42,120
Total PV of MC[2] ($)				
Stripper (w/out BE)	2,487	3,522	4,558	4,974
Boll Buggy	0	183	183	183
Module Builder	2,626	2,626	2,626	2,626
Tractor(s) 20% of PV of MC	105	210	210	210
Total PV of MC	5,218	6,541	7,577	7,993
Performance Rate; ac/hr	4	5	6.5	8

Note: W/out BE refers to without the use of a bur-extractor.

1 THI refers to the total taxes, housing, and insurance over the life of the machine.

2 PV of MC refers to the total present value of the maintenance cost over the life of the machine.

Table 2. Cost Estimates for Equipment Configurations Associated with Stripper Harvesting Alternatives with Bur-Extractors.

	4-row	6-row	8- Row	2-4 Row
Purchase Cost ($)				
Stripper (w/out BE)	114,300	125,300	128,300	228,600
Boll Buggy	0	13,300	14,300	13,300
Module Builder	20,600	20,600	20,600	20,600
Tractor(s) 20% of PC	12,000	24,000	24,000	24,000
Total Purchase Cost	146,900	183,200	187,200	286,500
Investment Cost ($)				
Stripper (w/out BE)	126,394	138,558	141,876	252,788
Boll Buggy	0	14,707	15,813	14,707
Module Builder	22,780	22,780	22,780	22,780
Tractor(s) 20% of IC	13,270	26,539	26,539	26,539
Total Investment Cost	162,444	202,584	207,008	316,814
Total THI[1] ($)				
Stripper (w/out BE)	2,286	2,506	2,566	4,572
Boll Buggy	0	266	286	266
Module Builder	412	412	412	412
Tractor(s) 20% of THI	240	480	480	480
Total THI	2,938	3,664	3,744	5,730
Fixed Cost ($)				
Stripper (w/out BE)	128,680	141,064	144,442	257,360
Boll Buggy	0	14,973	16,090	14,973
Module Builder	23,192	23,192	23,192	23,192
Tractor(s) 20% of FC	13,510	27,019	27,019	27,019
Total Fixed Cost	165,382	206,248	210,743	322,544
Annual Fixed Cost ($/yr)				
Stripper (w/out BE)	18,383	20,152	20,635	36,766
Boll Buggy	0	2,139	2,300	2,139
Module Builder	3,313	3,313	3,313	3,313
Tractor(s) 20% of AFC	1,930	3,860	3,860	3,860
Total Fixed Cost	23,626	29,464	30,108	46,078
Total PV of MC[2] ($)				
Stripper (w/out BE)	7,582	8,618	9,653	15,165
Boll Buggy	0	183	183	183
Module Builder	2,626	2,626	2,626	2,626
Tractor(s) 20% of PV of MC	105	210	210	210
Total PV of MC	10,313	11,637	12,672	18,184
Performance Rate; ac/hr	3	4	5.5	6

Note: W/ BE refers to with the use of a bur-extractor.

1 THI refers to the total taxes, housing, and insurance over the life of the machine.

2 PV of MC refers to the total present value of the maintenance cost over the life of the machine.

Table 3. Cost Estimates for Equipment Configurations Associated with Picker Harvesting Alternatives.

	2-row	4-row	6- Row
Purchase Cost ($)			
Picker	120,650	194,000	273,650
Boll Buggy	0	13,300	13,300
Module Builder	20,600	20,600	20,600
Tractor(s) 20% of PC	12,000	24,000	24,000
Total Purchase Cost	153,250	251,900	331,550
Investment Cost ($)			
Picker	133,413	214,529	302,603
Boll Buggy	0	14,707	14,707
Module Builder	22,780	22,780	22,780
Tractor(s) 20% of IC	13,270	26,539	26,539
Total Investment Cost	169,463	278,555	366,629
Total THI[1] ($)			
Picker	2,413	3,880	5,473
Boll Buggy	0	266	266
Module Builder	412	412	412
Tractor(s) 20% of THI	240	480	480
Total THI	3,065	5,038	6,631
Fixed Cost ($)			
Picker	150,307	241,687	340,916
Boll Buggy		14,973	14,973
Module Builder	23,192	23,192	23,192
Tractor(s) 20% of FC	13,510	27,019	27,019
Total Fixed Cost	187,009	306,871	406,100
Annual Fixed Cost ($/yr)			
Picker	21,472	34,527	48,702
Boll Buggy	0	2,139	2,139
Module Builder	3,313	3,313	3,313
Tractor(s) 20% of AFC	1,930	3,860	3,860
Total Fixed Cost	26,715	43,839	58,014
Total PV of MC[2] ($)			
Picker	21,321	42,299	63,277
Boll Buggy	0	183	183
Module Builder	2,626	2,626	2,626
Tractor(s) 20% of PV of MC	105	210	210
Total PV of MC	24,052	45,318	66,296
Performance Rate (ac/hr)	2	4	7

1 THI refers to the total taxes, housing, and insurance over the life of the machine.

2 PV of MC refers to the total present value of the maintenance cost over the life of the machine.

Table 4. Average Cost Estimates for Equipment Configurations Associated with Strippers Without Bur-Extractors by Size of Operation.

Acres	4 Row	6 Row	8 Row	2-4 Row
	------- cents / lint pound -------			
500	11.08	13.9	13.91	20.01
600	9.48	11.83	11.77	16.83
700	8.35	10.37	10.25	14.56
800	7.52	9.29	9.12	12.86
900	6.89	8.46	8.24	11.55
1000	6.4	7.81	7.55	10.51
1100	6.02	7.29	6.99	9.66
1200	5.72	6.86	6.53	8.95
1300	5.49	6.52	6.14	8.36
1400	5.30	6.23	5.82	7.86
1500	5.17	6.00	5.54	7.43
1600	5.07	5.81	5.30	7.05
1700	5.01	5.65	5.10	6.73
1800	4.98	5.52	4.93	6.44
1900	4.98	5.43	4.78	6.19
2000	5.02	5.36	4.65	5.97
2100	5.10	5.31	4.54	5.77
2200	5.21	5.28	4.44	5.60
2300	5.37	5.28	4.36	5.44
2400	5.59	5.30	4.30	5.30
2500	5.87	5.35	4.24	5.18

Table 5. Average Cost Estimates for Equipment Configurations Associated with Strippers With Bur-Extractors by Size of Operation.

Acres	4 Row	6 Row	8 Row	2-4 Row
	------- cents / lint pound -------			
500	12.82	15.51	15.32	22.74
600	11.08	13.27	12.99	19.18
700	9.87	11.70	11.35	16.65
800	9.01	10.55	10.12	14.77
900	8.38	9.68	9.18	13.31
1000	7.93	9.01	8.43	12.16
1100	7.60	8.48	7.83	11.23
1200	7.39	8.06	7.34	10.46
1300	7.27	7.74	6.94	9.82
1400	7.24	7.49	6.60	9.29
1500	7.29	7.30	6.32	8.83
1600	7.44	7.17	6.08	8.45
1700	7.69	7.09	5.88	8.11
1800	8.08	7.05	5.72	7.83
1900	8.64	7.07	5.58	7.59
2000	9.44	7.13	5.47	7.38
2100	10.60	7.24	5.38	7.20
2200	12.38	7.41	5.31	7.05
2300	15.29	7.64	5.26	5.44
2400	20.79	7.96	5.23	5.30
2500	34.66	8.36	5.22	6.75

Table 6. Average Cost Estimates for Equipment Configurations Associated with Pickers by Size of Operation.

Acres	2 Row	4 Row	6 Row
	------- cents / lint pound -------		
500	9.73	14.23	18.20
600	8.64	12.10	15.29
700	7.95	10.61	13.22
800	7.56	9.51	11.67
900	7.38	8.67	10.47
1000	7.40	8.02	9.53
1100	7.64	7.51	8.75
1200	8.15	7.10	8.11
1300	9.06	6.78	7.58
1400	10.64	6.53	7.12
1500	13.65	6.33	6.73
1600	NR	6.19	6.40
1700	NR	6.09	6.11
1800	NR	6.03	5.86
1900	NR	6.02	5.63
2000	NR	6.04	5.44
2100	NR	6.11	5.27
2200	NR	6.23	5.12
2300	NR	6.40	4.99
2400	NR	6.63	4.87
2500	NR	6.95	4.77

The NR (not realistic) means that this machine become economically infeasible for harvesting the number of acres specified. This results from an unrealistic amount of time required to harvest the specified number of acres.

Figure 1. Average Cost Estimates for Equipment Configurations Associated with Strippers without Bur-Extractors by Size of Operation

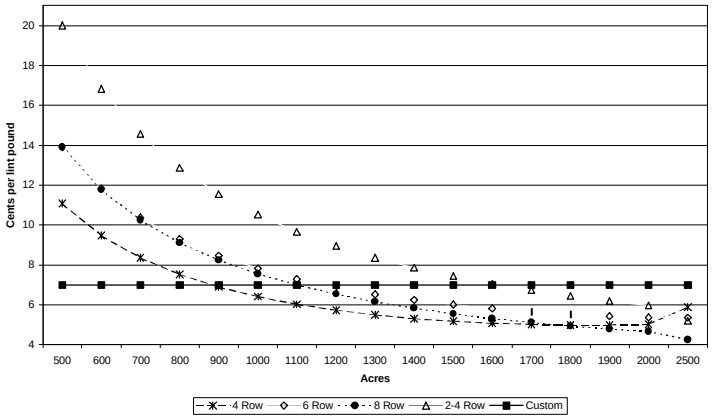

Figure 2. Average Cost Estimates for Equipment Configurations Associated with Strippers with Bur-Extractors by Size of Operation.

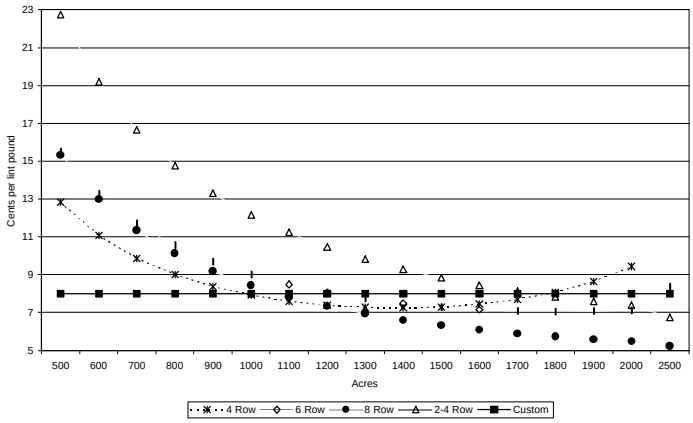

Figure 3. Average cost Estimates for Equipment Configurations Associated with Pickers by size of Operation