ABSTRACT

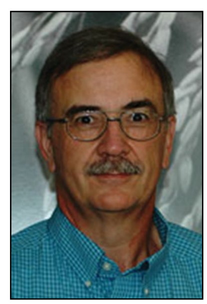
Onboard module building cotton harvesters currently offer cotton producers the potential to improve harvest efficiency and reduce harvest costs as a means of supporting cotton as an economically viable option in many farm crop rotation production systems. Using data provided by producers currently using this technology in a few southern cotton states, this study estimates current capital and operating costs of onboard module cotton pickers based on field experience and makes comparisons with the costs of using traditional basket pickers. Total per acre cotton harvest cost for the onboard module system was estimated to be approximately $26 less expensive than harvesting cotton with comparable sized basket pickers.

Comparative Costs of Onboard Module Building Cotton Harvest Systems in the Mid-South

By Michael E. Salassi, Michael A. Deliberto, and Lawrence L. Falconer

Introduction

The United States cotton industry is currently facing many challenges, including rising production costs, stagnant yields, high world cotton stock levels, and potentially less income support from future farm programs. All of these factors have a direct impact on the bottom line of cotton producers and substantially influences the ability of cotton to compete with other crops for production acres. This is especially true in the Mid-South where cotton acres have declined significantly in recent years.



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This project was supported by USDA Agricultural Marketing Service Federal State Marketing Improvement Program Grant 12-25-G-1277.

In 2005, there were 3.38 million acres of cotton harvested in the states of Alabama, Arkansas, Louisiana, and Mississippi (UDSA, NASS). By 2014, total harvested cotton acreage declined to 1.26 million acres, primarily due to the improved comparative economic advantage of crops such as corn and soybeans. With the inability to control the cost of crop production inputs as well as the volatility of cotton market prices and yields from year to year, one of the primary goals of decision making at the farm level has been to make production choices and decisions which will result in lowering production costs per pound of cotton produced. Historically, variety selection has been the predominant factor in lowering, or at least stabilizing, production costs per pound of cotton lint produced.

Occasionally, a change in production technology comes along which can also serve to significantly lower per unit production costs. The relatively recent development of onboard module building cotton harvesters does provide an opportunity for cotton producers to lower harvest costs per acre and thereby lower total costs per pound of cotton. Now that some cotton producers in the Mid-South have utilized the onboard module cotton harvesters for a few years, more reliable estimates of the capital and operating costs can be obtained which makes more accurate cost comparisons with traditional basket pickers possible. Performance parameters utilized in this analysis are based on information from cotton producers currently using onboard module building cotton pickers in selected southern states. The results presented in this analysis do not represent a region-wide survey of cotton producers using module building harvesters. But rather, the purpose of this study was to estimate current and comparable cotton harvest performance and cost parameters for cotton harvest in the Mid-South with validation of these estimates by selected large-scale producers utilizing module harvesters.

The number of module building cotton harvesters being used in the Mid-South is relatively small. Although these machines have been on the market for several years, the high cost as well as the great harvest capacity of these machines results in users being primarily large farms with large acreages of cotton. Comparative performance measures, and related costs, for module harvesters versus basket harvesters were estimated and then reviewed by two to four very large cotton producers in each of the states of Louisiana and Mississippi. In many instances, these farms were some of largest cotton farms in each of the states and accounted for sizeable portions of total cotton acreage. Each of these farms has utilized module harvesters for a few years and has a good feel for the reasonable range of performance measures. Although performance measures can vary from farm to farm as well as over a range of harvest conditions, producers interviewed as part of this study indicated that performance measures estimated in this study were in line with their field experiences.

As total harvest costs comprise such a significant part of total cotton production costs, much research has been conducted over the years to evaluate not only the performance, but also the costs of alternative cotton harvest systems and equipment configurations. A large amount of previous economic research has evaluated the comparative costs of utilizing stripper versus picker harvest systems (Nelson, et al., 2000; Willcutt, et al., 2001; Yates, et al., 2007; Keeling, et al., 2011). None of these previous studies have included evaluation of onboard module cotton pickers. Some of the early economic research evaluating the costs of onboard module building cotton harvest systems was conducted in Mississippi. Parvin (2005) estimated the operating costs of onboard module cotton pickers with traditional four-row and six-row cotton pickers. Although estimated cost for the onboard module picker was lower than traditional pickers, cost estimates for all systems were estimated using the same assumed levels of harvest speed and hours of annual use. A later study estimated the harvest costs for the new onboard harvest systems by per pound of lint and per bale of cotton basis (Martin & Valco, 2008). Both of these early studies utilized limited assumptions regarding the operating performance of the module pickers resulting from the fact that these machines represented new technology in the market place and actual producer experience with these machines at that time was rather limited.

Traditional cotton harvest units, whether a picker or stripper harvester, deposit harvested cotton lint in to an onboard basket which is later unloaded into a module builder. Capacities of these onboard baskets vary greatly depending upon the specific size and type of harvester. Stripper machines have basket capacities in the 800 to 900 cubic feet range. Traditional cotton pickers will have basket capacities of approximately 1,150 cubic feet for four-row pickers and 1,400 cubic feet for six-row pickers. Capacities of these onboard baskets will hold about seven and a half pounds of cotton per cubic foot.

Two major agricultural equipment manufacturers have offered onboard module building cotton pickers to cotton producers over the past few years. Case-IH manufactures the Module Express 625 picker, a 365 horsepower machine which forms harvested cotton into a module. This is a six-row cotton picker with a 4,000 to 12,000 pound module chamber capacity, capable of producing an 8 x 8 x 16 foot module of cotton (Case-IH). The John Deere 7760 is a 530 horsepower machine which forms harvested cotton into round bales wrapped with plastic. This is also a six-row cotton picker, forming round modules of cotton up to ninety inches in diameter and 96 inches wide, with a module cotton weight of 4,500 to 5,500 pounds (John Deere). Cost estimates presented in this study are based on operating parameters of the John Deere 7760 module picker.

Harvest Unit Performance Rates

The specification of machine performance rate is central to the accurate estimation of the variable costs of operating harvest units such as cotton pickers. Performance rates are a statement of machine capacity per unit of time and are typically stated in units of acres covered (harvested) per hour of operation. The performance rate, or effective field capacity, of a specific harvest unit is a function of primarily two values: the theoretical field capacity of the machine as well as an adjustment for field efficiency (John Deere). Theoretical field capacity is the maximum possible operating capacity of the machine, in acres per hour, which can be obtained at a given forward speed assuming the machine is utilizing its full harvest width. Although a harvester can reach theoretical field capacity, it cannot maintain operation at that level over an extended period of time, due to the fact that harvest operations will be interrupted for things such as field turns, refueling, and field maintenance. Of the total time spent in the field, field efficiency represents the percent of time that the harvester is actually harvesting the crop.

The actual or effective field capacity of farm machinery is the rate of time at which it can perform its primary function under normal operating conditions. Effective field capacity, in acres harvested per hour of operation, for a cotton picker can be estimated by using the following formula:

$$(1) \qquad EFC = \frac{FS \times MW}{8.25} \times FE$$

where *EFC* = effective field capacity in acres per hour, *FS* = machine field speed in miles per hour, *MW* = machine width in feet, *FE* = field efficiency in percent, and 8.25 is the ratio between 5,280 feet per mile and 43,560 square feet per acre. The first part of this equation estimates theoretical field capacity. The second part of this equation makes an adjustment for field efficiency, the percent of machine operating time during which it is performing it primary function. In the case of cotton harvesters, field efficiency represents the percent of operating time during which the machine is actually harvesting cotton. Factors which cause the field efficiency measure to be less than 100 percent include any number of conditions which would cause delays in the harvest operation such as waiting to unload, idle time on headlands, and checking or refueling the harvester.

Table 1 presents estimates of effective field capacity (i.e., performance rates) for a four-row and six-row traditional basket picker as well as a new six-row module picker. Two key parameters in these estimates, field speed and field efficiency, are based on producer estimates of what are actually observed under field conditions in southern US cotton production. The baskets' pickers operate at about 70 percent field efficiency at speeds of about 3.6 miles per hour for the four-row picker and about 4.2 miles per hour for the six-row picker, slightly faster due to increased machine capacity. Growers with newer onboard module building pickers indicated that they could run their machines at about five miles per hour. A more conservative field speed of 4.8 miles per hour was used in this analysis. Growers also indicated that the field efficiency was greater for the onboard module pickers, in the range of 80 to 85 percent. Since the module pickers can wrap and drop a cotton bale without having to stop, the amount of machine operating time while not actually harvesting cotton is greatly reduced. Field efficiency can vary from field to field and farm to farm for a variety of reasons. One of the primary factors affecting field efficiency measures for module harvesters compared with basket pickers is the fact that module harvesters do not have to stop to unload harvested cotton into a boll buggy for transport to a module builder. Growers using module harvesters indicated that the two main advantages of using these machines to harvest was the slightly faster forward speed at which the machine can be run as well as the reduction in down time related to boll buggy and module builder operations in the field. An increase in field efficiency by roughly 10 to 15 percent was indicated as a reasonable estimate by growers using module harvesters.

The resulting performance rates (i.e., effective field capacities) estimated here are for the three types of cotton pickers correlated closely with information indicated by the cotton producers from field experience. The four-row basket picker had an estimated harvest performance rate of 3.89 acres per hour (0.257 hours per acre) and the six-row basket picker had an estimated performance rate of 6.77 acres per hour (0.148 hours per acre). The estimated harvest performance rate for the six-row module picker was 9.40 acres per hour (0.106 hours per acre). This value was within the range of potential harvest ability of approximately eight to ten acres per hour, depending upon conditions, indicated by the growers currently operating module cotton pickers. Fuel and labor costs for operation of the module picker alone were estimated to be higher than the basket pickers on a cost per hour of operation basis ($92.26 per hour), using 2013 input price values. However, the increased field efficiency and potential greater harvest speed resulted in a lower estimated harvest machine cost on a per harvested acre basis, compared with the basket pickers. Fuel and labor cost per acre for the module picker and a single operator were estimated to be $9.82 per acre, compared to $16.06 and $10.26 for the four-row and six-row basket pickers.

One area of interest regarding the operating costs of the new module cotton pickers is the relationship between harvest field speed and field efficiency. It is generally assumed, and initial field experience suggests, that the module pickers can be operated at a slightly greater harvest speed and will perform with greater harvest field efficiency than the traditional basket pickers. With traditional basket pickers, the harvest unit would move through the field harvesting cotton. When the basket would fill to its capacity with harvested cotton lint, the picker would stop in the field, and a field tractor would then bring a boll buggy alongside for the harvested lint to be emptied into for transport to a module builder. Harvest performance rates for these types of pickers are in the range of three to four acres per hour for a four-row picker and six to seven acres per hour for a six-row picker. The advantage offered by the newer onboard module pickers is not only the significant reduction in harvest labor required, but also the increase in harvest performance and efficiency due to the reduction in time required to unload harvested cotton from the picker to the boll buggy. When the onboard module capacity is reached during harvest, the picker unloads the wrapped cotton module on the ground and continues harvesting. The only other labor and machinery required to harvest the cotton is a field tractor and operator which moves the modules to loading sites, operating independently of the module harvester. Some growers have indicated that on large tracts of cotton, one field tractor moving harvested cotton modules can provide adequate harvest support to two module pickers. Field tractor labor and machinery costs of moving cotton modules in the field are included as costs in the module harvester system presented here.

Although the economic analysis presented here focuses solely on comparative harvest system ownership and operating costs, one additional factor which should also be considered is differences in cotton yield field losses related to picking efficiency. Several factors have an impact on cotton picker efficiency losses including picking the crop too soon after defoliant application, picking an immature crop, not centering the machine properly over the row profile, as well as handling losses within the cotton harvest system. Given the reduction in crop handling permissible with the module harvest system compared to the module builder system, it would be expected that picking losses would be reduced with the new onboard module harvesters.

Table 2 presents estimates of the expected range of fuel and labor costs for the onboard module picker over alternative ranges of field speed and field efficiency which would most likely be observed under actual harvest field conditions. Under normal operating harvest conditions, the module picker has the potential to operate at 80 to 90 percent field efficiency with harvest speeds of 4.6 to 5.0 miles per hour. Over this range of harvest performance, it is estimated that the module picker could harvest cotton at rates of 8.47 to 10.36 acres per hour. Even when operating at slightly lesser field efficiency or slower harvest speed, the harvest capacity of the module picker, in terms of acres harvested per hour, would still be expected to be equal to or greater than the harvest capacity of comparable sized basket pickers. At a field efficiency of 80 percent for the module picker, a field speed as low as 3.7 miles per hour would still result in a higher field performance rate equal to or greater than the traditional six-row basket picker.

For the predicted range of module picker harvest parameters, 4.6 to 5.0 mile per hour harvest speed and 80 to 90 percent field efficiency, harvest machine fuel and labor cost were estimated to range from $8.90 to $10.89 per acre harvested. These cotton picker harvest cost estimates are approximately $4 to $6 per acre less than cost estimates for a comparably sized basket picker. The primary factor resulting in this lower variable harvest cost is related to the higher harvest performance rates experienced with the module pickers.

Total Harvest System Costs

Comparative total per acre cotton harvest system costs, using 2013 purchase price and variable input price values, are presented for the four-row and six-row basket pickers (Table 3 and 4) and for the six-row onboard module system (Table 5). These estimated costs include charges for all labor and equipment utilized in harvesting the cotton crop. The two basket picker systems include fixed and variable costs associated with a separate traditional module builder. For each harvest system, including the module picker, labor costs for an additional field laborer, not directly associated with field machine operation, is also charged to cover additional cotton harvest labor which supports harvest operations, such as refueling tractors and harvesters and assisting in the handling and transfer of cotton modules and bales. This labor charge per acre is based on the performance rate of the particular cotton picker.

Estimated total cotton harvest system cost for the onboard module system was estimated at $51 per harvested acre, compared with $149 and $77 for the two basket picker systems, respectively. This cost was based on more realistic operating assumptions including 250 hours of annual use as well as the slightly higher harvest speed and field efficiency. Only two machine operators are required for the onboard module building harvester, one person to operate the module picker and another person to operate a tractor moving the module bales to a transport location. The $26.21 per acre fixed capital cost for the module picker is based on an assumed purchase price of $575,000 with a useful life of ten years and 250 hours of annual use per year. The higher purchase cost of these onboard module harvester machines, along with their greater field capacity, are going to mean that they will have to be utilized over more acres on an annual basis to realize the potential economic advantages possible.

Impact of Annual Use on Fixed Cost

In addition to the field capacity or performance rate, which directly impact variable harvest costs per acre, the economically efficient use of harvest machinery is also dependent upon the amount of annual use of the machine which directly impacts fixed harvest costs per acre harvested. By definition, total annual fixed costs associated with owning harvest machinery are constant over a given growing season. However, the economically efficient use of that machinery implies that it is used over a large enough acreage in a given year in order to lower fixed costs per acre down to a low enough level to make the use that harvest equipment economical for the grower. This is especially critical for the module harvesting system, as the purchase price and resulting annual fixed costs are much greater for this harvest system compared to the basket pickers.

Capital recovery cost estimation is a method of calculating the annual depreciation and interest charges related to the ownership of farm equipment. It is an alternative and more concise means of calculating equipment ownership costs than the traditional procedure of calculating depreciation and interest separately. The capital recovery amount is the annual payment that will recover the initial investment lost through depreciation, plus interest on the investment (Kay, Edwards, and Duffy, 2004). This amount will also generally be slightly higher than the sum of the average annual depreciation and interest, calculated separately, because the capital recovery method assume that interest charges are computed at the beginning of each year and are compounded annually. The capital recovery factor is a function of the interest (*i*) and the number of years of expected useful life (*n*) and can be computed by either of the two often stated formulas below:

(2) $$CRF = \frac{i(1+i)^n}{(1+i)^n - 1} = \frac{i}{1-(1+i)^{-n}}$$

where *CRF* represents the annual capital recovery factor for a machinery investment of n years at an annual interest rate of *i*%.

Once the capital recovery factor is determined, the annual capital fixed cost of ownership of a piece of farm machinery can be computed by using the formula below:

(3) $$CRCPY = [(RC - SV) \times CRF)] + (SV \times IR)$$

where *CRCPY* = the annual capital recovery charge (or fixed ownership cost) per year, *RC* = the replacement cost or purchase price of the equipment, *SV* = the salvage value, *CRF* = the calculated cost recovery factor and *IR* = the interest rate. For purposes of the cotton harvest cost analysis presented in this article, comparable annual capital recovery charges were estimated for a six-row module picker and a six-row basket picker. For the module picker, using a purchase price of $575,000, a ten year useful life, an assumed salvage value of 30 percent and an intermediate term interest rate of 5.25 percent, the capital recovery factor was calculated to be 0.13108 yielding an annual capital recovery cost of $61,817. For the six-row basket picker, a purchase price of $450,000 was assumed, with all other parameters the same as for the module picker. The annual capital recovery cost for the basket picker was estimated to be $48,378.

The primary purpose of the specific fixed cost analysis presented in this study was to estimate and contrast measures of fixed cost per unit for these two harvest machines on a comparable basis. Harvest machinery fixed cost varies greatly from farm to farm depending upon the machinery purchase practices of the farm operator. Some machines are purchased new and kept for just a few years before they are traded in for new replacement machines. These used machines are then acquired by other farms and kept in operation for a variable length of time. In the evaluation of the decision by a farm to switch cotton harvest systems, comparable fixed cost estimates provide some useful information to evaluate the ownership costs of these machines over comparable acres harvested or hours of annual use, keeping in mind that the performance rates are different. As a result, a ten year useful life with a 30 percent salvage rate was chosen as the basis on which to estimate and compare fixed ownership costs.

Fixed cost values were estimated for a six-row module picker and a comparable six-row basket picker over a range of alternative hours of annual use as well as over a range of alternative annual acres of cotton harvested. Table 6 provides comparable estimates of fixed costs for specific hours of annual use ranging between 150 and 300 hours per year. On a cost per hour basis, estimated fixed costs for the module picker were higher than for the basket picker, however, the difference in fixed cost per hour of operation between the two harvest units decline as annual operation hours increase. At 200 hours of annual use, fixed cost for the module picker was estimated at $309 per hour, compared with $242 per hour for the basket picker, a difference of $67 per hour. At 300 hours of annual use, fixed cost for the module picker was estimated at $206 per hour, compared with $161 per hour for the basket picker, a difference of only $45 per hour.

Given the difference in performance rates between the two cotton pickers, the six-row module picker can harvest significantly more cotton acres over the same amount of time than the six-row basket picker can. As indicated in Table 1, a six-row module picker can harvest approximately 9.40 acres per hour, 2.63 acres per hour more than the six-row basket picker. Therefore, at 200 hours of annual use, the module picker could harvest 535 more acres of cotton annually than the basket picker. At 300 hours of annual use, an additional 803 acres of cotton could be harvested by the module picker. This increased harvest efficiency and capacity negates the differences in fixed cost per hour of operation. On a cost per acre harvested basis, fixed costs for the module picker at specific hours of annual use are lower, within $4 per acre or less when compared to a comparable basket picker.

Table 7 provides estimates of fixed costs and hours of annual use required to harvest specific levels of cotton acreage annually. At 1,400 acres of cotton harvested annually, fixed cost estimates for the module picker were $44 per harvested acre, approximately $9 per acre higher than for the basket picker. However, the module picker would require only 148 hours of operation to harvest that level of cotton acreage, fifty-nine hours less than what would be required with the basket picker. The savings in variable operating cost would more than cover the slight increase in fixed cost per acre. Fixed cost per harvested acre declines greatly for higher levels of harvested acreage. At annual harvested acreage levels exceeding 2,000 acres of cotton, fixed cost per harvested acre for the module picker were estimated to decline below $30 per acre. In addition, although the capital recovery charge per hour of use is greater for the module picker compared with the basket picker, these fixed charges per hour of use for the module picker decline substantially at annual harvested acreage levels above 2,000 acres per year.

Given the harvest capacity of these new module pickers, annual acres of cotton harvested per machine would need to approach and possibly exceed 2,000 acres of cotton in order to achieve the necessary cost savings to make the module pickers economically feasible and thereby be adopted by large numbers of cotton producers. If a farming operation is large enough, these cost savings could be achieved within the specific individual farming operation. In other cases where the amount of cotton acreage on the farm is insufficient to economically justify the use of a module picker on that farm alone, it may be necessary to custom harvest some additional cotton acreage on other farming operations, at a custom charge, in order to achieve the desired cost savings. Under this scenario, cotton harvest fixed costs per acre would be reduced on the farm and the income from custom harvest of other additional cotton acres would help to offset the ownership costs associated with a higher valued harvest unit.

Summary and Conclusions

With the economic challenges associated with cotton production in its ability to compete for acres within a farm's crop rotation scheme, the cotton crop must be produced at the lowest possible cost per output unit basis possible. Selecting and producing high yielding cotton varieties has, and continues to be, one of the more important production decisions which directly impact the profitability of cotton production. Increasing yield per acre has always been one of the most effective ways of lowering cost per output unit. In addition, utilization of more efficient farm machinery, particularly harvest machinery, can lower both operating and ownership equipment costs on a per acre basis under certain production conditions. The adoption and use of the new onboard module building cotton pickers can provide cotton producers with a means of lowering harvest costs.

This study estimated the expected capital and operating costs of the new onboard module building cotton pickers with comparisons to the traditional basket pickers using operating performance measures based on actual producer experience. Module picker operation parameters, specifically harvest speed and field efficiency, were based on observations from cotton producers who have currently used this harvest technology over the past few years in selected southern states. Performance rates, in terms of harvest acreage covered per unit of time, were estimated to be in the range of nine to ten acres of cotton harvested per hour. Field efficiency was expected to be in the 85 percent range. Total harvest system cost for a six-row onboard module picker was estimated to be approximately $51 per acre, an estimated savings of about $26 per acre over a comparable six-row basket picker. Onboard module pickers with different purchases prices and operating parameters from those utilized in this analysis would of course have slightly different cost estimates. A significant factor in the ability to realize potential cost savings with this new harvest technology will be the ability to utilize these harvest units over larger acreages of cotton in a given harvest season. This factor will be largely dependent on individual farm size as well as acreages of cotton produced on farms in close proximity.

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Table 1. Cotton Picker Field Performance Rates and Fuel and Labor Costs

Cotton Harvest Unit Performance Rate and Variable Cost	*Basket Picker 4-row*	*Basket Picker 6-row*	*Module Picker 6-row*
Operation Parameters:			
Field speed (mph) [FS]	3.6	4.2	4.8
Machine size (# rows)	4	6	6
Row width (inches)	38	38	38
Machine width (feet) [MW]	12.7	19.0	19.0
Field efficiency (%) [FE]	70	70	85
Fuel use (gal/hr)[1]	14.3	16.4	23.3
Performance Rates:			
Acres per hour	3.89	6.77	9.40
Hours per acre	0.257	0.148	0.106
Variable Costs:			
Labor cost per hour[2]	15.30	15.30	15.30
Fuel cost per hour[3]	47.19	54.15	76.96
Total fuel and labor cost per hour	62.49	69.45	92.26
Total fuel and labor cost per acre	16.06	10.26	9.82

[1] Fuel use based on a factor of 0.044 gal/hp-hr.
[2] Harvest machine operator labor charged at a rate of $15.30 per hour.
[3] Fuel cost based on a diesel price of $3.50/gal.

Table 2. Onboard Module Picker Performance Rates and Variable Costs Under Alternative Field Speeds and Field Efficiencies

(1) Acres per Hour

		Field Speed (mph)					
		4.0	4.2	4.4	4.6	4.8	5.0
Field Efficiency (%)	70%	6.45	6.77	7.09	7.42	7.74	8.06
	75%	6.91	7.25	7.60	7.94	8.29	8.64
	80%	7.37	7.74	8.11	8.47	8.84	9.21
	85%	7.83	8.22	8.61	9.00	9.40	9.79
	90%	8.29	8.70	9.12	9.53	9.95	10.36

(2) Hours per Acre

		Field Speed (mph)					
		4.0	4.2	4.4	4.6	4.8	5.0
Field Efficiency (%)	70%	0.155	0.148	0.141	0.135	0.129	0.124
	75%	0.145	0.138	0.132	0.126	0.121	0.116
	80%	0.136	0.129	0.123	0.118	0.113	0.109
	85%	0.128	0.122	0.116	0.111	0.106	0.102
	90%	0.121	0.115	0.110	0.105	0.101	0.097

(3) Fuel & Labor Cost per Acre[1]

		Field Speed (mph)					
		4.0	4.2	4.4	4.6	4.8	5.0
Field Efficiency (%)	70%	14.31	13.63	13.01	12.44	11.92	11.45
	75%	13.35	12.72	12.14	11.61	11.13	10.68
	80%	12.52	11.92	11.38	10.89	10.43	1002
	85%	11.78	11.22	10.71	10.25	9.82	9.43
	90%	11.13	10.60	10.12	9.68	9.27	8.90

[1] Fuel use based on a factor of 0.044 gal/hp-hr for a 530 hp module cotton picker. Fuel cost based on a diesel price of $3.50/gal. Harvest machine operator labor charged at a rate of $15.30 per hour.

Table 3. Total Cotton Harvest Costs per Acre for a 4-Row Basket Picker

	Fixed	Fuel	Repairs	Labor	Total
	Dollars per harvested acre				
Cotton picker – 4-row basket picker[1,2]	61.11	12.86	15.26	6.40	95.63
Boll buggy	3.62	--	1.68	--	5.30
Boll buggy tractor	6.83	8.79	1.71	2.47	19.80
Module builder	4.21	--	1.96	--	6.17
Module builder tractor	6.83	8.79	1.71	4.93	22.23
Total harvest cost per acre	*$82.61*	*$30.44*	*$22.32*	*$13.80*	*$149.17*

[1] Cotton picker capital fixed costs based on 200 hours of annual use.
[2] Cotton picker labor cost includes charges for an operator and one field laborer.

Table 4. Total Cotton Harvest Costs per Acre for a 6-Row Basket Picker

	Fixed	Fuel	Repairs	Labor	Total
	Dollars per harvested acre				
Cotton picker – 6-row basket picker[1,2]	28.64	8.50	6.66	3.69	47.49
Boll buggy	1.67	--	0.78	--	2.44
Boll buggy tractor	3.94	5.06	0.98	1.42	11.40
Module builder	2.23	-	1.04	--	3.26
Module builder tractor	3.94	5.08	0.98	2.84	12.84
Total harvest cost per acre	*$40.41*	*$18.64*	*$10.44*	*$7.95*	*$77.43*

[1] Cotton picker capital fixed costs based on 250 hours of annual use.
[2] Cotton picker labor cost includes charges for an operator and one field laborer.

Table 5. Total Cotton Harvest Costs per Acre for a 6-Row Module Picker

	Fixed	Fuel	Repairs	Labor	Total
	Dollars per harvested acre				
Cotton picker – 6-row module picker[1,2]	26.21	8.65	6.10	1.78	42.74
Round bale hauler tractor	2.82	3.64	0.70	1.53	8.69
Total harvest cost per acre	*$29.03*	*$12.29*	*$6.80*	*$3.31*	*$51.43*

[1] Cotton picker capital fixed costs based on 250 hours of annual use.
[2] Cotton picker labor cost includes charges for an operator.

Table 6. Estimated Fixed Capital Ownership Costs for 6-Row Cotton Pickers For Alternative Hours of Annual Harvest Machine Use

Hours of Annual Use	Capital Recovery Per Hour of Use: Basket Picker[1]	Capital Recovery Per Hour of Use: Module Picker[2]	Estimated Annual Acres Harvested: Basket Picker	Estimated Annual Acres Harvested: Module Picker	Capital Recovery Per Harvested Acre: Basket Picker	Capital Recovery Per Harvested Acre: Module Picker
(hours)	--------*($/hour)*--------		--------*(acres)*--------		--------*($/acre)*--------	
150	323	412	1,014	1,415	48	44
175	276	353	1,182	1,651	41	37
200	242	309	1,351	1,887	36	33
225	215	275	1,520	2,123	32	29
250	194	247	1,689	2,358	29	26
275	176	225	1,858	2,594	26	24
300	161	206	2,027	2,830	24	22

[1] Capital recovery costs based on a $450,000 purchase price, 10 years of useful life, 30% salvage value, 5.75% interest rate, and performance rate of 0.148 hours per acre.

[2] Capital recovery costs based on a $575,000 purchase price, 10 years of useful life, 30% salvage value, 5.75% interest rate, and performance rate of 0.106 hours per acre.

Table 7. Estimated Fixed Capital Ownership Costs for a 6-Row Cotton Pickers For Alternative Acreages of Cotton Harvested Annually

Annual Cotton Acres Harvested	Capital Recovery Per Harvested Acre: Basket Picker[1]	Capital Recovery Per Harvested Acre: Module Picker[2]	Estimated Hours of Annual Use: Basket Picker	Estimated Hours of Annual Use: Module Picker	Capital Recovery Per Hour of Use: Basket Picker	Capital Recovery Per Hour of Use: Module Picker
(acres)	--------*($/acre)*--------		--------*(hours)*--------		--------*($/hour)*--------	
1,400	35	44	207	148	233	417
1,600	30	39	237	170	204	364
1,800	27	34	266	191	182	324
2,000	24	31	296	212	163	292
2,200	22	28	326	233	149	265
2,400	20	26	355	254	136	243
2,600	19	24	385	276	126	224

[1] Capital recovery costs based on a $450,000 purchase price, 10 years of useful life, 30% salvage value, 5.75% interest rate, and performance rate of 0.148 hours per acre.

[2] Capital recovery costs based on a $575,000 purchase price, 10 years of useful life, 30% salvage value, 5.75% interest rate, and performance rate of 0.106 hours per acre.