PICKER VERSUS STRIPPER HARVESTERS ON THE HIGH PLAINS OF TEXAS

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Abstract

Picker and stripper harvest systems were compared for harvesting irrigated cotton on the High Plains. Four varieties of cotton were harvested using a six-row picker harvester and a six-row stripper harvester with and without field cleaning. A net present value analysis was conducted comparing each harvest system. Inputs for time in motion and fiber quality were determined based on field data from the 2006 and 2007 harvest seasons.

Introduction

Over a fourth of the cotton bales produced in the United States since 2002 have been produced in Texas (USDA, 2006) with most of that cotton coming from the High Plains region. Five of the eight distinct cotton producing regions in Texas, including the High Plains, Rolling Plains, Central Blackland, Coastal Bend, and Winter Garden regions, are primarily harvested using stripper harvesters, while the Upper Gulf Coast, Rio Grande Valley, and El Paso/Trans-Pecos regions primarily use picker harvesters (Nelson et al., 2001). Approximately 85 percent of the cotton produced in Texas is currently stripper harvested (Glade et al., 1996).

Unlike picker harvesters, which use spindles to remove seed cotton from the boll of the plant, stripper harvesters use brushes and bats that indiscriminately remove seed cotton, bolls, leaves, and many branches from the stem of the plant. As a result, stripper harvested cotton contains more foreign matter than spindle picked cotton. This increased foreign matter leads to higher transportation costs per bale to haul modules to the gin as well as potentially higher costs of processing the cotton, due to the use of additional cleaning machinery at the gin. Foreign matter may be reduced by the use of a field cleaner (often called a burr extractor), but foreign matter levels are still greater than found in spindle picked cotton.

Stripper harvesters do have several advantages over picker harvesters, including lower purchase prices, fewer moving parts in the row units, lower fuel consumption and maintenance requirements, and faster ground speeds in low yielding cotton. Picker harvesters, however, pick cleaner cotton, are perceived to maintain fiber quality characteristics better than strippers, and are able to harvest cotton at higher speeds in high yielding stands.

As irrigation technology has improved and new cotton varieties have been introduced and adopted on the High Plains, yields in the region have dramatically increased, sometimes reaching four to five bales per acre. It is estimated that between 300,000 and 400,000 acres of drip irrigation has been installed on the High Plains in the past ten years for cotton production, and over 1.1 million acres are irrigated with center pivot systems equipped with high efficiency application packages. Furthermore, foreign textile mills continue to raise their standards for fiber quality as cotton spinners are forced to compete with synthetic fibers that are not plagued with fiber contamination and degradation. These increased yields and higher quality demands have the potential to make harvesting High Plains cotton with pickers an attractive option.

Several economic analyses have been suggested to evaluate different cotton harvest systems. Vories and Bonner (1995) compared gross returns per acre from picked and stripped cotton and found that on average, the stripper had greater return per acre. However, this study was conducted on cotton yielding less than two bales per acre and may not be reflective of returns in higher yielding cotton. Vories and Bonner (1995) also made no attempt to analyze differences in operational costs between systems but compared returns based on lint value only. Faircloth et al (2004) found similar results in northeast Louisiana, but their comparison suffered from similar deficiencies.

Nelson et al (2001) compared alternative stripper and picker harvesting systems and included operational and maintenance costs for each system along with the cost of custom harvesting as an alternative to equipment ownership. The analysis by Nelson et al (2001) includes many important considerations and may serve as a model for further comparisons, but Nelson et al (2001) compared only different stripper systems with other stripper

systems and picker systems with other picker systems. No comparison was made between picker and stripper based harvest systems. Spurlock et al (2006) conducted a similarly robust economic analysis comparing different row configurations for picker harvesters, but again, no comparison was made between picker and stripper systems.

Yates et al (2007) proposed results for an economic study comparing picker and stripper harvesters, but he extrapolated the fiber quality results from an older two-row model picker to a new six-row picker and from an older four-row stripper to a new eight-row picker. Yates et al (2007) states that "performance rates" were used in the model, but no discussion is given regarding the information included in those "performance rates." Yates et al (2007) described the economic model used as the Cotton Economics Research Institute Cotton Harvesting Cost Calculator, but gave no details of the model. Given the lack of information and the unscrupulous extrapolation, the results of Yates et al (2007) should not be considered as a viable economic model.

Willcutt et al (2001) described the most comprehensive economic model for comparing harvest systems using the COTSIM cotton harvester simulation model developed by Chen et al (1992). Willcutt et al (2001) simulated various harvesters on various size farms with different row configurations (e.g. skip-row, solid rows, etc.), but all production systems were assumed to yield 875 pounds of lint per acre (1.8 bales per acre). Willcutt et al (2001) found that, even with a five cent per pound reduction in price for lint, stripper systems yielded higher net returns than picker systems. However, Willcutt et al (2001) assumed similar basket volumes for both machines, assumed that strippers could operate the same number of hours per day as pickers, and that the same number of modules would be produced from both systems. All of these assumptions are erroneous and may significantly affect harvest system economics. Willcutt et al (2001) concluded, however, that if strippers were operated fewer hours per day than pickers and the number of harvest days available was limited, returns from stripper systems quickly fell to or below the level of returns from picker harvesters. Furthermore, Willcutt et al (2001) did not account for slower stripper speeds that will result from higher yielding stands, which also favor picker harvester systems.

While each of the aforementioned studies yields insight into the decision matrix needed to determine the best harvest system for irrigated cotton on the High Plains, none of these studies addresses the issue holistically. A net present value analysis was conducted to compare the economic returns for picker and stripper harvesters on the High Plains of Texas. Model inputs regarding harvester performance and cotton fiber quality from each system were determined from field measurements taken during harvest of four varieties of cotton in 2006 and 2007.

Methods

A net present value analysis was conducted to compare the economic returns to be expected from six-row picker and stripper harvesters operating on cotton planted on 30 inch rows. Field measurements for model inputs from each machine were taken during the 2006 and 2007 harvest season (table 1).

Table 1. Harvester parameter inputs measured during 2006 and 2007 harvest seasons.

	Picker	Stripper with Field Cleaner	Stripper without Field Cleaner
Speed (mph)	4.0	3.7	3.4
Basket Capacity (bales)	6.75	1.89	1.71
Dump Time (s)	77	54	54
Lint Turnout (%)	35.6	30.2	26.6
Seed Turnout (%)	52.9	46.2	40.9

The cost of each machine was calculated assuming a purchase price of 90% of the MSRP (Spurlock et al., 2006), a loan life of seven years at 5.0% APR, and a salvage value equal to 45% of the purchase price (Nelson et al., 2001). Taxes, housing, and insurance were calculated as 2% of the purchase price per year (ASAE Standards, 2006).

Harvester fuel use was estimated at 16 and eight gallons per hour for the picker and stripper, respectively, and a spot diesel price of $2.15/gallon was assumed. A single application of harvest aid was assumed for picked cotton at $8/acre, whereas a second harvest aid application (at an additional cost of $8/acre) was assumed for stripped cotton.

Labor costs were a function of the time required to harvest a given area based on measured time-in-motion data, and a labor rate of $5.15/hr was assumed. Ginning was assumed to cost $2.50/cwt with no bagging and tie charges, and seed was sold for $130/ton.

A full module was harvested using each of the harvest treatments, and all modules were ginned at a commercial gin. Average USDA classing office data and loan values are shown in table 2.

Table 2. USDA bale grades and loan value.[a]

	Picker	Stripper with Field Cleaner	Stripper without Field Cleaner
Micronaire	3.5 x	3.2 y	3.2 y
Length (in.)	1.11 x	1.09 y	1.10 x,y
Uniformity (%)	80.4 x	79.4 y	79.2 y
Strength (g/tex)	27.1 x	26.2 x	26.6 x
Elongation (%)	8.4 x	8.7 x	8.5 x
Rd (%)	81.6 x	81.1 x,y	80.9 y
+b	8.1 x	8.5 x,y	8.7 y
Leaf	2.0 x	2.5 x	2.3 x
Loan ($/lb)	0.572 x	0.542 y	0.527 z

[a] No significant differences were detected (α = 0.05) between means in the same row followed by the same letter.

Results and Discussion

Assuming one harvester is used to harvest 800 acres of cotton, a producer would see equal returns per acre between a picker and stripper with field cleaner at a yield around 1.8 bales per acre. Below this yield, producers would see greater return with a stripper while for higher yields; a greater return would be achieved using a picker harvester (fig. 1). The non-burr extracted cotton yields less return per acre for all yields under the assumptions used in this analysis.

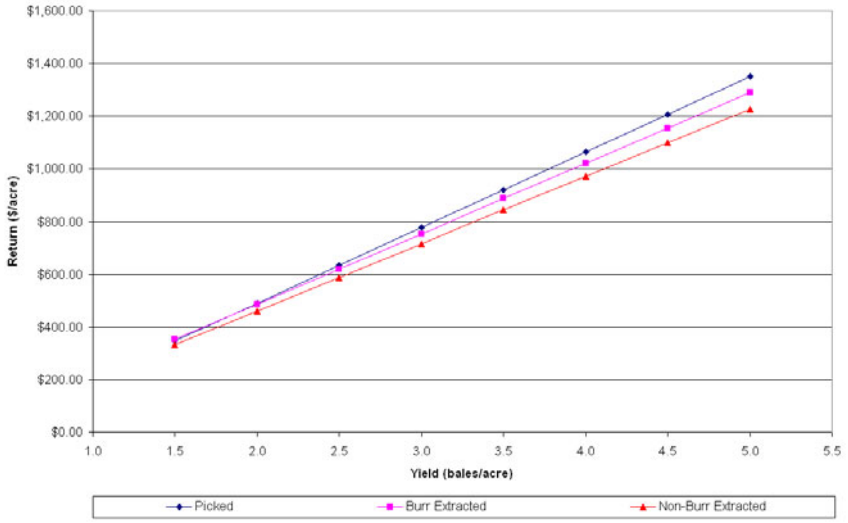

Figure 1. Return per acre for 800 acres of harvested cotton.

Relative returns per acre for the three harvest systems considered are shown in table 3 assuming 800 acres of cotton harvested per machine.

Table 3. Relative returns ($/acre) for various harvest systems.

Yield (bales/acre)	Picker	Stripper with Field Cleaner	Stripper without Field Cleaner
1.5	14	19	Base
2.0	30	26	Base
2.5	45	32	Base
3.0	61	38	Base
3.5	77	44	Base
4.0	93	50	Base
4.5	108	57	Base
5.0	124	63	Base

The breakeven line for a six-row picker and six-row stripper with field cleaner under the assumptions stated above is shown in fig. 2.

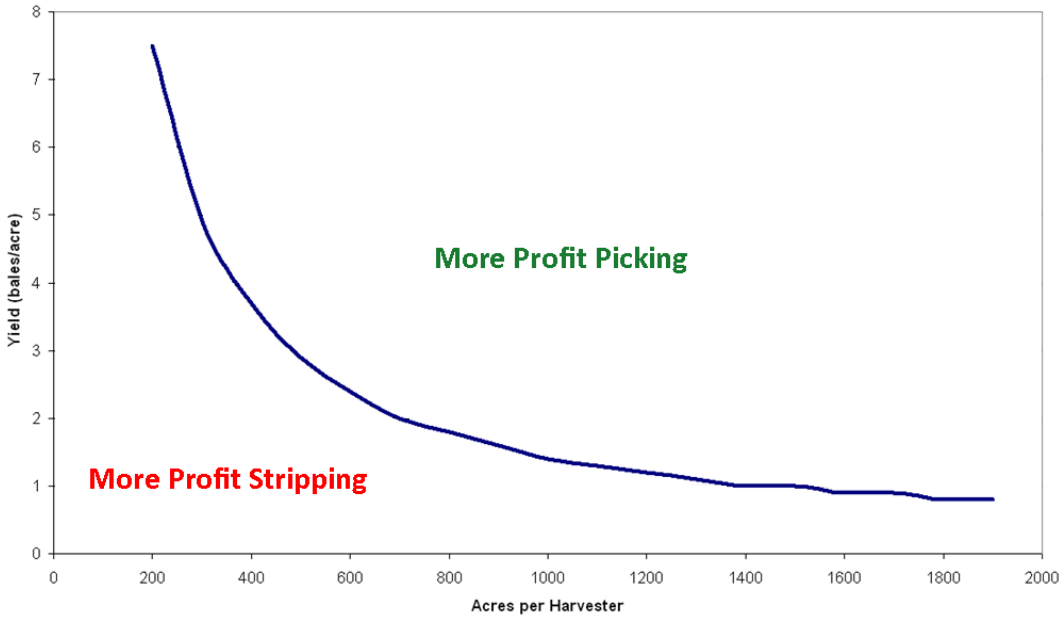

Figure 2. Breakeven curve for six-row picker and six-row stripper with field cleaner.

As more data is available regarding grade differences between harvester regimes as a function of variety, maturity, yield, etc., the bounds of uncertainty for the curve shown in fig. 2 will be more clearly defined.

Conclusions

A net present value analysis was conducted to compare the economic returns to be expected from six-row picker and stripper harvesters. Many model inputs were measured from field scale operation of machinery during the 2006 and 2007 harvest seasons. For an 800-acre harvest area per machine, it was found that pickers yielded greater return per acre when yield exceeded 1.8 bales/acre while strippers provided greater return per acre for yields below 1.8 bales per acre. A breakeven curve was established as a function of area harvested per machine and yield.

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