

SURVEY ESTIMATION OF SUGARCANE CHOPPER HARVESTER COSTS IN LOUISIANA

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ABSTRACT

A sample of sugarcane growers in Louisiana were surveyed to estimate the actual harvest costs growers incur in using combine or chopper harvesters to harvest sugarcane. An inventory of harvesting equipment used as well as data on harvest operations was collected for the purpose of estimating variable and fixed harvest costs. Estimated fixed harvest costs, for combines, tractors and wagons, averaged \$2.65 per metric ton (\$2.41 per short ton) of cane harvested while variable harvest costs for fuel, labor and repairs averaged \$3.80 per metric ton (\$3.45 per short ton). Total estimated harvest cost averaged \$6.45 per metric ton (\$5.86 per short ton) of cane harvested, with an average cutting rate of 40.8 metric tons per hour (45.0 short tons per hour).

INTRODUCTION

Sugarcane is a major agricultural commodity in Louisiana as well as in the United States. In 2004, sugarcane ranked second behind poultry in total cash receipts in Louisiana, accounting for 14.9 percent of total state cash receipts from sales of agricultural commodities (Louisiana Agricultural Statistics Service, 2005). In 2005, sugarcane in Louisiana represented 49.3 percent of total area devoted to sugarcane in the U.S., with 183,800 total hectares grown for sugar and seed, producing 9,491,755 metric tons of cane (National Agricultural Statistics Service, 2006).

Growers face a constant challenge of trying to reduce production costs per unit of output in the face of relatively constant market prices. The average U.S. raw sugar price has varied little from year to year in response to a domestic supply management program, ranging between \$0.452/kg (\$0.205/lb) and \$0.479/kg (\$0.217/lb) over the 2001-2005 crop years (Economic Research Service, 2006). Over this same period, the U.S. producer prices paid index for production items, interest, taxes and wages increased by approximately 20 percent (National Agricultural Statistics Service, 2005).

In addition to higher crop yields per hectare, increasing economic efficiency in production operations can also reduce production costs. Table 1 presents a breakdown of projected sugarcane production costs for Louisiana in 2006 (Breau and Salassi, 2006). These costs are based on a representative sugarcane farming operation with harvest through a third ratoon crop. Percent of total farm area is shown for each phase of production, including fallow, seed bed preparation, planting, field operations and harvest. In this rotation, approximately 76.1 percent of the farm area would be harvested for sugar. Harvest operations represent the largest share of total farm production expenses, at 27.6 percent. Since harvest costs represent a

significant portion of total farm expenses, increasing the economic efficiency of sugarcane harvest operations can have a significant impact on reducing total farm costs.

A great deal of research has been conducted over the past several years evaluating the use of combine harvesters to harvest sugarcane in Louisiana. Much of this research has focused on management of harvest residue on fields (Kennedy et al. 2005, Kornecki et al. 2004, Richard and Johnson, 2003) and optimization of combine ground and fan speeds (Viator et al. 2004, Waguespack et al. 2003). Considerable research is being conducted in other sugarcane-producing countries focusing primarily on optimizing harvest and transport operations. This work has included optimization of harvest group scheduling (Higgins, 2002), simulation of harvest to mill delivery systems (Hansen et al., 2002), economic case study analysis of regional harvest operations (Higgins et al., 2004), as well as PC-based decision support tools to evaluate alternative harvest and transport situations (Singh and Pathak, 1994).

Published estimates of sugarcane harvest costs in other regions show values significantly less than what would be expected for Louisiana. An earlier study evaluating performance and utilization of sugarcane harvest machinery in South Africa reported harvest costs ranging from \$3.23 to \$3.87 per ton of sugarcane harvested (Meyer, 1999). A study which evaluated a fully mechanized combine harvest system for several farms in South Africa reported harvest and infield transport costs ranging from \$2.14 to \$2.92 per ton (Meyer et al., 2000). Two studies from Australia report actual harvest costs ranging between \$3.69 and \$5.01 per ton for the 2000 harvest season (Higgins and Muchow, 2003) and average harvest costs ranging from \$3.18 to \$5.39 per ton over the 1996 to 2002 period (Muscat and Agnew, 2004). Although projected costs of sugarcane harvest operations in Louisiana have been made based upon a set of machine operation and performance assumptions, no recent studies have investigated the actual costs incurred by growers using combines to harvest sugarcane. This article reports the results of a study conducted in 2005 to survey growers regarding their harvest operations and to estimate the actual fixed and variable harvest costs incurred by growers using combine harvesters.

MATERIALS AND METHODS

The objective of this study was to estimate the average total harvesting cost associated with using combines to harvest sugarcane in Louisiana. This work was conducted in cooperation with the Cora-Texas sugar factory. A mail survey instrument was developed to collect information about harvesting practices and costs. The survey instrument was developed and mailed out in the summer of 2005, seeking information and data concerning the 2004 harvest season. Surveys were sent to all growers which shipped cane to Cora-Texas in 2004. Sixteen out of 37 total growers responded to the survey resulting in a response rate of 43 percent.

The survey contained questions concerning (1) number of combines used per farm, age, purchase price, hours of use in 2004, and anticipated years of useful life; (2) number of wagons used, size, purchase price, and anticipated years of useful life; (3) information on daily harvest operations in 2004 including daily quota, yield, acres harvested, hours in the field, and harvesting

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rate; (4) harvest fuel and labor; and (5) tractors used for harvest operations. From this data, variable and fixed harvest costs were estimated. Annual fixed costs estimated for combines included depreciation, interest and insurance. Combine depreciation expenses were estimated using years of useful life obtained from survey responses. Interest costs were estimated using a 7-percent interest rate, and insurance costs were based on survey responses. Annual depreciation and interest costs were estimated for wagons, assuming a 10-year useful life, as well as that portion of tractor fixed costs applicable to harvest, based on the ratio of hours used for harvest to total annual hours of use. Variable costs included labor, fuel and repairs for combines and labor and fuel for tractors. Labor costs were estimated using the base hourly wage reported by each farm surveyed plus 27.5 percent for wage benefits. Given the significant increase in fuel prices which occurred between 2004 and 2005, a 2005 diesel price of \$0.594/liter (\$2.25/gallon) was used to estimate combine and tractor fuel costs. Total costs were then converted to cost per ton based on yields reported in the survey by growers for 2004.

RESULTS AND DISCUSSION

A summary of survey response data on harvesting operations is shown in Table 2. Total area of sugarcane harvested annually varied widely, from 181.8 to 1,436.7 hectares per farm. Average sugarcane area per farm surveyed was 619.4 hectares. Total sugarcane tonnage harvested in 2004 ranged from 9,546.2 to 106,199.0 metric tons (10,525 to 117,000 short tons), with an average harvested yield of 66.5 metric tons per hectare (29.6 short tons per acre). The number of combines per farm utilized in 2004 to harvest sugarcane ranged from one to three, with approximately three wagons used to haul cane from the field per combine harvesting. Farms surveyed harvested an average 8.1 hectares (20 acres) per day to meet an average daily mill quota of 555.1 metric tons (612 short tons) delivered. Average time in the field per day of harvest was 10.4 hours with 8.3 hours of actual cutting and the remainder of time spent for servicing of harvest equipment. Average harvesting rate for farms surveyed was 40.8 metric tons (45.0 short tons) of sugarcane per cutting hour.

Estimated variable and fixed harvest costs for the sample of growers surveyed is presented in Table 3. Total harvest fixed costs averaged \$2.65 per metric ton (\$2.41 per short ton) of cane harvested, ranging from \$1.48 to \$5.66 per metric ton. Fixed costs on combines represented the largest component of harvest fixed costs, averaging \$1.58 per metric ton (\$1.43 per short ton) or 59 percent of total fixed cost. Estimated average fixed costs for wagons and tractor used for harvest were \$0.29 and \$0.79, respectively, per metric ton of cane harvested. Weighted average combine variable harvesting expenses of fuel, labor and repairs were estimated at \$1.69 per metric ton of cane harvested, with labor cost estimated at \$0.37 per metric ton, fuel cost at \$0.82 per metric ton, and repair cost at \$0.50 per metric ton. Tractor variable cost for harvest operations averaged \$2.11 per metric ton of cane harvested, with \$0.90 in labor costs and \$1.21 in fuel costs. Total average harvest cost was estimated at \$6.45 per metric ton of cane harvested (\$5.86 per short ton), ranging from \$4.09 to \$11.44 per metric ton (\$3.71 to \$10.38 per short ton).

Optimal use of sugarcane combines to minimize total harvest costs per unit has the most significant impact on combine fixed costs resulting from the inverse relationship between tonnage harvested and combine fixed cost per ton. Using a combine over a larger harvest area will not change the variable cost per ton of cane harvested, but will reduce the fixed cost associated with the harvesting equipment. In this study, the average annual use of combines by growers surveyed was 728 hours per year. An annual use of 1,000 hours per year would have lowered combine fixed cost by \$0.66 per metric ton (\$0.60 per short ton) of cane harvested.

CONCLUSIONS

Harvest of sugarcane represents a large capital investment for sugarcane farms and also represents a significant share of total farm production expenses. Optimal use of combine harvesters to minimize sugarcane harvest costs is primarily dependent on the amount of area over which a machine is used, thereby reducing fixed cost per unit of output. The challenge confronting growers in Louisiana is how to arrange harvest operations to achieve desired cost savings. Options include using a harvester over more acres on an individual farm, sharing harvesting equipment with a small number of growers in a fairly localized area, or utilizing a more broad scale group harvest type of arrangement. Given the diversity of sugarcane farming operations in Louisiana, the most optimal harvesting arrangement is expected to vary across growers.

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Table 1. Projected sugarcane production costs in Louisiana for 2006.

Production phase	Percent of total farm area (%)	Variable cost per hectare (dollars/ha)	Total cost per hectare (dollars/ha)	Percent of total farm cost (%)
Fallow / seed bed preparation	20.0	372	577	8.9
Cultured seed cane	0.1	1340	1366	0.7
Hand planting cultured seed cane	0.1	588	758	0.4
Harvesting whole stalk seed cane	0.4	174	296	0.9
Mechanical planting	19.4	526	654	9.7
Plant cane field operations	20.0	540	641	9.8
First stubble field operations	20.0	785	900	13.8
Second stubble field operations	20.0	804	919	14.1
Third stubble field operations	20.0	804	919	14.1
Harvest for sugar operations	76.1	294	473	27.6

Table 2. Average survey responses on harvesting operations.

Item	Respondent average	Minimum	Maximum
Total area harvested per farm (<i>hectares</i>)	619.4	181.8	1,436.7
Total volume of sugarcane harvested (<i>metric tons</i>)	41,073.5	9,546.2	106,119.0
Number of combines used	1.6	1.0	3.0
Number of wagons used	4.7	2.0	12.0
Daily quota (<i>metric tons</i>)	555.1	249.4	1,496.5
Area harvested per day (<i>hectares</i>)	8.1	3.2	20.2
Time in field per day (<i>hours</i>)	10.4	8.0	14.0
Time actually harvesting per day (<i>hours</i>)	8.3	5.0	13.0
Harvesting rate per combine (<i>metric tons / hour</i>)	40.8	27.2	68.0
Annual use of combine (<i>hours</i>)	728.0	525.0	1,152.0

Table 3. Estimated average harvest cost per ton of sugarcane harvested.

Cost item	Weighted average cost (dollars/metric ton)	Minimum	Maximum
Combine fixed cost	1.58	0.81	3.92
Wagon fixed cost	0.29	0.17	0.48
Tractor fixed cost	0.79	0.32	2.38
Total harvest fixed cost	2.65	1.48	5.66
Combine labor cost	0.37	0.12	0.61
Combine fuel cost	0.82	0.36	1.59
Combine repair cost	0.50	0.21	2.75
Tractor labor cost	0.90	0.53	1.53
Tractor fuel cost	1.21	0.37	3.72
Total harvest variable cost	3.80	2.49	6.94
Total harvest cost	6.45	4.09	11.44