

## Sugarcane Combine Harvester Ownership Costs

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### Introduction

Farm machinery costs are a significant portion of the total costs of producing agricultural commodities. Besides their impact on the important decisions of selection and purchase of specific pieces of machinery, farm machinery costs have a significant impact on the profits of the overall farming operation. As a result, the efficient use of existing machinery on the farm is critical in minimizing whole farm machinery costs.

There are two basic types or categories of farm machinery costs: ownership costs and operating costs. There are also two ways of calculating farm machinery costs: total costs and average costs. Ownership costs, or fixed costs, are basically machinery costs that are fixed in nature and do not vary with the number of acres over which they are used or with the level of crop production or output. Total annual ownership costs associated with owning a tractor or harvester, for example, would be a fixed or constant amount regardless of the number of hours used annually. Operating costs, also called variable or direct costs, do vary directly with the level of output or acres over which they are used. Total operating costs associated with a tractor or harvester would increase as the hours of annual use of the machine increase. Average farm machinery costs are determined by dividing total machinery costs by some measure of output or production. This measure of output can

be the number of acres over which the machine was used in a given year or it can be the total amount of crop harvested in the appropriate yield units. Average ownership or fixed costs per acre would be calculated by dividing total ownership costs of a machine by total acres harvested. Average operating or variable costs per acre would be calculated by dividing total operating costs by the number of acres harvested. Because the total annual ownership costs of a machine are fixed, using that machine over an increasing number of acres results in decreasing average ownership costs per acre. Since total operating costs are directly proportional to hours of use, average operating costs per hour of use or per acre are generally assumed to be constant.

This report presents annual ownership cost estimates associated with sugarcane combine harvesters. Two primary types of annual machinery ownership costs are defined, and estimates of these costs are calculated using current combine harvester purchase prices. The effect on annual ownership costs per unit of using a combine harvester over various acreages is presented with estimates of both annual cost per acre and cost per ton of sugarcane harvested. Finally, the impact of different sugarcane yield levels on the annual ownership costs of combine harvesters is estimated for various acreage levels.

### Annual Ownership / Fixed Costs

Ownership costs of farm machinery begin with the purchase of the machine and continue for as long as the machine is owned. Two major categories of annual farm machinery ownership costs are depreciation and interest.

Other types of farm machinery ownership costs that may be incurred include taxes, insurance and housing.

Depreciation is a noncash expense that represents the loss in value of a farm machine caused by age, use or obsolescence. It also is an accounting procedure that provides a means of recovering the initial purchase cost of a machine by spreading the cost over its entire useful life. Several different methods can be used to calculate depreciation for a

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farm machine, depending upon whether depreciation costs are to be spread evenly over the machine's useful life or whether larger depreciation costs are to be charged in the initial years of ownership. Regardless of the method used, total depreciation is about the same.

The second major category of annual farm machinery ownership costs is interest on investment. Purchasing a farm machine ties up farm investment capital that could be used for other farm investments. As a result, there is an opportunity cost associated with investing in the purchase of a specific farm machine. The opportunity cost charged on farm machinery capital should reflect the expected return from investing the capital in its next best alternative use. When borrowed capital is used to purchase machinery, the interest cost is based on the intermediate-term interest rate on farm machinery loans. Depending upon the source of capital used to purchase the machine, the appropriate interest rate to use in determining the annual interest on investment cost should be the rate of return on alternative investments, the current interest rate on borrowed funds or a weighted average of the two.

Depreciation and interest together represent the amount of money set aside to cover the loss in value (depreciation) of a farm machine as well as the interest on the remaining asset value. Traditional methods of computing depreciation and interest on investment of farm machinery do not provide a large enough sum of money annually to cover both depreciation of the asset value and to pay interest on the unrecovered investment at the specified interest rate over the expected useful life of the machine. An alternative method of calculating depreciation and interest is to compute the annual capital recovery charge for the specific farm machine. The capital recovery amount is the annual payment that will recover the initial investment in the machine lost through depreciation, plus interest on the unrecovered amount. This value is generally slightly higher than the sum of depreciation and interest values calculated by traditional methods, because capital recovery

assumes that interest charges are computed on values at the beginning of each year and compounded annually.

The capital recovery factor, used in the calculation of annual capital recovery charges, can be estimated by the following equation:

$$CRF = \frac{R}{1 - (1 + R)^{-T}}$$

where

CRF = capital recovery factor  
R = intermediate-term interest rate  
T = total years of useful life.

This capital recovery factor (CRF) can be interpreted as the amount of money per dollar of machinery investment required to pay annual interest costs on unrecovered investment and to recover the costs of the investment within the specified number of years at the given interest rate. Using this capital recovery factor, the annual capital recovery charge can be computed as follows:

$$ACRC = [(PP - SV) * CRF] + (SV * R)$$

where

ACRC = annual capital recovery charge  
PP = purchase price (or replacement cost)  
SV = salvage value.

The first part of this equation computes the annual capital recovery charge on the total depreciable value of the farm machine; the second part of the equation allows for interest charges on nonzero salvage values. This annual capital recovery charge includes both depreciation and interest on investment and represents the total annual ownership cost associated with the farm machine.

## Estimated Ownership Costs

This section presents estimated annual ownership costs for a sugarcane combine harvester based on current equipment purchase prices. Information required to determine annual ownership costs (purchase price, useful life, salvage value, and interest rate) is below.

Purchase price	\$217,000
Useful life	10 years
Salvage value	10%
Interest rate	9%

Estimated capital recovery factor and annual ownership costs for a sugarcane combine harvester, based on the information above, can be estimated as follows:

$$CRF = \frac{9\%}{1 - (1 + 9\%)^{-10}} = 0.1558$$

$$ACRC = [(\$217,000 - \$21,700) * 0.1558] + (\$21,700 * 9\%) = \$32,385$$

The estimated capital recovery factor for the sugarcane harvester in this example is 0.1558. This factor implies that it would require \$0.1558 per dollar of initial investment to recover that investment plus interest costs over a 10-year expected life at 9% interest. With a combine purchase price of \$217,000, a 10% salvage value (\$21,700), a 10-year useful life and an interest rate of 9%, the annual capital recovery charge (including depreciation and interest) for a sugarcane combine harvester is an estimated \$32,385 per year. This value is an estimate of the total annual ownership costs associated with purchasing a combine harvester; it is considered to be fixed because the cost is incurred regardless of the number of hours the harvester is used each year.

Although total annual ownership costs are fixed in nature, average ownership costs per acre or per unit of out-

put can be reduced by increasing the acreage over which the harvester is used. This reduction in average ownership cost is referred to as economies of size and is the result of the more efficient use of farm machinery.

The impact on the annual ownership cost per unit of output from using a sugarcane combine harvester over alternative acreages can be seen in Table 1. Total annual ownership cost for a combine harvester is an estimated \$32,385 per year. Average ownership cost per acre harvested can be obtained by dividing total annual ownership cost by the number of sugarcane acres harvested. As seen in Table 1, using the harvester over more acres in a given year can significantly reduce annual ownership costs per acre. For example, using a combine harvester to harvest 300 acres of sugarcane per year results in an estimated annual ownership cost for the combine of \$107.95 per harvested acre.

**Table 1 - Sugarcane Combine Harvester Annual Ownership Costs Over Range of Acreage and Tonnage**

Total Acres Harvested	Total Tons of Sugarcane Harvested	Annual Combine Harvester Ownership Cost	
		Cost per Acre	Cost per Ton
100	3,500	\$323.85	\$9.25
200	7,000	161.92	4.63
300	10,500	107.95	3.08
400	14,000	80.96	2.31
500	17,500	64.77	1.85
600	21,000	53.97	1.54
700	24,500	46.26	1.32
800	28,000	40.48	1.16
900	31,500	35.98	1.03
1,000	35,000	32.38	0.93
1,100	38,500	29.44	0.84
1,200	42,000	26.99	0.77
1,300	45,500	24.91	0.71
1,400	49,000	23.13	0.66
1,500	52,500	21.59	0.62

Annual ownership costs were estimated assuming a total ownership cost of \$32,385 and a sugarcane yield of 35 tons per acre harvested.

If the combine was used to harvest 900 acres of sugarcane in a season, annual ownership costs decrease to \$35.98 per harvested acre. On a cost per ton of sugarcane harvested basis, annual ownership costs would decrease from \$3.08 to \$1.03 per ton harvested, assuming a sugarcane yield of 35 tons per acre.

Yield differences also affect average ownership costs. As shown in Table 2, differences in sugarcane yield can result in significant differences in annual ownership costs

**Table 2 - Impact of Yield Differences on Annual Ownership Costs per Ton of Sugarcane Harvested**

Total Acres Harvested	Annual Combine Harvester Ownership Costs per Ton of Sugarcane Harvested		
	30 ton/acre yield	35 ton/acre yield	40 ton/acre yield
300	\$3.60	\$3.08	\$2.70
600	1.80	1.54	1.35
900	1.20	1.03	0.90
1,200	0.90	0.77	0.67
1,500	0.72	0.62	0.54

per ton of sugarcane harvested. A combine harvester used to harvest 600 acres of sugarcane per year, for example, has an estimated annual ownership cost per ton of \$1.80 with a yield of 30 tons of sugarcane per acre. Yield increases to 35 and 40 tons of sugarcane per acre would reduce this annual ownership cost to \$1.54 and \$1.35 per ton, respectively.

Farm machinery ownership costs represent a substantial portion of total agricultural production costs. The purchase of a combine harvester represents a sizeable investment for a sugarcane farm. Although total annual ownership costs of these machines are fixed, efficient use of sugarcane harvesters can result in substantial reductions in annual ownership costs per acre. One of the primary means of increasing the efficiency of harvester use is by extending the annual hours of use, by increasing the acreage harvested on a single farm or sharing the use of the combine harvester with another farm. Increased machine use efficiency decreases machinery costs per acre and increases overall farm profitability.

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