

ESTIMATING FARM POWER & MACHINERY COSTS

Farm power, machinery and equipment are major cost items in agriculture. Larger machines, new technology, higher prices for parts and new machinery, and higher energy prices have caused machinery and power costs to rise in recent years. However, good managers can control machinery and power costs per hectare. Making smart decisions about how to acquire machinery, when to trade, and how much capacity to invest in can reduce machinery costs by as much as Rs 10000 per hectare. All of these decisions require accurate estimates of the costs of owning and operating farm machinery.

Machinery Costs

Farm machinery costs can be divided into two categories: (i) annual ownership costs i.e. Fixed cost, which occur regardless of machine use, and (ii) operating costs, which vary directly with the amount of machine use. The true value of some of these costs is not known until the machine is sold or worn out. But the costs can be estimated by making a few assumptions about machine life, annual use, and fuel and labour prices.

1. **Ownership costs (also called fixed costs)** include depreciation, interest (opportunity cost), taxes, insurance, and housing facilities.

Depreciation

Depreciation is a cost resulting from wear, obsolescence, and age of a machine. The degree of mechanical wear may cause the value of a particular machine to be somewhat above or below the average value for similar machines when it is traded or sold. The introduction of new technology or a major design change may make an older machine suddenly obsolete, causing a sharp decline in its remaining value. But age and accumulated hours of use usually are the most important factors in determining the remaining value of a machine. Before an estimate of annual depreciation can be calculated, an economic life for the machine and a salvage value at the end of the economic life must be specified. The economic life of a machine is the number of years for which costs are to be estimated. It often is less than the machine's service life because most farmers trade a machine for a different one before it is completely worn out. A good rule of thumb is to use an economic life (Age) of 10 to 12 years for most new farm machines and a 15-year life for tractors, unless it is known that the machine will be traded sooner. Salvage value (SV) is 10 % purchase price (PP) of the machine.

$$\text{Depreciation} = \frac{PP - SV}{\text{Age}}$$

Interest

If the operator borrows money to buy a machine, the lender will determine the interest rate to charge. But if the farmer uses his or her own capital, the rate will depend on the opportunity cost for that capital elsewhere in the farm business. If only part of the money is borrowed, an average of the two rates should be used. For the example we will assume an average interest rate (i) of 8-10 percent.

$$\text{Interest} = \frac{PP + SV}{2} \times \frac{i}{100}$$

Taxes and Insurance

This cost usually is much smaller than depreciation and interest, but they need to be considered. A cost estimate equal to 1.0 percent of the purchase price often is used.

Housing

Providing shelter, tools, and maintenance equipment for machinery will result in fewer repairs in the field and less deterioration of mechanical parts and appearance from weathering. That should produce greater reliability in the field and a higher trade-in

value. An estimated charge of 1.0 percent of the purchase price is suggested for housing costs.

Total Ownership Cost (Fixed Cost)

The estimated costs of depreciation, interest, taxes, insurance, and housing are added together to find the total ownership cost.

If the tractor/Machinery is used 500 hours per year, the total ownership cost per hour is: Ownership cost/use hours per year

- 2. Operating costs** (also called variable costs) include repairs and maintenance, fuel, lubrication, and operator labour.

Repairs and Maintenance

Repair costs occur because of routine maintenance, wear and tear, and accidents. Repair costs for a particular type of machine vary widely from one geographic region to another because of soil type, rocks, terrain, climate, and other conditions. Within a local area, repair costs vary from farm to farm because of different management policies and operator skill. The best data for estimating repair costs are the operator's own records of past repair expenses. Good records indicate whether a machine has had above or below average repair costs and when major overhauls may be needed. They also will provide information about the operator's maintenance program and mechanical ability. Without such data, repair costs must be estimated 5-8 percent of purchase price of tractor/power tiller per year.

Fuel

Fuel costs can be estimated by using average fuel consumption for field operations in liters per hour. Those figures can be multiplied by the fuel cost per litre to calculate the average fuel cost per hour/hectare.

Lubrication

Surveys indicate that total lubrication costs on most farms average about 15 percent of fuel costs. Therefore, once the fuel cost per hour has been estimated, it can be multiplied by 0.15 to estimate total lubrication costs.

Labour

Because different size machines require different quantities of labour to accomplish such tasks as planting or harvesting, it is important to consider labour costs in machinery analysis. Labour cost also is an important consideration in comparing ownership to custom hiring. Actual hours of labour usually exceed field machine time by 10 to 20 percent, because of travel time and the time required to lubricate and service machines. Consequently, labour costs can be estimated by multiplying the labour wage rate times 1.1 or 1.2. Using a labour value of Rs 50 per hour for our tractor. Different wage rates can be used for operations requiring different levels of operator skill.

Total Operating Cost

Repair, fuel, lubrication, and labor costs are added to calculate total operating cost.

Total Cost

After all costs have been estimated, the total ownership cost per hour can be added to the operating cost per hour to calculate total cost per hour to own and operate the machine.

Implement Costs

Costs for implements or attachments that depend on tractor power are estimated in the same way as for the example tractor, except that there are no fuel, lubrication, or labor costs involved.

Composition of Costs

An example problem will be used to illustrate the calculations. The example uses a 15 horse power diesel power tiller with a list price of Rs 150,000. An economic life of 10 years is assumed, and the tiller is expected to be used 500 hours per year.

Assumption

- Salvage value (SV): 10%
- Interest rate : 10 %
- Insurance & taxes: 1% of PP
- Housing: 1 % of PP
- Fuel consumption: 1lit/hour
- Fuel Cost = Rs 50 per lit
- Lubrication cost: Rs150 per lit
- Lubrication consumption : 5% of fuel
- Repair and Maintenance : 5-8 %
- Labour : Rs 50 per hour

Solution: The total cost can be calculated as:

1. Fixed Cost:

$$\begin{aligned} \text{a. Depreciation} &= \frac{PP - SV}{\text{Age}} &&= \frac{150000 - 15000}{10} \\ &&&= \text{Rs}13500 \text{ per year} \end{aligned}$$

$$\begin{aligned} \text{b. Interest} &= \frac{PP + SV}{2} \times \frac{i}{100} &&= \frac{150000 + 15000}{2} \times \frac{10}{100} \\ &&&= \text{Rs } 8250 \text{ per year} \end{aligned}$$

$$\begin{aligned} \text{c. Insurance \& Taxes} &= 1\% \text{ of PP} &&= 0.01 \times 150000 \\ &&&= \text{Rs } 1500 \text{ per year} \end{aligned}$$

$$\begin{aligned} \text{d. Housing} &= 1\% \text{ of PP} &&= 0.01 \times 150000 \\ &&&= \text{Rs } 1500 \text{ per year} \end{aligned}$$

Total fixed cost= Rs 24750 per year

Total fixed cost per hour = Rs 49.5

2. Operating Cost

$$\begin{aligned} \text{a. Repair \& Maintenance} &= 5\% \text{ of PP} &&= 0.05 \times 150000 \\ &= \text{Rs } 7500 \text{ per year} \\ \text{Per hour cost} &= 7500/500 &&= \text{Rs}15.0 \end{aligned}$$

$$\text{b. Fuel} = 1 \times 50 = \text{Rs } 50 \text{ per hour}$$

$$\text{c. Lubrication} = 1 \times 0.05 \times 150 = \text{Rs } 7.5 \text{ per hour}$$

$$\text{d. Labour cost} = \text{Rs } 50 \text{ per hour}$$

Total operating cost= Rs 122.50

Total cost = 49.5 + 122.5 = 172.0

How much hours the machinery is to be used annually, which has to be calculated as follows:

$$\begin{aligned} \text{BEP} &= \frac{\text{Fixed cost per year}}{\text{Custom hiring, Rs/h} - \text{Operating cost, Rs/h}} \\ &= \frac{24750}{400 - 122.5} = \text{Rs } 89.18 \text{ hours/year} \end{aligned}$$

- **Economics of farm Equipment**

Annual use of Power tiller: > 600 hours

Profit to Entrepreneur/farmer

Annual Expenditure	: 172 X 600	= 1,03,200
Annual Income	: 400 X 600	= 2,40,000

Net annual income, Rs		= 1,36,800
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