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COMPARISON of the POWER COSTS of TRACTORS

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COMPARISON OF THE POWER COSTS OF TRACTORS

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A knowledge of tractor power costs serves several purposes in the agricultural industry. It is useful in general farm operations, but also for calculating custom charges and comparing different types of tractors. An easy method to calculate power costs is presented in this publication, along with examples.

TRACTOR POWER COSTS

The power costs of a tractor can be divided into basic costs and operating costs.

Basic Costs

Basic costs include interest, depreciation, repairs, insurance and housing. It is best to charge the interest yearly whether you use the tractor or not. Depreciation and repair costs, calculated on an hourly basis, apply only when the tractor is operating. Insurance and housing costs are charged on an annual basis in this publication.

Interest

Interest on the money invested in a tractor is one part of the cost because the money could be earning interest. Charge interest whether you have paid for the tractor or are involved in a financing plan. Determine the interest on half the replacement cost plus 10 percent for trade-in value.

Depreciation

A depreciation cost is included so that money will be available to replace the tractor when it wears out or becomes obsolete.

Repairs

Eighty percent of the replacement cost is estimated for the repair costs on the basis of a life estimate of 10,000 hours. This 80 percent, based on records kept of gasoline tractors, is also being used for propane and diesel tractors because no reliable repair cost figures are available for these types.

Insurance and Housing

One and one-half percent per year of the replacement cost of a tractor is charged for insurance and housing.

Example

This is a gasoline tractor with a replacement cost of $7,500 and is used 600 hours per year. It is rated at 60 drawbar horsepower. The life estimate is 10,000 hours.

Interest	— Interest per year: 6/100 × ½ ($7,500 + $750)	= $ 247.50
	Interest cost per hour of use: $247.50/600	= 0.41
Depreciation	— Depreciation in life estimate of 10,000 hours	= 7,500.00
	Depreciation cost per hour of use: $7,500/10,000	= 0.75
	Depreciation cost per year: 600 × $0.75	= 450.00
Repairs	— Repair cost for life estimate: 80/100 × $7,500	= 6,000.00
	Repair cost per hour: $6,000/10,000	= 0.60
	Repair cost per year: 600 × $0.60	= 360.00
Insurance and Housing	— Insurance and housing cost per year: 3/200 × $7,500	= 112.50
	Insurance and housing cost per hour of use: $112.50/600	= 0.19

Basic Cost per Year

Interest	$247.50
Depreciation	450.00
Repairs	360.00
Insurance and Housing	112.50
	$1,170.00

A Graphical Method to Obtain the Basic Cost

Figure 1 can be used to obtain the basic cost if you do not wish to make the above calculations. Using the same tractor as in the preceding example, find the replacement cost of the tractor at A and follow the horizontal line to the 600-hour annual use line at B. Follow the vertical line to C. The basic cost is $1,170

Operating Costs

The operating costs of a tractor include fuel, oil, grease and labor.

Fuel

The amount of fuel used by a tractor depends upon its size and load. The fuel consumed per hour for the rated drawbar load, as indicated by the Nebraska Tests, is used in this publication. You may use fuel records, if available.

Oil and Grease

Calculate oil costs for a gasoline tractor on the basis of an oil change every 150 hours of use, and include a filter every two oil changes. During

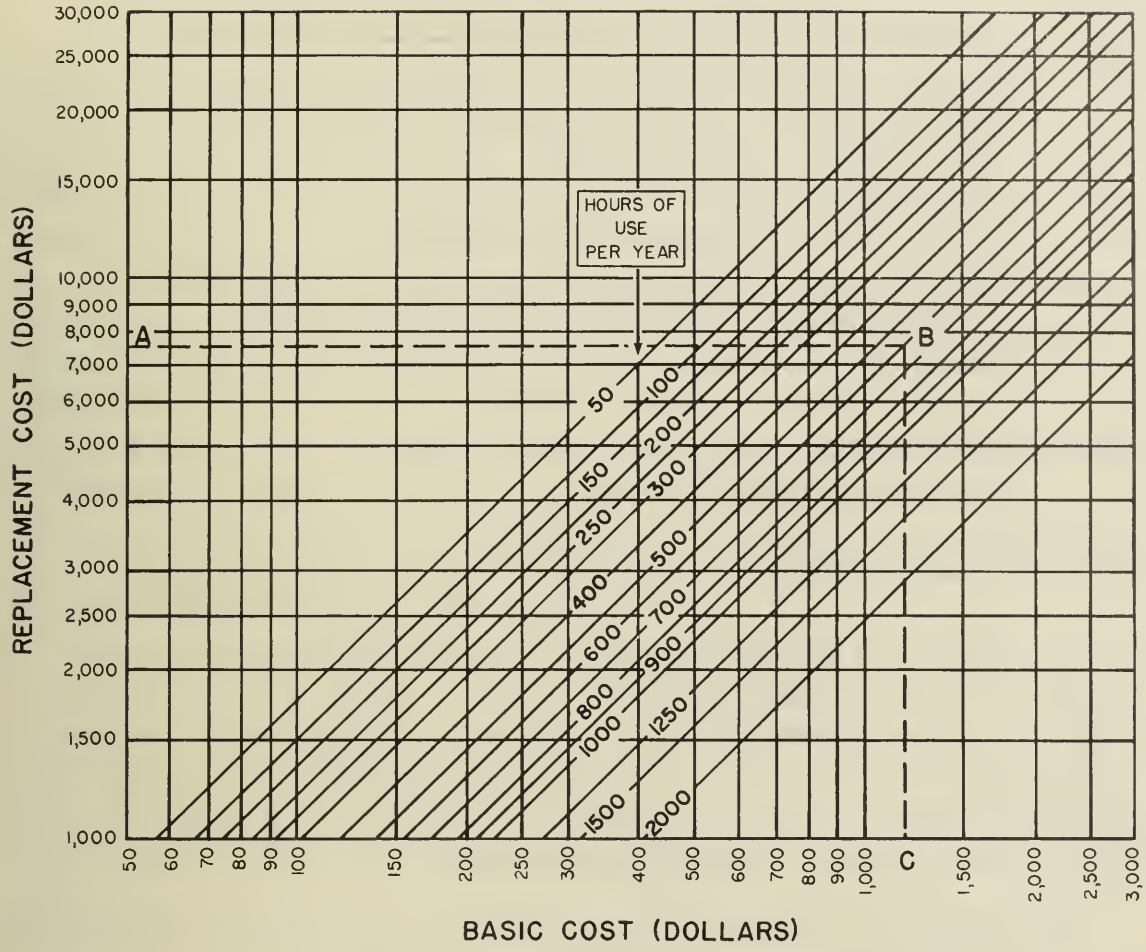

Figure 1. The present replacement cost of a tractor plotted against the annual hours of operation to estimate the basic cost in dollars per year.

this period, one to two quarts of oil will be added as makeup. A tractor requires about ½ pound of grease and transmission oil per day.

Labor

A cost for labor, including board and room, of $1.10 per hour is used in this publication. When calculating the labor cost, use the rate for your area.

Example

The same tractor is used as in illustrating basic costs.

Fuel — The tractor uses 6.36 gallons of gasoline per hour on a rated drawbar load of 60 horsepower.

Fuel cost per hour at 24 cents per gallon:	6.36 × $0.24 =	$ 1.53
Fuel cost per year (600 hours of use):	600 × $1.53 =	915.84
Fuel tank and accessories cost per year	=	8.00

Oil	– The tractor requires 7 quarts of oil at each change and 2 quarts as makeup.	
	Oil cost per hour at 60 cents per quart: 9/150 × $0.60	= $ 0.036
	Filter cost per hour: $3.00/300	= 0.01
	Oil and filter cost per hour	= 0.046
	Oil and filter cost per year: 600 × $0.046	= 27.60
Grease	– The tractor uses grease and transmission oil at the rate of 0.5 pound per 10-hour day or 0.05 pound per hour.	
	Grease cost per hour at 40 cents per pound: 0.05 × $0.40	= $ 0.02
	Grease cost per year: 600 × $0.02	= 12.00
Labor	– Cost per hour, including board and room	= $ 1.10
	Cost per year: 600 × $1.10	= 660.00

Operating Cost per Year

Fuel and storage	$923.84
Oil and grease	39.60
Labor	660.00
	$1,623.44

Yearly Power Costs

The yearly power costs are the sum of the basic cost and the operating cost. For the tractor used in the preceding example they are:

Basic cost		$1,170.00
Operating cost		1,623.44
Yearly power cost (600 hours annual use)		$2,793.44
Hourly power cost: $2,793.44/600	=	$ 4.65

It is necessary at times to compare the power costs of two tractors that differ in rated load (75 percent of the maximum power developed on the drawbar as rated at Nebraska). For a fair comparison express the cost as cost per hour per horsepower developed. In the example, if the tractor develops 60 horsepower on the drawbar the cost per horsepower hour is $4.65/60 = $0.08. If the horsepower used is less than the rated load the cost per hour will be greater. For example, if the tractor in the above example was used on a job requiring only 40 horsepower, the cost per horsepower hour, assuming the same efficiency, would be $4.65/40 = $0.12.

PROPANE TRACTORS

If you are considering the purchase of a propane tractor, there are several factors to note. Some of these factors cannot be measured financially, but take them into account before you make a decision.

Propane tractors may be hard to start in cold weather without a heater. Antifreeze must be maintained in the cooling system at all times to prevent the vaporizer heater from freezing even in the summer. Refueling requires special pumps and hoses. The operator must be careful not to spill the liquid because it is very inflammable, and he must wear gloves during this operation because a finger freezes very quickly on contact with leaking gas. Storage tanks for propane are more expensive than for other fuels. If propane is used domestically, charge only part of the storage cost to the tractor. A small truck tank is also necessary for refilling the tractor in the field.

Propane is not economical in converted tractors unless the compression ratio has been changed to take advantage of the higher octane rating. Even then it is not advisable because the tractor bearings and crankshaft may not be designed for the increased horsepower. The best method is to buy a tractor designed and built for propane.

Some investigators have reported that repair costs for propane tractors are less than for gasoline tractors, but not enough evidence is available to assess this difference accurately. Combustion in propane tractors is more complete and the oil picks up fewer contaminants, allowing it to be used over longer periods; also the oil filter requires less frequent changes. The propane tractor operates more quietly because of decreased exhaust noise.

COMPARING POWER COSTS OF TRACTORS

Before buying a new tractor determine the most economical type. Consider the following factors before you make a decision:

- The initial purchase price differences.
- The fuel consumption (Nebraska Tests).
- The local fuel and oil prices.
- The annual hours of use.
- The cost of auxiliary equipment such as fuel tanks.

The effect of these factors on the choice of a tractor is illustrated in the following examples.

Prior to the purchase make an estimate of the annual power costs to decide whether a diesel, propane or gasoline tractor is the most economical. Yearly power costs for 600 and 1,000 hours of annual use have been calculated for three 6-plow tractors with rated horsepowers of approximately 60 drawbar.

The gasoline model costs $7,500, the diesel model $8,400 and the propane model $8,000.

Power Costs for a 6-plow Gasoline Tractor

	Annual hours of use	
	600	*1,000*
Basic cost from Figure 1	$1,170.00	$1,750.00
Fuel – Gasoline, 24 cents per gallon, 6.36 gallons per hour at rated load, 600 hours, from previous example	915.84	
1,000 hours, 1,000 × 6.36 × $0.24		1,526.40
Auxiliary equipment, storage tank and pump	8.00	8.00
Oil – 9 quarts every 150 hours at 60 cents per quart, 600 hours, previous example	21.60	
1,000 hours, 1000 × 9/150 × $0.60		36.00
1 oil filter every 300 hours at $3.00 600 hours, previous example	6.00	
1,000 hours, 1000/300 × $3.00		10.00
Grease – ½ pound per 10 hours at 40 cents per pound 600 hours, 600 × 0.5/10 × $0.40	12.00	
1,000 hours, 1000 × 0.5/10 × $0.40		20.00
Labor – $1.10 per hour including board and room 600 hours, previous example	660.00	
1,000 hours, 1000 × $1.10		1,100.00
Total power cost per year	$2,793.44	$4,450.40

Power Costs for a 6-plow Diesel Tractor

	Annual hours of use	
	600	*1,000*
Basic cost from Figure 1	$1,300.00	$1,900.00
Fuel – Diesel at 21 cents per gallon, 4.46 gallons per hour at rated load, 600 hours, 600 × 4.46 × $0.21	561.96	
1,000 hours, 1000 × 4.46 × $0.21		936.60
Auxiliary equipment, storage tank and pump	8.00	8.00
Oil – 9 quarts every 100 hours, 60 cents a quart 600 hours, 600/100 × 9 × $0.60	32.40	
1,000 hours, 1000/100 × 9 × $0.60		54.00
1 oil filter every 200 hours at $3.00 600 hours, 600/200 × $3.00	9.00	
1,000 hours, 1000/200 × $3.00		15.00
Grease – Similar to gasoline tractor	12.00	20.00
Labor – The same as for gasoline tractor	660.00	1,100.00
Total power cost per year	$2,583.36	$4,033.60

Power Costs for a 6-plow Propane Tractor

	Annual hours of use	
	600	*1,000*
Basic cost from Figure 1	$1,275.00	$1,810.00
Fuel – Propane at 13 cents per gallon, 7.14 gallons per hour at rated load, 600 hours, 600 × 7.14 × $0.13	556.92	
1,000 hours, 1000 × 7.14 × $0.13		928.20
Auxiliary equipment, part of annual cost of storage tank, hoses and small field tank for refueling	40.00	40.00
Oil – 9 quarts every 300 hours at 60 cents a quart 600 hours, 600/300 × 9 × $0.60	10.80	
1,000 hours, 1000/300 × 9 × $0.60		18.00
1 filter every 600 hours at $3.00 600 hours, 600/600 × $3.00	3.00	
1,000 hours, 1000/600 × $3.00		5.00
Grease – Similar to gasoline tractor	12.00	20.00
Labor – The same as for gasoline tractor	660.00	1,100.00
Total power cost per year	$2,557.72	$3,921.20

Annual Power Cost Comparison

	600 hours of annual use		*1,000 hours of annual use*	
	Total cost	*Cost per hour*	*Total cost*	*Cost per hour*
Gasoline tractor	$2,793.44	$4.65	$4,450.40	$4.45
Diesel tractor	2,583.36	4.31	4,033.60	4.03
Propane tractor	2,557.72	4.26	3,921.20	3.92

Observations

At the fuel prices used in the examples, the power costs for the diesel and propane tractors, for both 600 and 1,000 hours of annual use, are considerably lower than for the gasoline tractor.

The diesel and propane tractors show an overall saving in power costs because of the lower fuel costs. The price of propane fuel is now low enough that the propane tractor provides the most economical tractor power. The propane tractor can now supply power slightly more cheaply than the diesel and considerably more cheaply than the gasoline tractor. Where propane gas can be obtained locally at 13 cents per gallon or lower, the purchase of a propane tractor should be considered seriously, particularly if this fuel is used domestically on the farm.

These costs have been calculated for the three types of tractors at rated load, which is the highest point of efficiency as far as fuel economy

is concerned. As the load decreases from this point the efficiency of the diesel tractor exceeds that of the propane tractor by a small margin, and the gasoline type by a much larger one on lighter loads. If possible, when buying a tractor choose a size that will, on the average, be loaded near the rated load. If the average load is much less than the rated load, the diesel tractor is the best choice as long as the operating temperature is carefully maintained.

As the hours of operation per year are increased the power cost per hour decreases. This is so because interest on the money invested is charged on a yearly basis. The greater the hours of annual use the less the interest charge per hour.

COMMENTS

The examples in this publication may be used to compare the power costs of all types of wheel and track tractors, including gasoline, diesel and propane models.

Tractors on the farm are operated under a wide range of conditions. Where possible, calculate the costs on the basis of the specific conditions of operation for each tractor. It should not be concluded from the above examples that any specific type of tractor has the lowest operating costs under all circumstances.

Helpful Publication

Thompson, J.L. *Agricultural Machinery Costs*. Can. Dep. Agr. Pub. 1291.