

How Much does that Tractor Really Cost?

Grade Level: 4-8

Lesson Overview

Buying a tractor is a lot like buying a car. In addition to the purchase price, make, model, features, and fuel efficiency are factors to consider. But farmers must also analyze the ownership and operating costs of equipment over time. Get students thinking about farming expenses as they perform calculations to estimate tractor ownership costs.

Student Objectives

1. Determine the costs involved in owning and operating farm machinery.
2. Use tables to calculate answers to math problems.
3. Identify various costs in farming.
4. Use problem solving methods in practical situations.

Materials

- ✓ Estimating Costs of Farm Machinery Information Sheet
- ✓ How Much does that Tractor Really Cost Worksheet

Vocabulary

- **silage** - silage is green chopped corn plants, fermented and stored above 50% moisture in silos or mounds without the presence of air; can be stored for several years with little loss of nutrients.
- **depreciation** - decline in the value of an item, as from wear and tear, or from being an older model of the item.
- **economic life** - the number of years for which costs are to be estimated for the loss that occurs under the terms of the contract.
- **insurance** - coverage, by contract, in which one party agrees to reimburse another.
- **interest** - a fee collected for the use of money.
- **maintenance** - keeping a machine in working order through timely repairs.
- **operating costs** - costs that vary directly with the amount of machine use.
- **ownership costs (fixed costs)** - costs that occur regardless of machine use, i.e. depreciation, interest, taxes, insurance, and housing facilities.

- **oxidation** - the dulling and/or hazy appearance of a vehicle's top paint or clear coat finish, which leads to rusting of a vehicle.
- **salvage value** - an estimate of the sale value of the machine at the end of its economic life.

Background Information

Vocabulary and student information sheet contain information needed.

Procedure

1. Ask the class to list the machines they think a grain farmer would have to own in order to prepare the soil, plant a crop, harvest and haul it, etc. Using the list below, assign each student or pair of students one of the machines. They must find out the cost of a particular brand of this machine (such as John Deere, Case IH, or Agco).

They can research on the computer, call a local farm machinery dealer, or write a letter to the farm machinery dealer to accomplish this. Generally, they will be given a price range of the machine, which could be compared to the base price of a car and one with all the bells and whistles.

4-wheel drive tractor
 24-ft. mulch-till ripper
 16-row planter
 Combine
 Grain platform for combine
 12-row corn head for combine
 gravity wagon, holds 415 bu.

Once the students have found their price, have them write the name, brand, and price on a card. Display these cards. If they have used the computer, they could include a photo of the machine.

Discuss the price variances with the class. Why would one brand cost more or less than another? Have them compare the price of a car, home, and such so they can understand how expensive these machines are.

2. After reading through Estimating Costs of Farm Machinery Information Sheet with the students, or having them read it to themselves, discuss the information. Make analogies to their buying a family car, or home, so that they are clear on the concepts. (home mortgage or monthly car payment)
3. Students should now complete How Much does that Tractor Really Cost? Worksheet by themselves, in groups, or as a whole class activity.

Extension Activities

Students hold a discussion as to which way they feel is the best to purchase equipment. Pay more each month with a lower interest rate or have less payment due with a higher interest rate. Students must rationalize their choices.

Additional Resources

- <https://farmdoc.illinois.edu/> The goal of the farmdoc (farm decision outreach central) project is to improve farm decision-making under risk through education and research. To meet this goal, the farmdoc website provides Illinois farmers with comprehensive and integrated risk management information and analysis. Publications, decision tools and databases related to a variety of risk management issues are found throughout the site.
<https://farmdoc.illinois.edu/management/handbook#cost-production>
- <https://youtu.be/SatAdhyok8Y> John Deere 2021 machines

Standards

Illinois Mathematics Standard

7.SP.8b: Find probabilities of compound events using organized lists, tables, tree diagrams, and simulation. b. Represent sample spaces for compound events using methods such as organized lists, tables and tree diagrams.

Illinois English Language Arts Standard

RST 4: Determine the meaning of symbols, key terms, and other domain specific words and phrases as they are used in a specific scientific or technical context relevant to grades 6 – 8 texts and topics.

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These mAGic lessons are designed to bring agriculture to life in your classroom. They address the Illinois Learning Standards in math, science, English language arts and social studies.

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Estimating Costs of Farm Machinery Information Sheet

Farm machinery costs are of two main types: ownership costs, which occur regardless of machine use, and operating costs, which depend on the amount of use.

Ownership costs, also called fixed costs, include depreciation, interest, taxes, insurance and storage. These costs can add up to almost 10% of the original cost of the machinery.

Depreciation refers to costs resulting from wear, age, and whether the machine is still current with the latest technology. Age and how many hours the machine has been used are usually the most important factors in determining the real value of the machine. This is just like your family car. Each year that you own it, as well as the number of miles it has been driven, depreciates the value of the car. This is called wear and tear. Tractors and other farm machines have a salvage value, which is an estimate of the expected trade-in allowance. Sometimes farmers keep the tractor until it wears out, at which time there is a zero-salvage value. Again, this is just like trading in a family car for a new one or keeping it until it is no longer operable.

Interest is the amount of money that the farmer has to pay the bank for the use of their money to buy the tractor. Many times, the farmer pays some of his own money for the tractor, and then borrows the rest from a bank. The bank will charge a certain percentage of the price in interest. Simply put, if you borrow \$100 at 6% interest for a year from your parents, you would have a monthly payment of approximately \$8.56. At the end of the year, you would have paid your parents \$103.28, which includes the interest of \$3.28. In other words, you pay your parents for letting you use their money. A farmer pays the bank for letting him use their money in just the same way.

Insurance should be carried on farm machinery to allow for replacement in case of a disaster such as a fire or tornado. Insurance rates are about 0.5% of the purchase price of the tractor. That would be about \$500 a year for insuring a \$100,000 tractor. Storage or shelter for the tractor varies from farm to farm. However, providing good shelter for the tractor will help slow deterioration of mechanical parts and the rusting and oxidation caused by weathering. Again, the estimated cost of shelter for the tractor is about 0.5%, as was the insurance.

Operating costs include repairs, maintenance, and fuel. Repair costs occur because of routine maintenance, wear and tear, and accidents. The best data for estimating repair costs are the farmer's own records of past repair expenses. For this reason, farmers keep detailed records of their maintenance on machines. However, there are references available that are used to show the average maintenance for farm machinery.

Fuel costs can also be estimated by referring to a publication provided by University of Illinois Extension, which lists the average fuel use in gallons per acre for many field operations. By simply multiplying the fuel cost per gallon by the average fuel use per acre, you can find estimated fuel costs.

By using all the different ways to estimate the costs of farm machinery for the year, a farmer can make an educated purchase of machinery to use on his or her farm. However, as with any estimation, it is simply that – an estimation of the costs – which will have to be weighed against the actual costs calculated after a year.

Name _____

How Much does that Tractor Really Cost? Worksheet

Actual Cost of a \$250,000 Tractor

Interest Rate	Length of Loan	Monthly Payment	Final Price
6.6%	36 months	\$3069.45	\$110,500.34
6.9%	48 months	\$2389.99	\$114,719.41
7.2%	60 months	\$1989.57	\$119,374.17
7.5%	72 months	\$1729.01	\$124,488.81

Use the above chart to answer questions 1-4. Remember to show your work.

1. What is the difference between the final cost of the tractor at 7.5% for 72 months and at 6.6% for 36 months?

2. Calculate the difference in your monthly payment from 6.9% and 7.5%.

3. What is the relationship between the length of time to pay back a loan and the final price?

4. What relationship is there between the monthly payment and the length of the loan?

Remaining Salvage Value as Percent of New List Price 150 Horsepower Tractor

	200 annual hours use	400 annual hours use	600 annual hours use
Age of tractor			
1 year	69%	67%	66%
5 years	47%	45%	44%
10 years	33%	32%	31%
15 years	24%	23%	22%

Use the above chart to answer questions 5-7. Remember to show your work.

5. If you keep a tractor for 15 years and use it 400 hours a year, what % of the purchase price is your remaining salvage value?
6. After having a \$250,000 tractor for 10 years, using it 600 hours annually, what salvage value does it have?
7. After only one year of owning a \$250,000 tractor and using it 200 hours, how much has it depreciated?

Accumulated Repair Costs of Tractor as a % of New List Price

Accumulated Hours	1,000	3,000	5,000	6,000	7,000	8,000	9,000	10,000
	1%	6%	18%	25%	34%	45%	57%	70%

Use the above chart to answer questions 8 and 9. Remember to show your work.

8. Calculate the repair costs after 1,000 hours for your \$250,000 tractor.

9. Calculate the repair costs after 10,000 hours for your \$250,000 tractor.

10. The average amount of diesel fuel required to harvest an acre of corn silage is 3.25 gallons. If diesel fuel costs \$2.60 a gallon, what is the average cost per acre?

How Much does that Tractor Really Cost? ANSWER KEY

Actual Cost of a \$250,000 Tractor

Interest Rate	Length of Loan	Monthly Payment	Final Price
6.6%	36 months	\$7674.79	\$276,292.44
6.9%	48 months	\$5976.13	\$286,854.24
7.2%	60 months	\$4975.04	\$298,502.40
7.5%	72 months	\$4323.61	\$311,299.92

Use the above chart to answer questions 1-4. Remember to show your work.

1. What is the difference between the final cost of the tractor at 7.5% for 72 months and at 6.6% for 36 months?

$$\mathbf{\$311,299.92 - \$276,292.44 = \$35,007.48}$$

2. Calculate the difference in your monthly payment from 6.9% and 7.5%.

$$\mathbf{\$5,976.13 - \$4,323.61 = \$1,652.52}$$

3. What is the relationship between the length of time to pay back a loan and the final price?

Answers will vary, but should include the fact that longer time = larger final price.

4. What relationship is there between the monthly payment and the length of the loan?

Answers will vary, but should include the fact that the longer the loan, the smaller the monthly payment.

Remaining Salvage Value as Percent of New List Price 150 Horsepower Tractor

	200 annual hours use	400 annual hours use	600 annual hours use
Age of tractor			
1 year	69%	67%	66%
5 years	47%	45%	44%
10 years	33%	32%	31%
15 years	24%	23%	22%

Use the above chart to answer questions 5-7. Remember to show your work.

5. If you keep a tractor for 15 years and use it 400 hours a year, what % of the purchase price is your remaining salvage value? **23%**

6. After having a \$250,000 tractor for 10 years, using it 600 hours annually, what salvage value does it have?

$$\mathbf{\$250,000 \times 31\% = \$77,500}$$

7. After only one year of owning a \$250,000 tractor and using it 200 hours, how much has it depreciated?

$$\mathbf{\$250,000 - (250,000 \times 69\%) = \$250,000 - \$172,500 = \$77,500}$$

Accumulated Repair Costs of Tractor as a % of New List Price

Accumulated Hours	1,000	3,000	5,000	6,000	7,000	8,000	9,000	10,000
	1%	6%	18%	25%	34%	45%	57%	70%

Use the above chart to answer questions 8 and 9. Remember to show your work.

8. Calculate the repair costs after 1,000 hours for your \$250,000 tractor.

$$\mathbf{\$250,000 \times 1\% = \$2,500.00}$$

9. Calculate the repair costs after 10,000 hours for your \$250,000 tractor.

$$\mathbf{\$250,000.00 \times 70\% = \$175,000.00}$$

10. The average amount of diesel fuel required to harvest an acre of corn silage is 3.25 gallons. If diesel fuel costs \$2.60 a gallon, what is the average cost per acre?

$$\mathbf{3.25 \times \$2.60 = \$8.45/acre}$$