A Fast and Simple Method to Estimate Typical Machinery Costs

Paul D. Mitchell, Agricultural and Applied Economics, UW Madison/Extension
(608) 265-6514, pdmitchell@wisc.edu

Machinery costs for grain and forage production are often difficult to accurately estimate, but are an important component of production costs. Controlling machinery costs is important for maintaining or improving profitability, as machinery costs often separate profitable farms from unprofitable farms. Machinery costs often equal or even exceed total costs for variable inputs such as fertilizer, seed, and herbicides. Also, farmers can do little to profitably change these input costs, but they can affect their machinery costs. The goal here is to describe a fast and simple method to estimate machinery costs for a "typical" farmer to develop a quick cost of production estimate or to provide benchmark for comparison. More complex methods provide more detailed and accurate cost estimates, but require more records and time to develop.

This fast and simple adjusts easily obtainable custom rates to estimate machinery costs. Beaton, Dhuyvetter, and Kastens (2003) developed the method using data from Kansas farmers. They used detailed cost data to calculate per acre machinery costs for each farmer, and then calculated a relative cost ratio—the ratio of each farmer's cost to the state average custom rate for that operation. They found that farmer machinery costs ranged from as low as 55% to almost 250% of the custom rate, indicating a wide variation in farmer machinery costs and one of the major factors separating profitable farms from unprofitable farms. Dhuyvetter and Kastens (2005) believe that this wide variation in machinery costs also holds in Wisconsin.

Beaton, Dhuyvetter, and Kastens (2003) propose several reasons why farmer machinery costs are usually higher than custom rates. Custom operators spread fixed machinery costs over more acres, so their total costs per acre are lower than for an owner-operator. Custom operators may be more efficient, such as by finding good deals on machinery purchases and getting volume discounts, or can justify larger equipment purchases and so obtain economies of scale. Also, because the farmer has less control over the timing of custom operations (e.g., the custom work is only done once the custom operator has finished with his own land), custom rates have to be discounted. Also, custom operators have lower labor and management costs—clients determine when and where to perform operations and the settings to use; the custom operator arrives when he can and does what he is asked. Finally, farmers performing custom operations for neighbors, friends, and relatives may be reluctant to charge their full cost, putting downward pressure on reported custom rates.

Beaton, Dhuyvetter, and Kastens (2003) developed a formula to describe how a farmer's machinery costs relate to the observed custom rate. They found that farmers operating more acres tended to have machinery costs closer to custom rates, while farmers operating fewer acres had higher costs. Using this relationship, they developed an equation for a "scale factor" to adjust the observed custom rate upward to give the typical machinery cost for a farmer. This scale factor equation is:

$$\text{Scale Factor} = 1.224 + 32.564/\text{Acres},$$

where Acres is the total number of acres the farmer operates for all crops. This scale factor is a number indicating how much larger a farmer's machinery costs are relative to the state average custom rate. For example, the Scale Factor for a farmer operating 1,000 acres of cropland is 1.224 + 32.564/1000 = 1.257, implying that farmer operating 1,000 acres of cropland has machinery costs 1.257 times more than the state average custom rate, or 25.7% higher.

Table 1 reports the Scale Factor for a range of cropland acres. Table 1 implies that a farmer operating 100 acres of cropland has machinery costs 55% higher than the custom rate, while farmers operating 2,000 or more acres have machinery costs about 24% higher than the custom rate. The scale factors in Table 1 imply that farmer machinery costs generally range between 50% and 25% higher than custom rates, with larger farms typically having lower machinery costs.

Table 1. Scale Factor for different levels of total cropland.

Acres of Cropland	Scale Factor	Acres of Cropland	Scale Factor
100	1.550	1,600	1.244
200	1.387	1,700	1.243
300	1.333	1,800	1.242
400	1.305	1,900	1.241
500	1.289	2,000	1.240
600	1.278	2,100	1.240
700	1.271	2,200	1.239
800	1.265	2,300	1.238
900	1.260	2,400	1.238
1,000	1.257	2,500	1.237
1,100	1.254	2,600	1.237
1,200	1.251	2,700	1.236
1,300	1.249	2,800	1.236
1,400	1.247	2,900	1.235
1,500	1.246	3,000	1.235

This Scale Factor can then be used to determine a farmer's machinery cost as follows:

Machinery Cost = Scale Factor x Custom Rate.

For example, if the state average custom rate for chisel plowing is $13.30/ac, then a fast and simple estimate of the machinery costs for a farmer operating 1,000 acres of cropland who does his own chisel plowing is 1.257 x 13.30 = $16.72/ac.

Wisconsin Agricultural Statistics Service (2005) publishes Wisconsin's Custom Rate Guide every 2-3 years, which provides custom rates to implement this procedure. The Wisconsin Guide also breaks down rates by district and region, so that farmers can develop machinery cost estimates more specific to their area. Also, custom rate guides for bordering states may be useful for farmers in some areas, especially if the Wisconsin guide becomes dated. Finally, an example is provided to illustrate use of this method.

Example

Farmer Smith, a grain farmer in south-central Wisconsin (Green County), operates (rents and owns) 1,500 acres in a corn-soybean rotation. Machinery operations he performs with his own equipment include chisel plowing and a field cultivating for tillage, planting using a conventional planter (drill for soybeans), and combining. Using the Wisconsin's 2004 Custom Rate Guide, the custom rates for these machinery operations in south central Wisconsin are summarized in Table 2. Since he operates 1,500 acres of cropland, his scale factor is 1.224 + 32.564/1500 = 1.246, which can also be obtained from Table 1. Table 2 also reports farmer machinery costs for these operations by multiplying the custom rates by this scale factor of 1.246 to obtain a fast and simple estimate.

Table 2. Machinery operations, custom rates, and typical farmer costs for Example 1.

Corn following Soybeans			Soybeans following Corn		
Operation	Custom Rate	Farmer Cost	Operation	Custom Rate	Farmer Cost
Chisel Plow	12.40	15.45	Chisel Plow	12.40	15.45
Field Cultivator	9.70	12.09	Field Cultivator	9.70	12.09
Plant (Conventional)	13.00	16.20	Plant (Drill)	13.80	17.19
Combine	24.10	30.03	Combine	24.30	30.28
Total	59.20	73.76	Total	60.20	75.01

Table 2 implies that for this example that machinery costs are about $75/ac for corn and soybeans. Soybeans are slightly higher because of higher planting and combining costs.

Because Wisconsin's 2004 Custom Rate Guide reports rates for numerous machinery operations for different crops, changing the analysis for different cropping practices is easy—simply list the operations, lookup the custom rates, and then multiply each by the scale factor. Also, these machinery costs can be combined with estimates of total variable input costs for fertilizer, seed, herbicides, etc. to obtain a quick estimate of the cost of production. A spreadsheet has been developed as a template for this purpose (see Additional Resources below).

Conclusion

Note that machinery costs vary greatly among farmers. Machinery costs estimated using this method represent costs for a "typical" farmer and do not represent any specific farmer's actual machinery costs or an in-depth study of machinery costs for the industry. Interpretation and utilization of this information is the responsibility of the user. The alternative to this fast and simple method is a careful, detailed, record-based approach that accounts for all the different types of machinery costs (depreciation, maintenance, fuel and lubrication, operator labor, interest, insurance and storage) and allocates them to specific crops. Such methods give good estimates of a specific farmer's machinery costs, but require good records and time to organize and to use them. Farmers wishing to develop more accurate estimates of their own cost of production using such methods should see Schuler and Frank (1991) and the University of Wisconsin Center for Dairy Profitability listed in Additional Resources below.

Additional Resources

Paul D. Mitchell, Department of Agricultural and Applied Economics, University of Wisconsin-Madison, developed a spreadsheet template to apply this fast and simple method to estimate machinery costs and the cost of production. The spreadsheet is available at http://www.aae.wisc.edu/mitchell/Budget%20Template.xls, or contact him directly at (608) 265-6514 and pdmitchell@wisc.edu.

To develop more accurate and detailed estimates of your machinery costs using your own information, the following resources are freely available on the internet, or contact your local county agent:

Schuler, R. T., and G. G. Frank. 1991. Estimating Agricultural Field Machinery Costs. University of Wisconsin-Extension Publication A3510. http://cecommerce.uwex.edu/pdfs/a3510.pdf.

University of Wisconsin Center for Dairy Profitability has budgets, spreadsheets, and software available. See their homepage at http://cdp.wisc.edu/ or contact them directly at (608) 263-5665 and dairyprofit@calshp.cals.wisc.edu.

References

These references are freely available on the internet, or contact your local county agent:

Beaton, A. J., K. C. Dhuyvetter, and T. L. Kastens. 2003. Custom Rates and the Total Cost to Own and Operate Farm Machinery in Kansas, Kansas State University Agricultural Experiment Station and Cooperative Extension Service publication MF-2583. http://www.agmanager.info/farmmgt/machinery/MF2583.pdf.

Dhuyvetter, K. C., and T. L. Kastens. 2005. Analyzing Your Business: How Do You Know Where You Stand? Wisconsin Custom Operators, Professional Nutrient Applicators of Wisconsin and Midwest Forage Association Annual Meeting. http://www.agmanager.info/farmmgt/machinery/WI%20Custom%20Operator%20Conf%20(Jan2005).pdf.

Wisconsin Agricultural Statistics Service. 2005. Wisconsin's 2004 Custom Rate Guide. http://www.nass.usda.gov/wi/custom_rate_2004.pdf.