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Benchmarking Crop Machinery Cost and Investment

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The continued increase in size of tractors, combines, and other machinery has enabled farms to operate more acres and reduce labor use per acre. However, this increase in machinery size also makes it increasingly important to evaluate the efficient use of machinery. A recent *farmdoc* article examined trends in machinery costs and its key components for Illinois grain farms (Paulson, Schnitkey, and Zulauf). This article illustrates the computation of crop machinery cost and investment for a case farm in west central Indiana, and uses FINBIN data (University of Minnesota) to examine machinery cost and investment benchmarks.

Key Machinery Benchmarks

Crop machinery cost per acre is computed by summing depreciation, interest, property taxes, insurance, leasing, repairs, fuel and lubricants, and custom hire and rental expense; and dividing the resulting figure by crop acres or harvested acres. Interest should include both cash interest paid and an opportunity charge on machinery and equipment that is owned. In regions where double-cropping predominates, using harvested acres is preferable.

Crop machinery investment per acre is computed by dividing total crop machinery investment (i.e., investment in tractors, combines, and other machinery) by crop acres or harvested acres. Again, in regions where double-cropping is prevalent, using harvested acres gives a more accurate depiction of machinery investment.

Machinery investment per acre typically varies with farm size. Thus, it is important for farms to compare machinery investment per acre with similarly sized farms and to examine the trend in this benchmark for a particular farm. A farm with relatively high machinery investment per acre needs to determine whether this high value is a problem. If the farm faces serious labor or timeliness constraints, this benchmark may be relatively high. However, if this benchmark is high due to the purchase of assets used to mitigate income tax obligations or for some other reason, the farm needs to think about their long-term strategy with respect to purchasing machinery and equipment.

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Case Farm Illustration

Crop machinery cost and investment per acre for a case farm in west central Indiana is presented in table 1. This case farm has 1500 acres of full-season corn and 1500 acres of full-season soybeans. If this farm had livestock, the relevant machinery cost and investment figures for the livestock operation would need to be excluded from total machinery cost and investment to compute the values in Table 1. Machinery costs include depreciation, interest, insurance, repairs, and fuel and lubricant. This farm does not custom hire or lease machinery so the values for these items are zero in Table 1. Interest was computed using information pertaining to the farm's term loan for machinery. Though it is often preferably to include opportunity interest cost in the computation of crop machinery cost, using the actual interest expense is more comparable to the benchmarks discussed below. In summary, the crop machinery cost per acre for the case farm was $152.45.

Table 1. Crop Machinery Cost and Investment Estimates for White County Farms

Item		2024
Machinery Cost per Acre		
	Depreciation	61.96
	Interest	14.33
	Property Taxes	0.00
	Insurance	13.66
	Leasing Expense	0.00
	Repairs	42.50
	Fuel and Lubricant	20.00
	Custom Hire and Rental Expense	0.00
	Total	$152.45
Machinery Investment per Acre		
	Self-Propelled Equipment	248.06
	Machinery	298.38
	Total	$546.44

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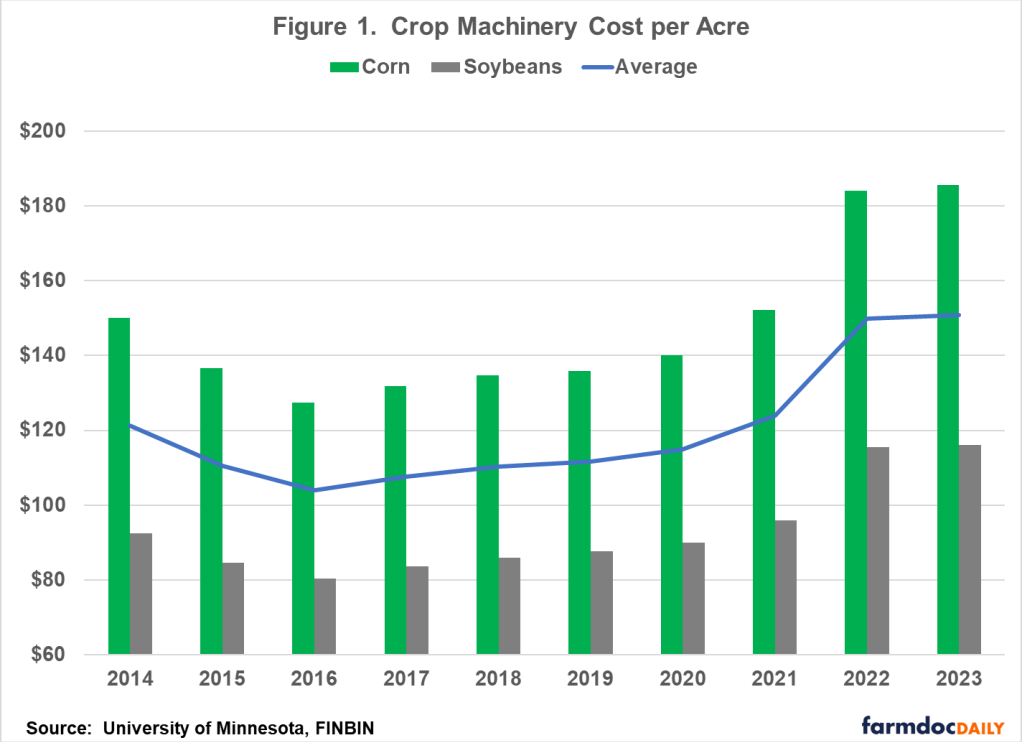
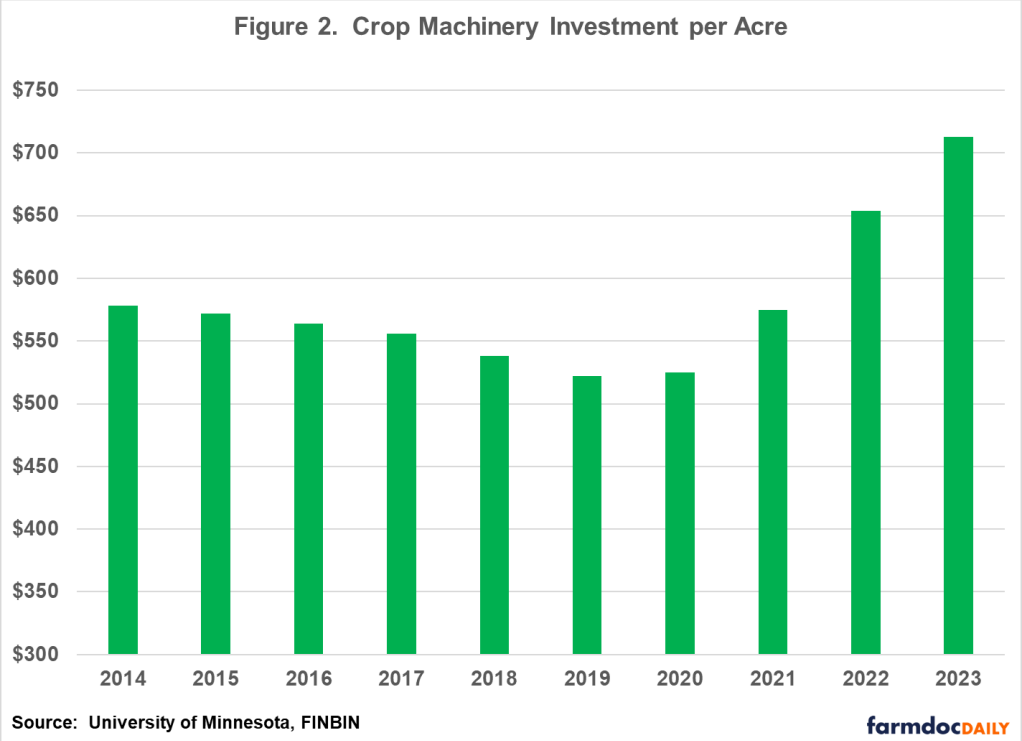
Using the Center for Farm Financial Management's FINBIN database, Figure 1 illustrates the trend in machinery cost per acre from 2014 to 2023 for crop farms. The chart illustrates crop machinery cost for corn, soybeans, and the average for the two crops. Discussion will focus on the average for the two crops. Crop machinery cost declined from 2014 to 2016, and then increased over the rest of the period. The largest increase in machinery costs occurred in 2021 and 2022, which correspond with sharp increases in breakeven prices for corn and soybeans. In 2023, the average machinery cost per acre for the two crops was $151. The machinery cost for the case farm is $152. As noted above, the $151 per acre figure represents an average for corn and soybeans. If we examine these crops separately, the machinery cost per acre in 2023 would be $186 for corn and $116 for soybeans.



To obtain some feel for how variable machinery cost is between farms, we compared the average machinery cost per acre for corn farms in 2023 with the averages for corn farms in the low 20 percent group with respect to net return per acre and for corn farms in the high 20 percent group with respect to net return per acre. The average crop machinery cost per acre for corn in 2023 was $185.61. The low profit group had an average machinery cost per acre of $226.12 or 21.8 percent higher than the average machinery cost. In contrast, the high profit group had an average crop machinery cost of $157.16 per acre or 15.3 percent lower than the average machinery cost. The difference in crop machinery costs between the low profit and high profit groups translates into a $0.37 per bushel difference in breakeven costs using average corn yields. A similar analysis was conducted for soybeans. For the case of soybeans, the difference in crop machinery costs between the low profit and high profit groups would translate into a difference in breakeven cost of $0.76 per bushel.

Crop machinery investment per acre for the case farm was $546. Figure 2 presents crop machinery investment per acre for farms with data included in the FINBIN database. Unlike the crop machinery cost computations which focused on corn and soybean production, the crop machinery investment computations incorporated into Figure 2 were for all farms categorized as crop farms. Average crop machinery investment in 2014 was $578 per acre. Crop machinery investment per acre declined from $578 in 2014 to $522 in 2019. After increasing modestly in 2020 ($525), average crop machinery investment increased to $575 in 2021, $654 in 2022, and $713 in 2023. Why did average machinery investment per acre increase so sharply in 2021, 2022, and 2023? In addition to upward pressure on costs for repairs, fuel and oil, insurance, and custom rates; capital purchases were relatively strong during this time period. Given lower expected capital purchases in 2024 and 2025, we expect crop machinery investment per acre to remain at current levels or decline slightly. As a comparison, the crop machinery investment per acre for the case farm is relatively low compared to the FINBIN average for 2023.



Potential variability in crop machinery investment per acre was examined by comparing average machinery investment per acre for farms with different levels of net farm income in 2023. The average crop machinery investment per acre for the farms with net farm income in the 20 to the 80 percentiles was $695. Farms in the low 20 percent net farm income group had an average machinery investment per acre of $802 or 15.4 percent higher than the average for the group with net farm income in the 20 to 80 percentiles. In contrast, farms in the high 20 percent net farm income group had an average crop machinery investment per acre of $684 or 1.6 percent lower than middle net farm income group.

In addition to examining crop machinery investment per acre for different net farm income groups, we examined machinery investment benchmarks for crop farms. Farms in the 30th percentile, meaning that 30 percent of the farms had values higher than this group, had an average machinery investment per acre of $1,031, while farms in the 70th percentile had an average machinery investment per acre of $478. When interpreting relatively low crop machinery investment values (e.g., $350 per acre and below), a word of caution is in order. Farms with very low crop machinery investment values tend to have older machinery that is largely depreciated out. Whether these farms can continue operating with this machinery for several more years is an open question.

Given the potential tradeoff between labor and machinery costs, it is often important to compute both labor and machinery benchmarks. The case farm has strong labor benchmarks. Gross revenue per worker is approximately $982,387 for the case farm. In addition, the ratio of total labor expense (hired labor plus family and operator labor) as a percentage of value of farm production is only 8.4 percent.

Conclusions

This article defined, described, and illustrated crop machinery cost and investment benchmarks using a case farm in west central Indiana. The case farm had a crop machinery investment that was lower than the average reported in the FINBIN database. Crop machinery cost per acre for the case farm was similar to the average reported in the FINBIN database. Using the analysis in this article, benchmarks for a corn/soybean farm are $150 per acre for crop machinery costs and $650 for crop machinery investment. Farms with values higher than this, need to carefully examine breakeven prices, carefully evaluate machinery purchases, and compute and compare labor cost benchmarks with similar-sized farms. In order to more fully gauge farm efficiency, it would be helpful to also compare the farm's profitability and financial efficiency ratios to farms of the same type and similar in size.

References

Center for Farm Financial Management, University of Minnesota, FINBIN web site, accessed December 17, 2024.

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