Top Farms and the Effect of Machinery Expenses

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Introduction

As shown in AgManager paper "What Makes a Top Farm? - Overview" (https://www.agmanager.info/finance-business-planning/research-papers-and-presentations/what-makes-top-farm), we explain the process of determining which farms are the most profitable over the last 10 years by ranking the net farm income per acre each year. In an earlier paper, we showed a clear difference among farms, especially at the top and bottom of the rankings. However, in that analysis, we did not evaluate why these differences might be happening.

We have begun to analyze some of the factors that might explain why some farms rank higher than others. These earlier analyses are:

- Top Farms and the Effect of Farm Size (https://www.agmanager.info/finance-business-planning/research-papers-and-presentations/top-farms-and-effect-farm-size)
- Top Farms and the Effect of Debt (https://www.agmanager.info/finance-business-planning/research-papers-and-presentations/top-farms-and-effect-debt)
- Top Farms and the Effect of Investing in Machinery (https://www.agmanager.info/finance-business-planning/research-papers-and-presentations/top-farms-and-effect-investing-machinery)

This current paper and the analyses to follow will continue to examine factors that might explain why some farms consistently rank higher than other farms.

The purpose of this paper is to evaluate machinery expenses per acre to see if that might be a factor in explaining why some farms are consistently more profitable than other farms. Crop farm machinery expenses per acre include machinery repairs, fuel expenses, equipment depreciation (based on management depreciation), machinery hired expenses, plus an opportunity

interest charge on crop machinery investment. These costs could be offset if any machinery custom work was performed. In the previous paper in this series, we saw that higher ranked farms had more machinery investment per acre. Thus, the initial hypothesis of this analysis was that these higher ranked farms would also have higher levels of machinery expenses. Having more machinery investment per acre would result in higher opportunity costs from that machinery investment as well as higher levels of depreciation.

We examine data from the Kansas Farm Management Association (KFMA). The KFMA has been helping farmers since the 1930's and actually has computerized farm records back to the early 1970's. There are currently around 2,500 farms in the KFMA system and in any given year about 1,500 of those farms will have records that are useable for research, teaching, and Extension analysis. This is one of the best systems in the country and the data provided by the KFMA can help answer those questions of farmer profitability.

Methods

As in the previous papers referenced above, we examine the machinery expense question in east, central, and western Kansas. The average 10-year farm ranking for each region was used as the dependent variable in a regression analysis where the machinery cost per acre is the independent variable. In addition to the regression analysis, we examine the distribution of machinery costs when the farms are put into deciles of profitability rankings.

Results

Figures 1, 2, and 3 show the trend lines predicting average farm rankings from the machinery expense per acre. The red line is the trend line while the red dotted lines represent the region of the 95 percent confidence band. The confidence band shows how accurate the trend line fits the data. The confidence band does not encompass 95% of the data like a prediction band. For all three regions of Kansas, the slope of the trend line is not significant. In other words, the amount of machinery expenses did not effect the farm ranking. Also, despite the higher ranking farms having more machinery investment per acre, this higher investment level did not lead to higher machinery expenses.

Figure 4 shows a cumulative distribution for machinery expenses per acre in the three regions of Kansas. At any given machinery expense per acre, the graph shows the percentage of farms that have that particular machinery expense per acre or less. As indicated on the graph, the regions vary considerable by their machinery expenses per acre. The east has the highest machinery expense while the west has the least. This result is entirely expected as rainfall affects how intensively the land can be farmed which in turn drives how much machinery is used. In eastern Kansas, 50% of the farms have machinery expenses of $95 or less. In central Kansas, 50% of the farms have machinery expenses of $84 or less while in western Kansas 50% of the farms have machinery expenses of $64 or less.

The rest of the analysis shows the effects of machinery expenses when the farms are grouped into deciles of profitability rankings. Each decile contains 10 percent of the farms for a region. Figure 5 shows the average machinery expense per acre for each region for each decile. Figures 6, 7, and 8 use violin graphs to show the variation among farms within a decile. The width of each group is an indication of the number of farms with that particular machinery expense per acre. The solid red bar line in each violin is the mean for that group while the dotted red lines are the 25th and 75th percentiles. As the graphs indicate, there is a fairly wide range of machinery expenses for each decile of profitability ranking. The violin graphs tend to echo the trend line analysis. That is, there is not a specific decile that is driving the trend line.

Conclusions

The previous paper on machinery investment showed differences in the farm rankings. The results were actually reversed from expected as higher ranked farms had more machinery. Thus for this paper, we expected those higher ranked farms with more machinery to have higher machinery costs as well since these farms would have higher opportunity costs from the higher investment level and would also have higher depreciation expenses. This didn't happen as we found no differences among the farm rankings when examining machinery costs.

There are several possible explanations for why higher machinery investment did not also lead to higher machinery expenses. First, those farms with higher

machinery investment likely had newer equipment which resulted in lower machinery repairs. Second, the higher ranked rank farms may actually do a better job of controlling machinery expenses but this gain was counter balanced by the resulting higher expenses of opportunity cost and depreciation.

Machinery is typically the second largest investment for a farm outside of land. Thus, one would expect that controlling machinery investment and machinery expenses would be key to helping profitability. However, our analysis has not shown that to be true. Farmers often use machinery purchases as a way to control their tax bills by purchasing more machinery in good years and less in bad years. This helps to even out their net farm income and avoid years of really high taxes. In the early years included in this analysis, farmers likely purchased more machinery than they might otherwise purchase because farm income was so high. In the later years of the analysis, farmers have purchased less machinery due to low net farm income. This equipment purchase strategy helps with a farm's cash flow and appears to not really affect their profitability either.

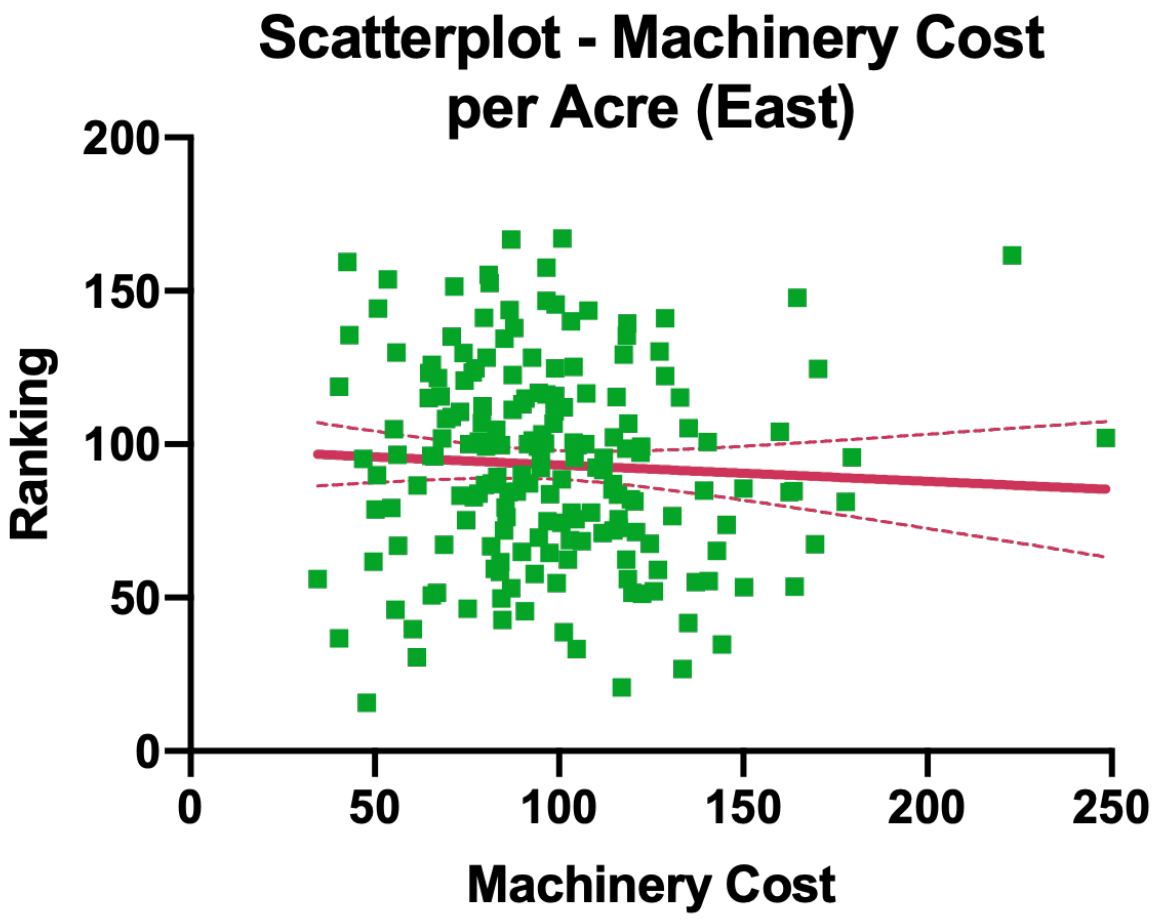

Figure 1. Scatterplot of Farm Rankings by Machinery Cost per Acre for Eastern Kansas

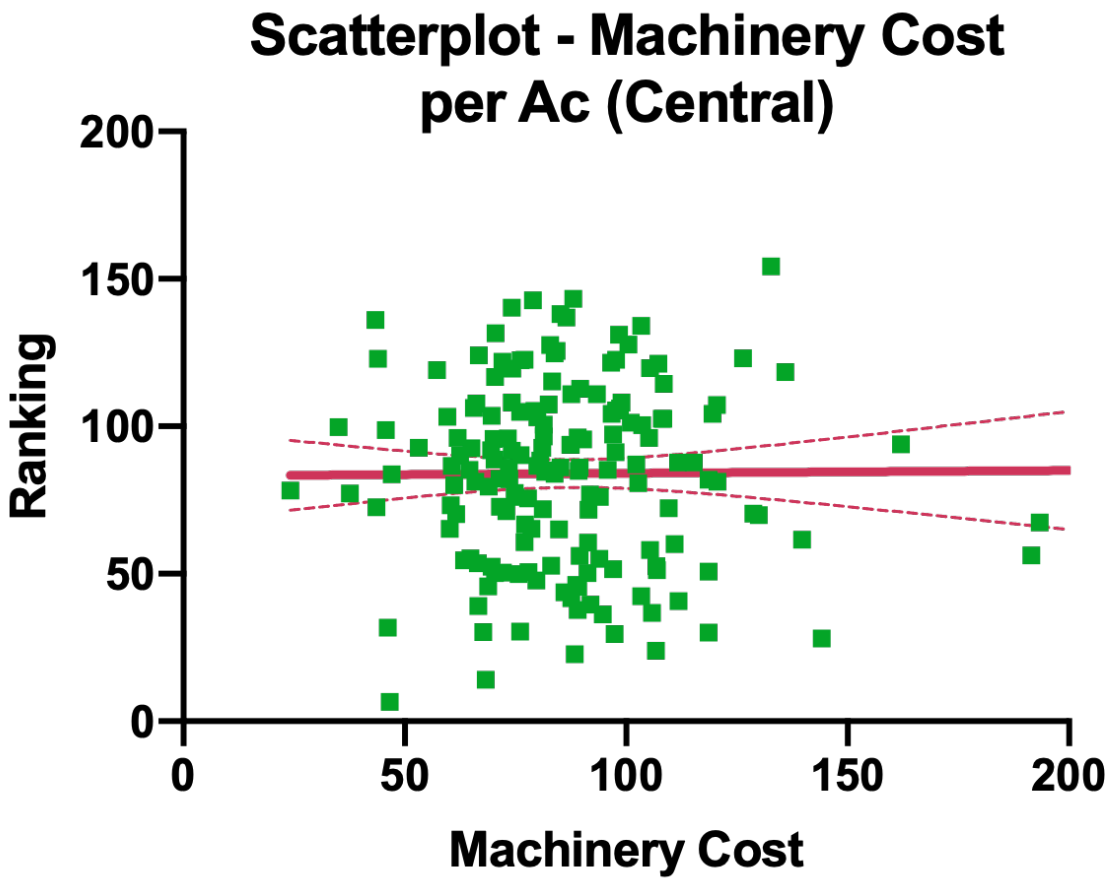

Figure 2. Scatterplot of Farm Rankings by Machinery Cost per Acre for Central Kansas

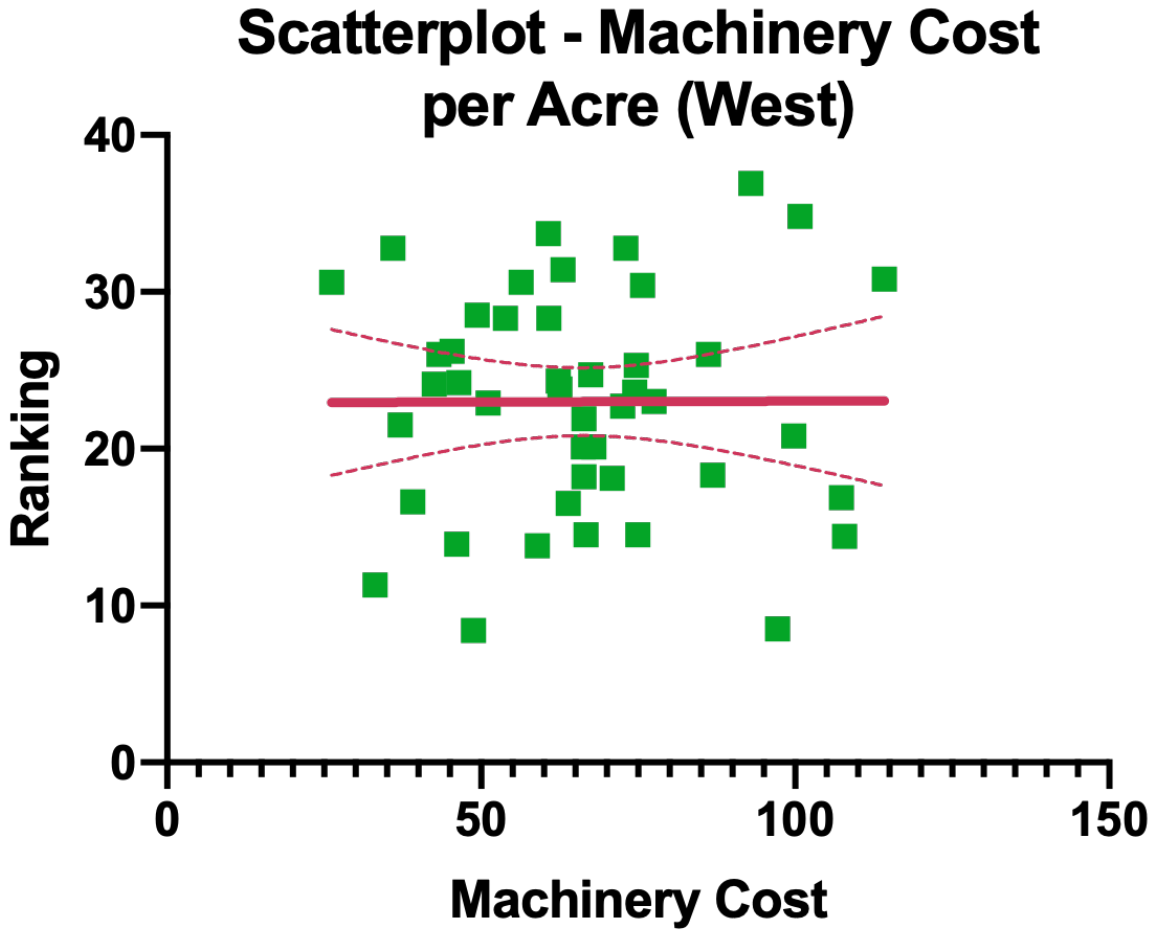

Figure 3. Scatterplot of Farm Rankings by Machinery Cost per Acre for Western Kansas

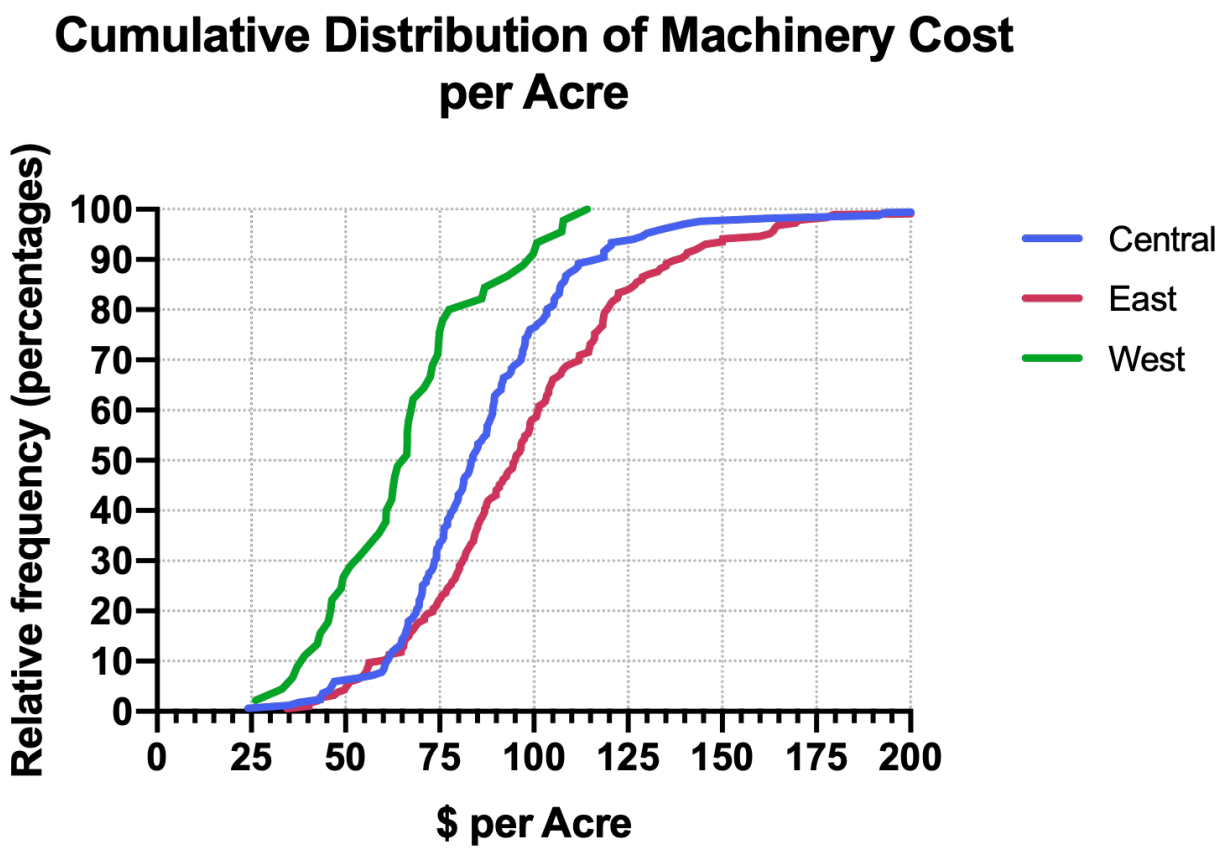

Figure 4. Cumulative Distribution of Machinery Cost per Acre by Region

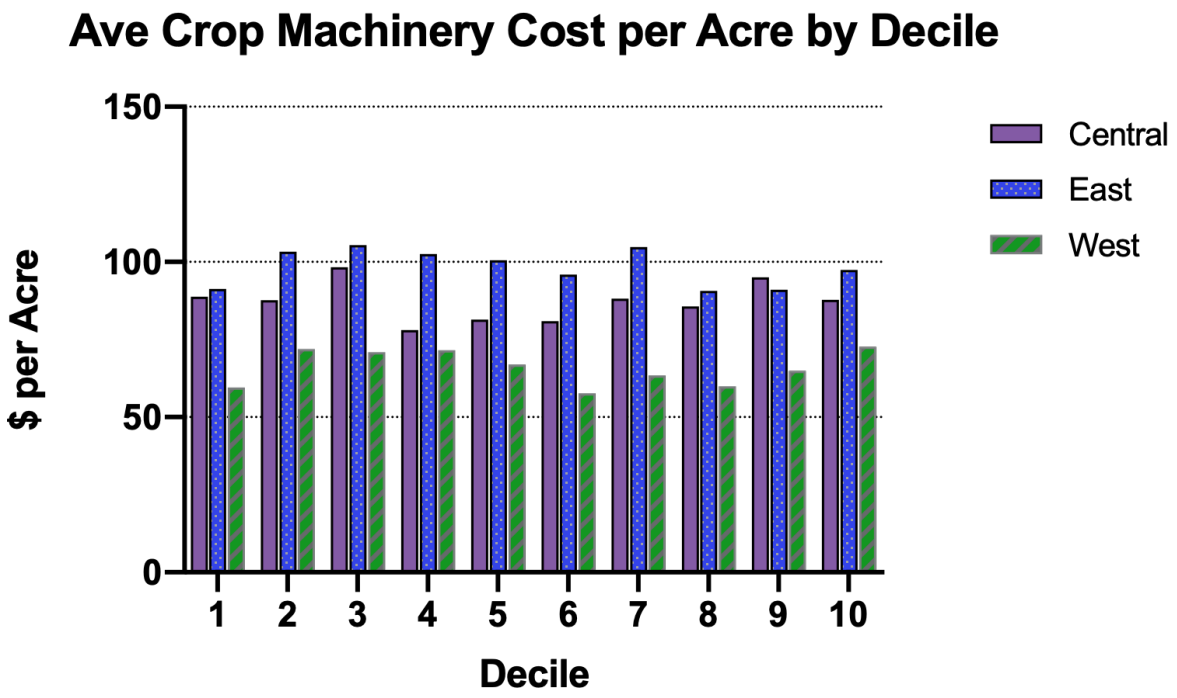

Figure 5. Average Machinery Cost per Acre by Profitability Decile for Central, Eastern, and Western Kansas

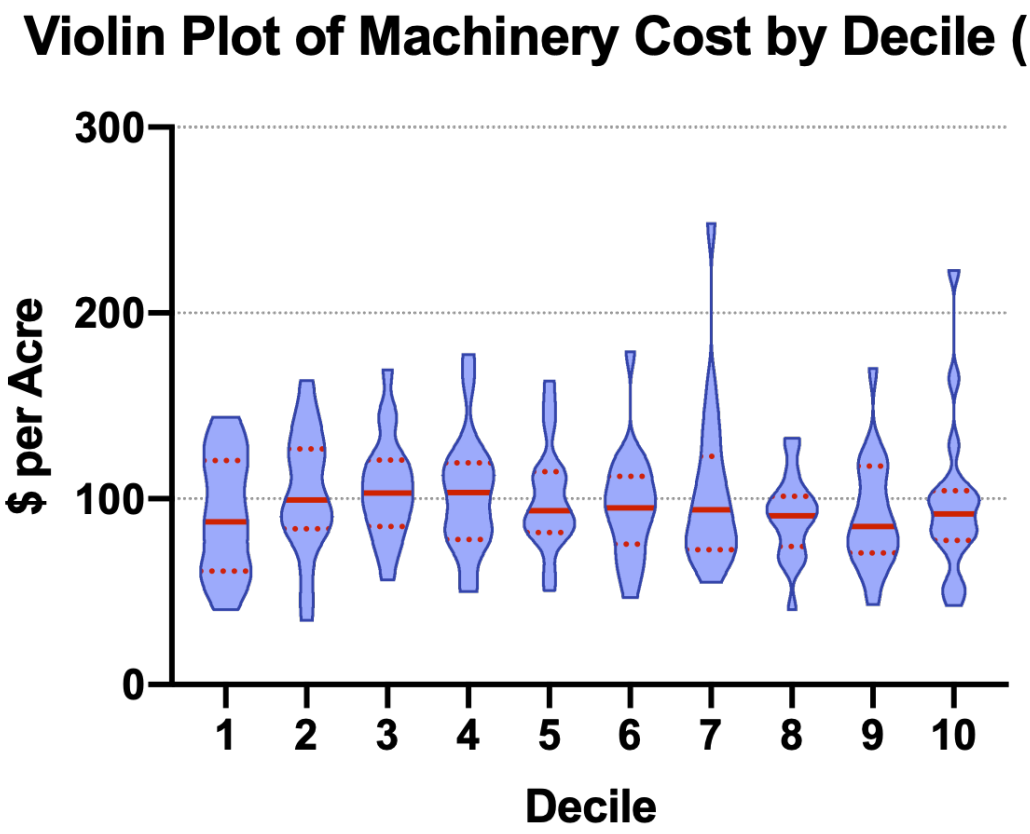

Figure 6. Violin Plot of the Distribution of Machinery Cost per Acre for Each Profitability Decile (East)

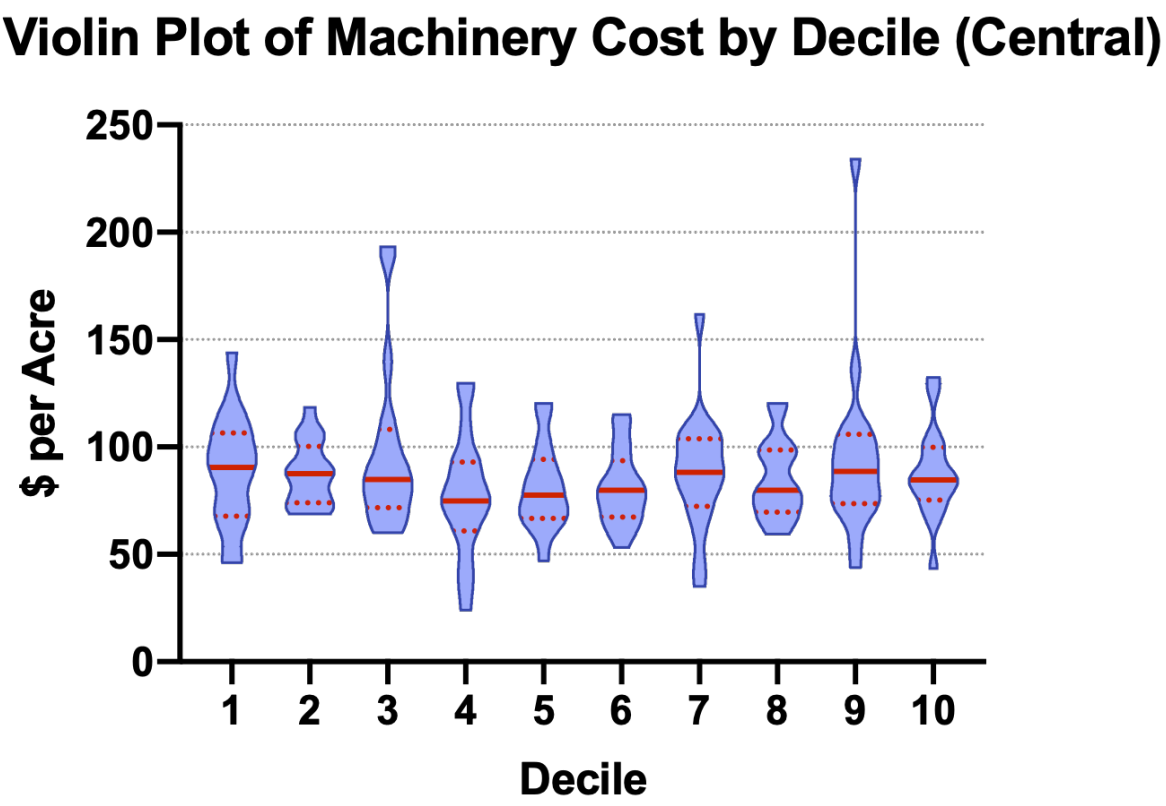

Figure 7. Violin Plot of the Distribution of Machinery Cost per Acre for Each Profitability Decile (Central)

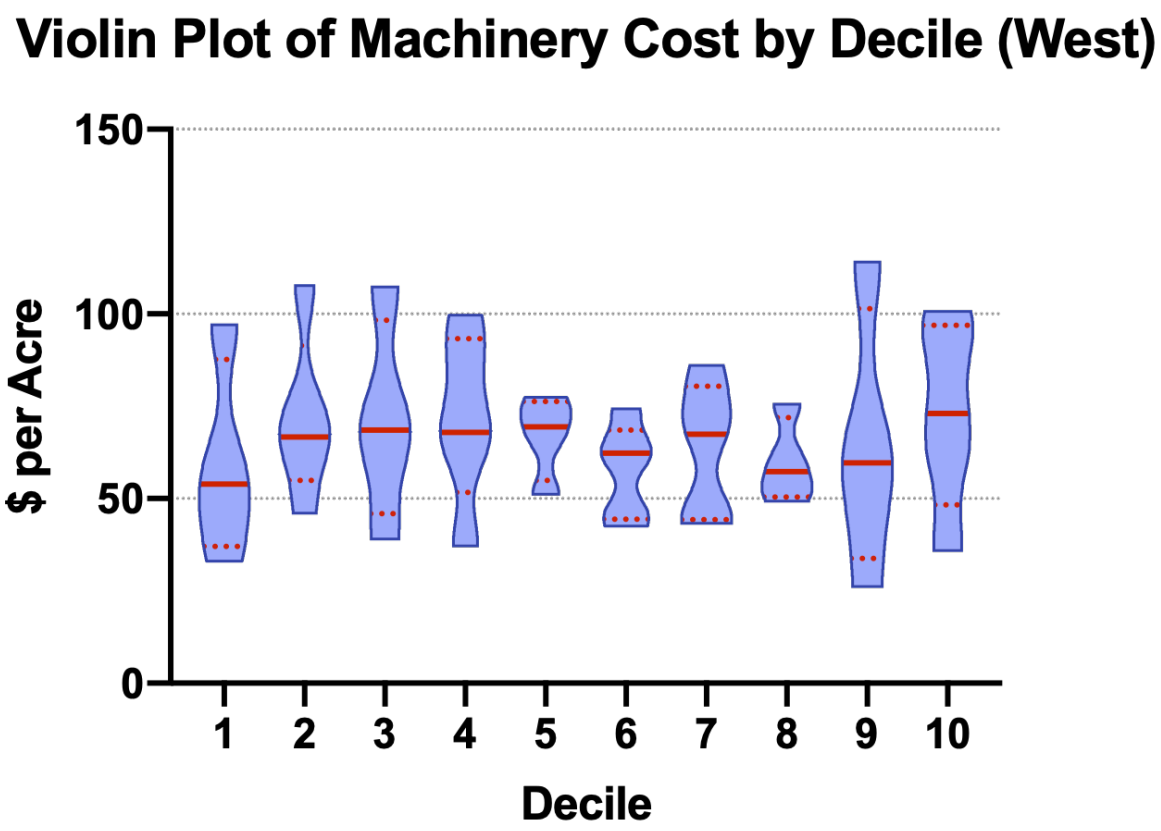

Figure 8. Violin Plot of the Distribution of Machinery Cost per Acre for Each Profitability Decile (West)

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