Fertilizer Prices - A June Update

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Introduction

Fertilizer continues to be a hot topic. Ibendahl has written about this several times already. The most recent update was in the context of the Russia/Ukraine war (https://www.agmanager.info/production-economics/prices-and-price-forecasts/russia-ukraine-conflict-and-effect-fertilizer). His fertilizer pricing model was updated in a February AgManager publication (https://www.agmanager.info/production-economics/prices-and-price-forecasts/whats-fertilizer-prices). The purpose of this article is to update the fertilizer pricing model to see if it is still able to predict fertilizer prices. When the February model was developed, Ibendahl added a new variable for inflation to help explain the rapid rise in fertilizer prices that occurred during the second half of 2021. However, there wasn't much data surrounding the new levels of anhydrous prices so there was a question of how this model would work going forward.

Data and Model

The February 2022 model continued to use the corn price to represent a demand for anhydrous ammonia with the oil price representing the supply. Inflation expectations were used to represent the price volatility. This model resulted in the following equation:

February 2022 model: Anhydrous ammonia ($/ton) =
- 104
+ 36.7 * corn ($/bu)
+ 2.14 * oil_6 mo lag ($/ barrel)
+ 140 * inflation expectations

This February model had an adjusted R-squared of 0.65 but with limited anhydrous prices above $1,000, the drop in fit was not unexpected. Now, with four more months of data, the model has the following equation:

June 2022 model: Anhydrous ammonia ($/ton) =
- 165
+ 33.5 * corn ($/bu)
+ 2.38 * oil_6 mo lag ($/ barrel)
+ 159 * inflation expectations_2 mo lead

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This revised model has an R-squared of 0.75 so it's getting better. Notice that in the June model, the corn price is slightly less important while the oil and inflation expectations are slightly more important. This June model also uses a two month lead for inflation. That is, anhydrous prices start to go up before inflation.

As can be seen in Figure 1 of actual anhydrous prices vs estimated anhydrous prices, the model is starting to fit the 2021 rapid rise in anhydrous better than it did earlier. This figure also shows the prediction for anhydrous for the rest of the year. As can be seen, prices are not expected to decline anytime soon. This prediction will be discussed later on in the paper. Figure 2 shows the same set of prices but going back to 2009 instead of just the last two years.

The other aspects of the model are similar to the February analysis. The historical prices since 2009 for the dependent variable (anhydrous) and the three independent variables (corn, inflation, and oil) are shown in Figure 3. Figure 4 shows a scatter plot of the actual vs predicted values. The correlation for these factors in the model is shown in Figure 5. Figure 5 packs a lot of information. The diagonal of the figure has the histogram and the density plot of the factor under consideration. For example, anhydrous, in the upper left hand corner has a bar graph for the histogram and the line is the density plot. A density plot can be thought of as a smoothed histogram. The other three factors can be interpreted similarly. The number along the sides are the scale for each individual figure. The prices for anhydrous can be found at the very bottom in the first column. Since 2009, only the last couple of months have been above $1,000 a ton so the histogram has a very wide and narrow upper tail.

The other boxes in Figure 5 represent the relationship between the factors. In the upper quadrant is the correlation. To find the correlation, draw a horizontal line or vertical line from the two factors you are interested in. Where those line cross in the upper quadrant is the correlation. For example, the correlation for anhydrous and corn is in the first row and the third column. This particular correlation is 0.72.

The lower quadrant is the scatter plot and regression line between the two factors being considered. Using anhydrous and corn again for an example, the scatter plot is in the third row and the first column. The axis labels for these scatter plots can again be found along the sides. Anhydrous has the prices along the bottom in the first column while corn prices are along the right side in the third row. As all these scatter plots show, there is just not enough data points where anhydrous is above $1,000 to get a good read on the price relationships.

Typically, most of the other fertilizers are highly correlated. This is especially true of the nitrogen products. Figure 6 shows this information in a similar manner to Figure 5.

However, even potash and anhydrous are strongly correlated at 0.72. DAP and MAP are the most highly correlated of all at 0.99.

Price Predictions

As shown in Figures 1 and 2, Ibendahl is predicting anhydrous prices to continue to rise through the rest of 2022. These figures show that anhydrous prices in the $1,600 to $1,700 are certainly possible. However, there is much uncertainty with this estimate. Ibendahl is assuming $125 oil, low $7 corn, and inflation of 8%. Economists like to say the cure for $4 gas is $4 gas (maybe that should be $5 now). What this means is that high gas prices often are a contributing factor to recessions in this country. A major recession would have the benefit of lowering gas and oil prices but at the cost of lower grain prices. A recession would thus lead to lower fertilizer prices. On the other side of prices is uncertainty about the Russia/Ukraine war. Oil prices have seemed to reach an unsteady price of $110 to $120 for the moment. There are certainly scenarios where oil could be higher.

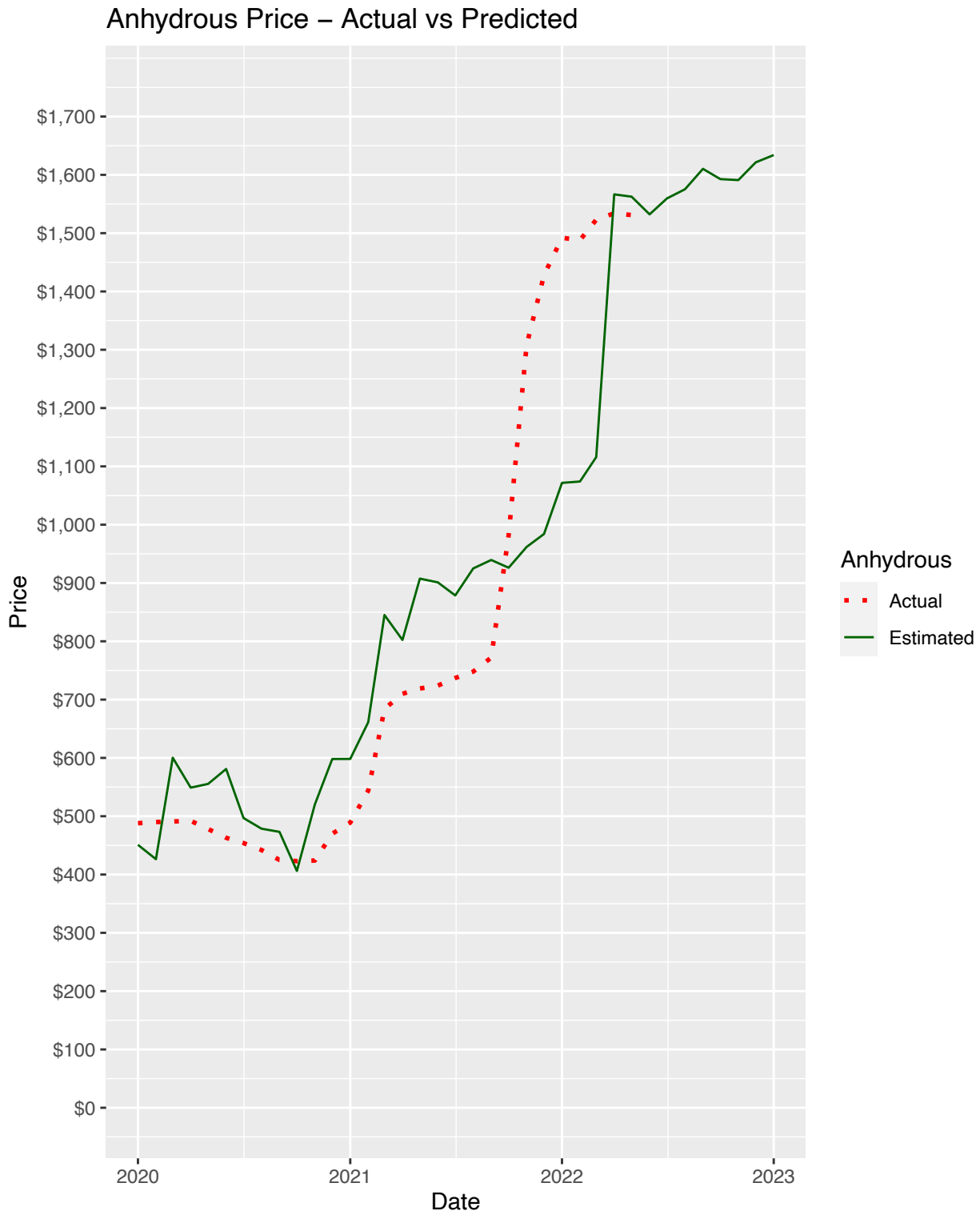

Figure 1. Actual Anhydrous Price for Last 2 Years and Prediction for 2023

Figure 2. Actual Anhydrous vs Estimated Anhydrous Prices Since 2009

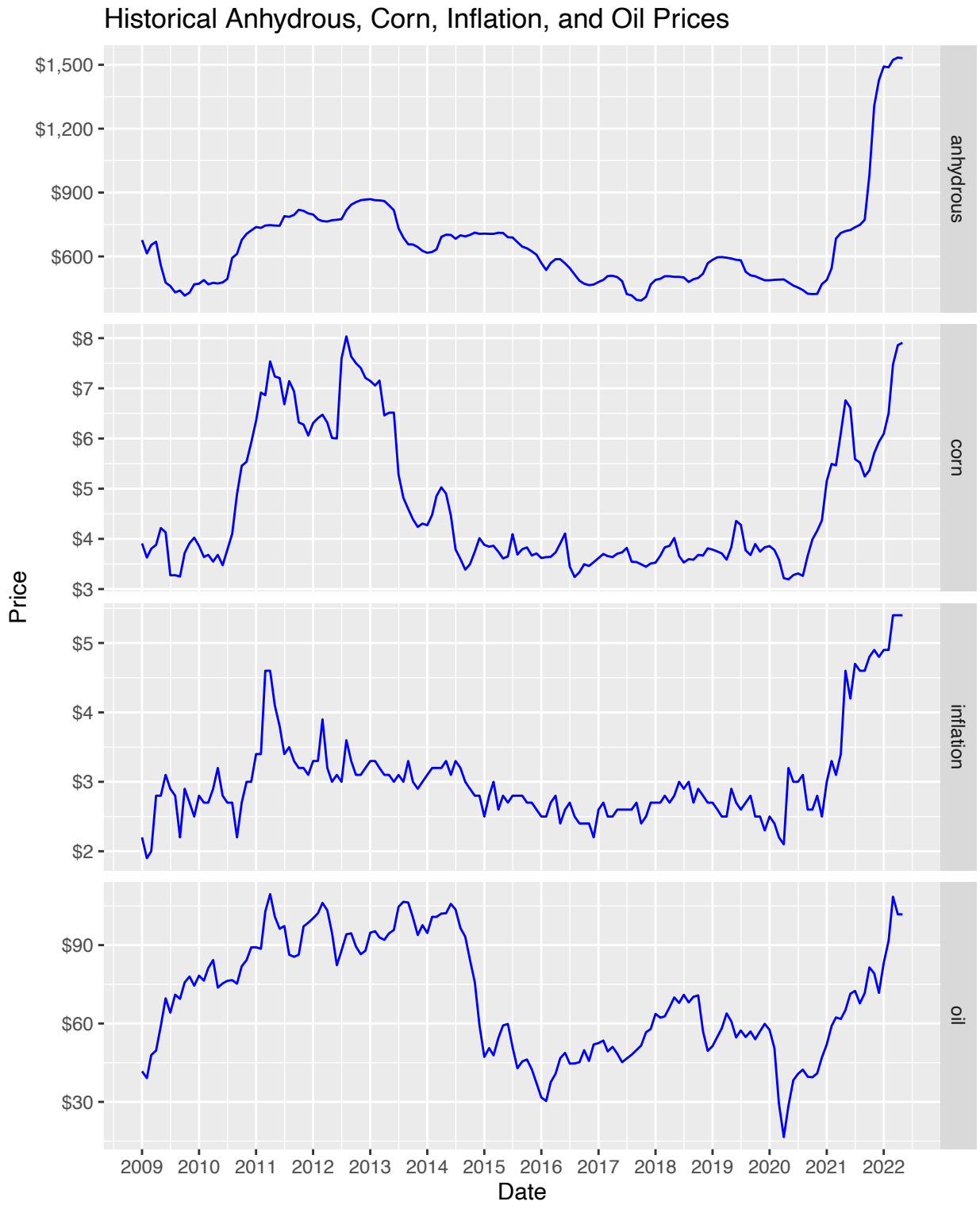

Figure 3. Historical Prices of Model Factors

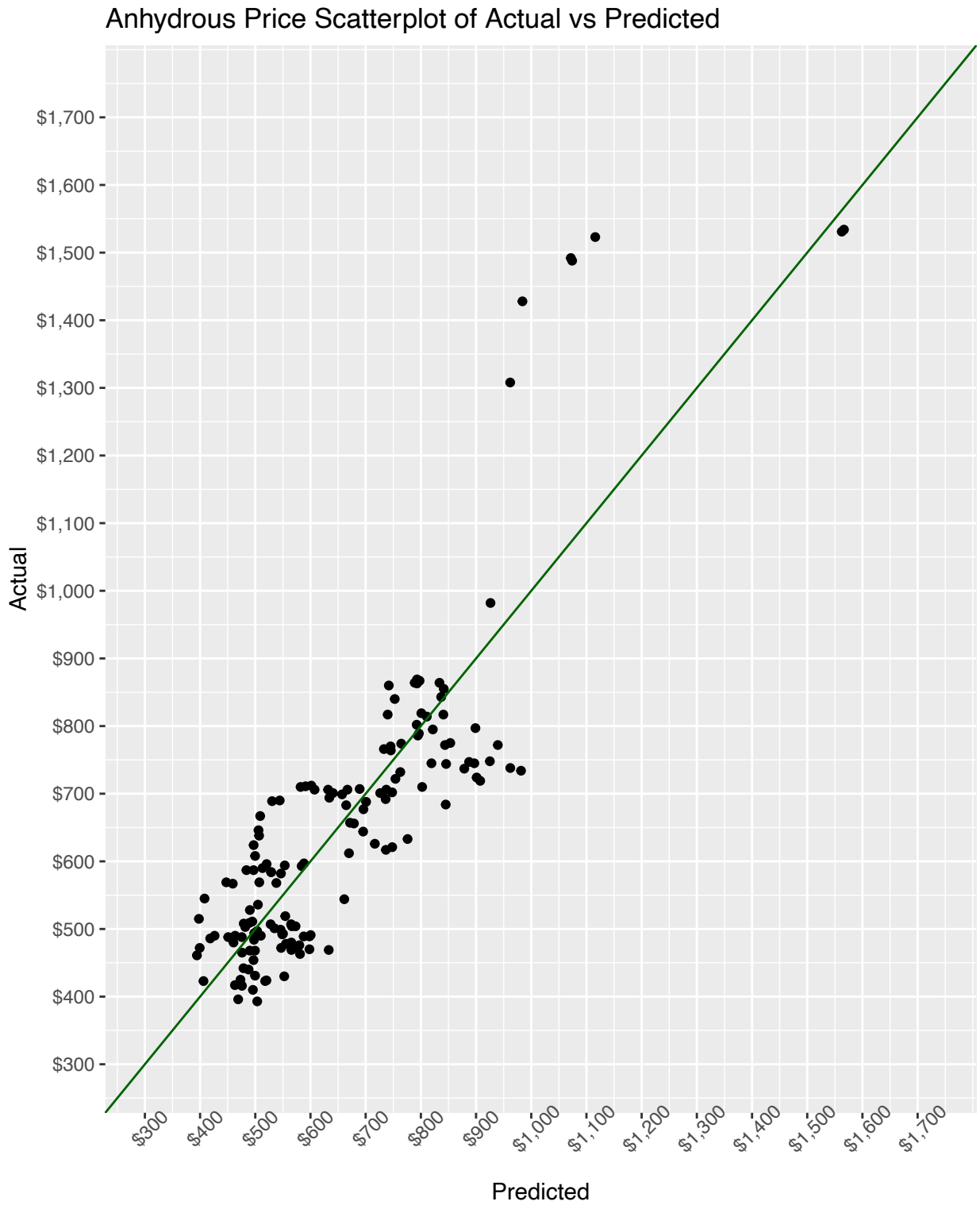

Figure 4. Model Analysis - Scatterplot of Actual vs Predicted Values

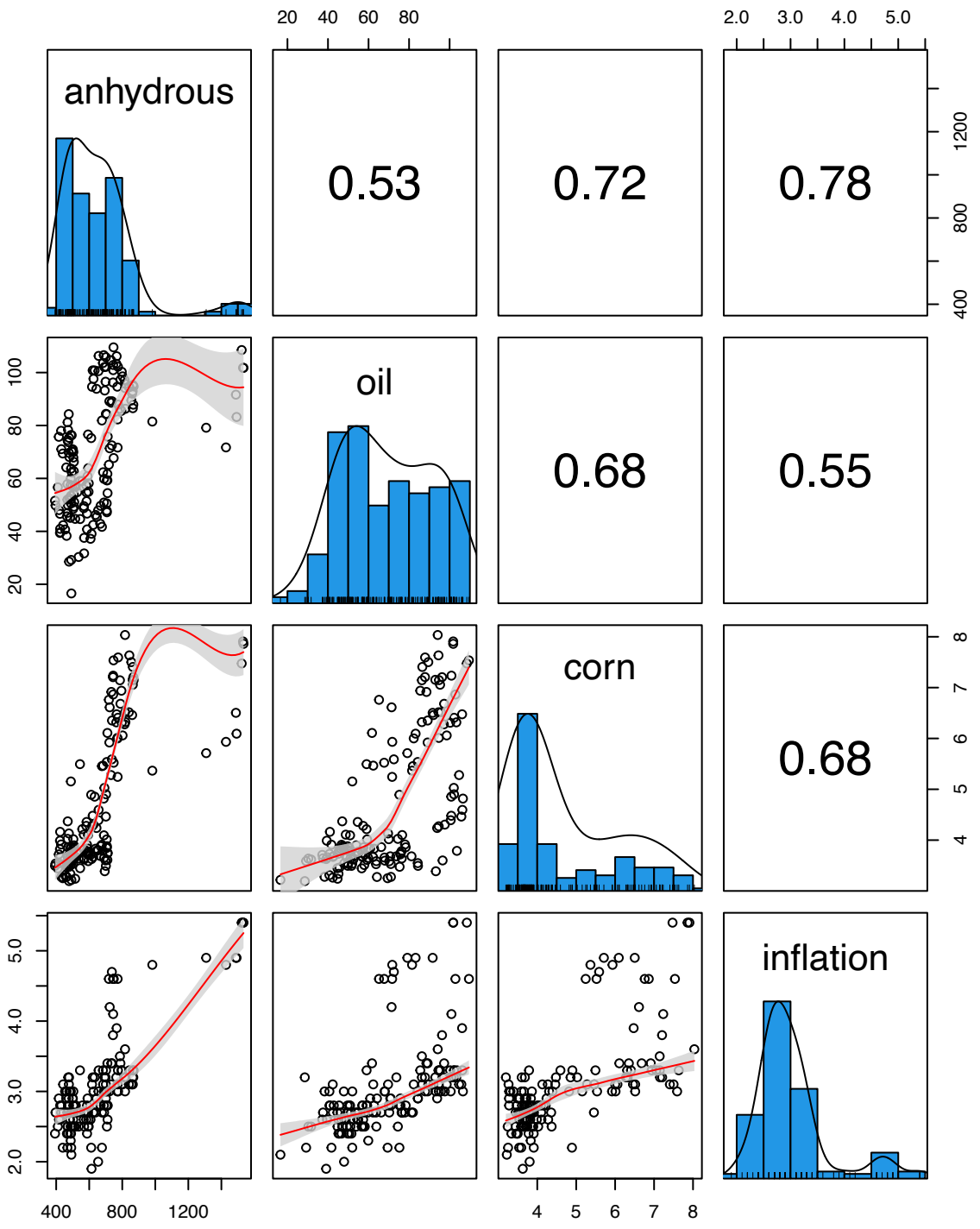

Figure 5. Correlation Comparison of Factors in Price Estimation Model

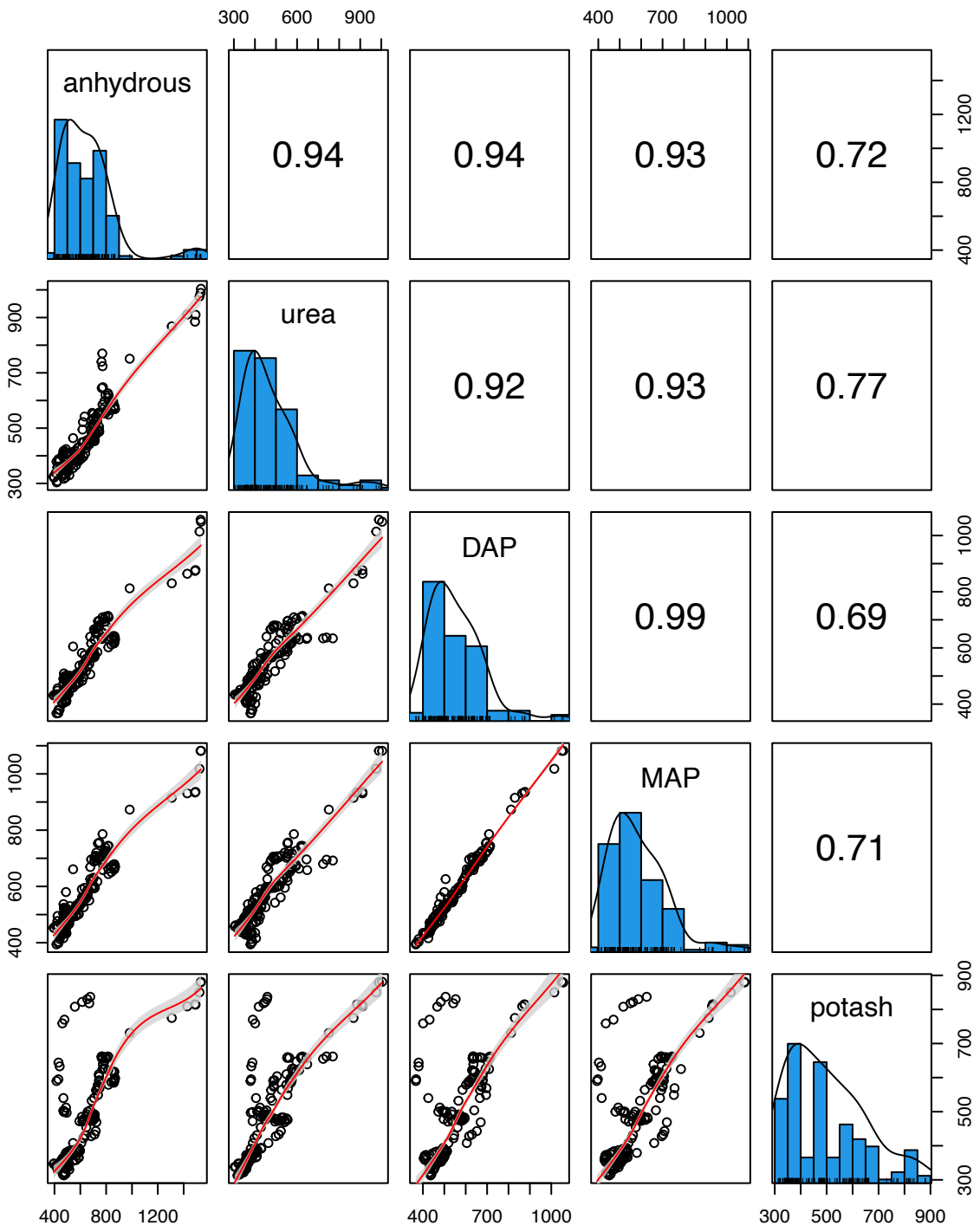

Figure 6. Correlation Comparison of Other Fertilizers