

Kansas Wheat Yield Outlook for 2024 - Week #16 (4/21/24)

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Week #16 prediction

Kansas wheat estimate for 4/21/24

Yield range from 40.2 to 44.6

Predicted yield of 42.4

Introduction¹

The USDA collects weekly crop conditions throughout the growing season. The crop is rated as either: very poor, poor, fair, good, or excellent. For wheat, these estimates are reported for a few weeks in late fall and then the estimates start again in the spring. As shown by Ibendahl in previous reports on AgManager.com, these crop reports can be used to build a model to predict final crop yields. In this publication, Ibendahl estimates Kansas wheat yields based on the week #16 (April 21, 2004) crop condition report from NASS.

As of week 16 in Kansas, for the winter wheat crop, 8% was rated very poor, 18% was poor, 38% was fair, 33% was good, and 3% was excellent. While it is still very early in the wheat season, this paper explains the model process and projects a possible yield. This paper is part of a weekly estimates of wheat yields for 2024 in Kansas.

Background

The USDA has historical state wheat yields going back to 1866. Figure 1 plots these as a line graph. What is interesting about this graph is that wheat yields were flat until 1950. Since then, yields have been steadily increasing. As shown in Figure 1, a regression of the last 30 years (the blue line) shows a 0.22 bushel increase in yield each year. The lowest yield in any year since 1970 has been 25% higher than the highest year before 1950. Figure 1 also shows the state average wheat yield has a large amount of variability. Yields were only 28 bushels per acre in 2014 while in 2016, yields were 57 bushels per acre.

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Estimate of Crop Condition

The weekly Crop Progress and Condition Report issued by the USDA National Agricultural Statistics Service, includes temperature, precipitation, and progress of crop planting, development and harvesting. This report is issued weekly, except during winter months when it is entered monthly. While this report gives the current crop condition, it doesn't make any projections about wheat yields. Predicting yields for wheat can be difficult as the crop often does better than it looks in the field and can quickly improve with timely rains.

There has been some research that has attempted to match the crop condition report back to yields. Bain and Fortenbery (Bain, R. and T. R. Fortenbery. 2013. "Impacts of Crop Conditions Reports on National and Local Wheat Markets." Proceedings of the NCCC-134 Conference on Applied Commodity Price Analysis, Forecasting, and Market Risk Management. St. Louis, MO. [<http://www.farmdoc.illinois.edu/nccc134>]) presented a paper that used an index of the crop condition report to estimate crop yields. Their procedure, described below, is used in this paper to show the relationship between crop conditions and wheat yields.

Procedure

Bain and Fortenbery construct an index of weekly crop conditions:

$$\begin{aligned} \text{CCIIndex} = & \\ & (\% \text{ acreage Excellent}) * 1 \quad + \\ & (\% \text{ acreage Good}) \quad * 0.75 \quad + \\ & (\% \text{ acreage Fair}) \quad * 0.50 \quad + \\ & (\% \text{ acreage Poor}) \quad * 0.25 \quad + \\ & (\% \text{ acreage Very poor}) * 0 \end{aligned}$$

The index ranges from [0, 100]. An index value of 100 corresponds to 100 percent of the surveyed crop being reported in excellent condition, and a value of 0 indicates 100 percent of the crop is in very poor condition. A value of 50 indicates the average crop condition for the state is in fair condition.

Weekly crop condition reports are available from NASS and go back to 1988. The start of the weekly wheat report in Kansas varies but for all the years since 1988, there is a weekly crop report available by either the last week of March or the first week in April. There is also a series of crop reports in the fall before a break occurs. The last 20 years of the wheat crop condition for week #16 in Kansas is shown in Figure 2.

In this analysis, the April 14, 2024 crop condition reports (week #16) are used to construct a CCI index for the last 30 years. These CCI indexes are then used in a regression analysis to estimate the wheat yield per acre where the yield is a function of the CCI index. To account for the yield trend, the actual model is an estimation of the deviation from the yield trend as a function of the CCI index. Figure 3 plots the deviation from the state average wheat yield trend line on the left axis and the CCI index on the bottom axis. The dark gray band represents the standard error. The standard error of the regression is the average distance that the observed values fall from the regression line.

Results

As might be expected for a wheat crop condition report the third week of April, the model doesn't predict very well. Based on week #16 scores, the model predicts wheat yields with an R-squared of 0.43. The estimated yield equation is

$$\text{Yield} = 0.394 * \text{CCI_score} - 21.5$$

That is, an improvement of 1% in the CCI score can increase the average state yield by nearly 0.4 bushels per acres. However, the low R-squared value is the result of large variations in the final wheat yield for a given CCI score. In other words, the CCI index is far from a perfect indicator of final wheat yields in the state, especially with the winter report on crop conditions. The large variability can easily be seen in Figure 3. A model that was able to predict yield perfectly would have all the individual points aligning along the blue regression line. Thus the model presented here should be looked at as more of an initial impression of wheat yields in the state.

As of week #16 for 2024, the trend line yield is 43.7 bu/ac. The CCI score of 51.3 has the model predicting a yield 1.2 bu/ac below trend. Thus the estimated yield for 7/21/24 is 42.4 bu/ac with a range from 40.2 to 44.6 bu/ac. Figure 4 shows the history of yield estimates since 4/7/24. This latest estimate is 1.3 bushels lower from last week.

Implications

Producers should look at these results as only a guide. In Kansas, moisture is key and timely rainfall or the lack of rainfall will make a big difference in yields. Yields have trended lower two weeks in a row and are now projected to be below average. Ibendahl plans to regularly this model. The reliability of the model will improve as harvest gets closer.

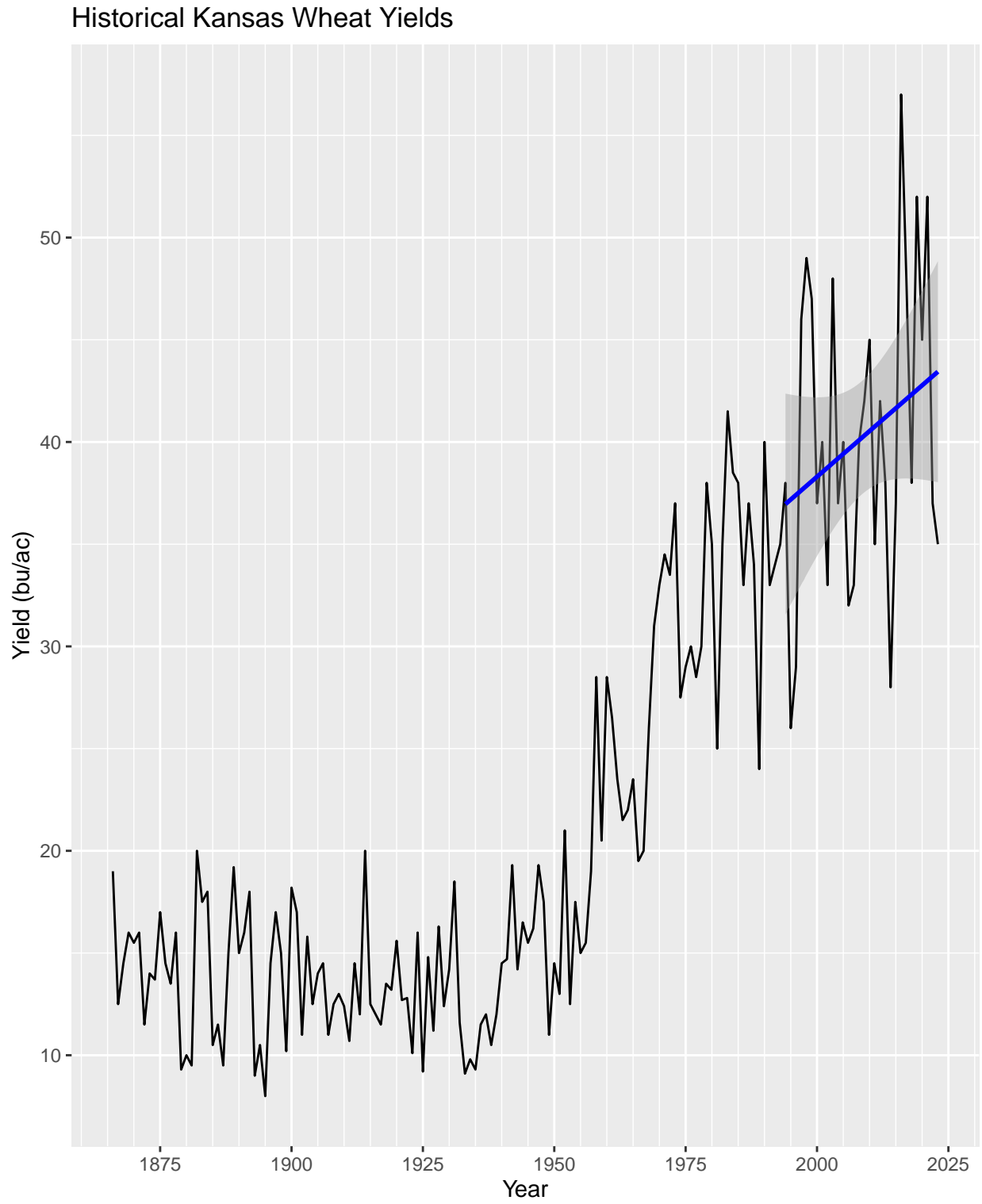


Figure 1: Historical State Wheat Yields from Kansas

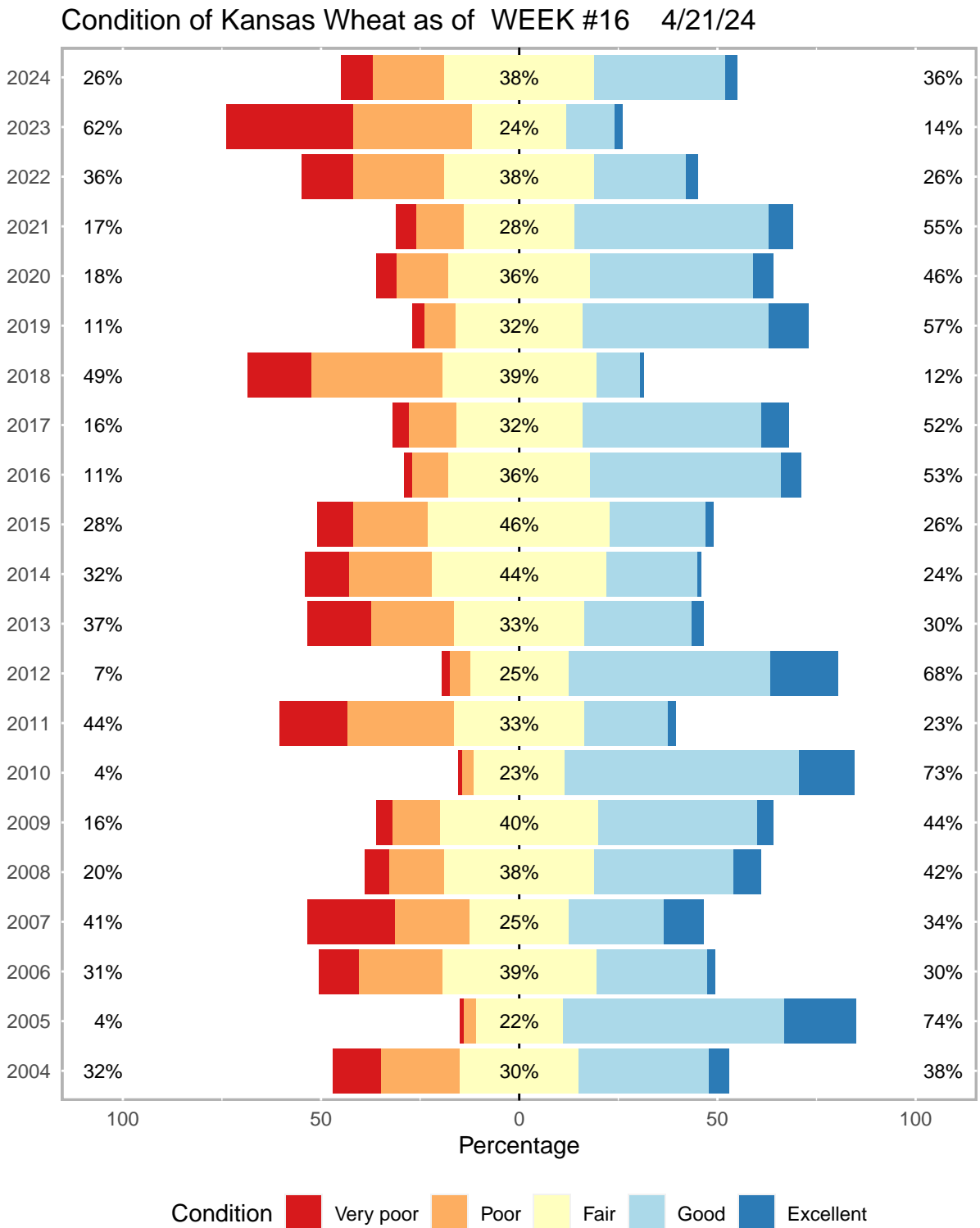


Figure 2: Historical Crop Conditions for Wheat in Kansas for Specific Week

Yield Prediction Based on CCI Score

WEEK #16

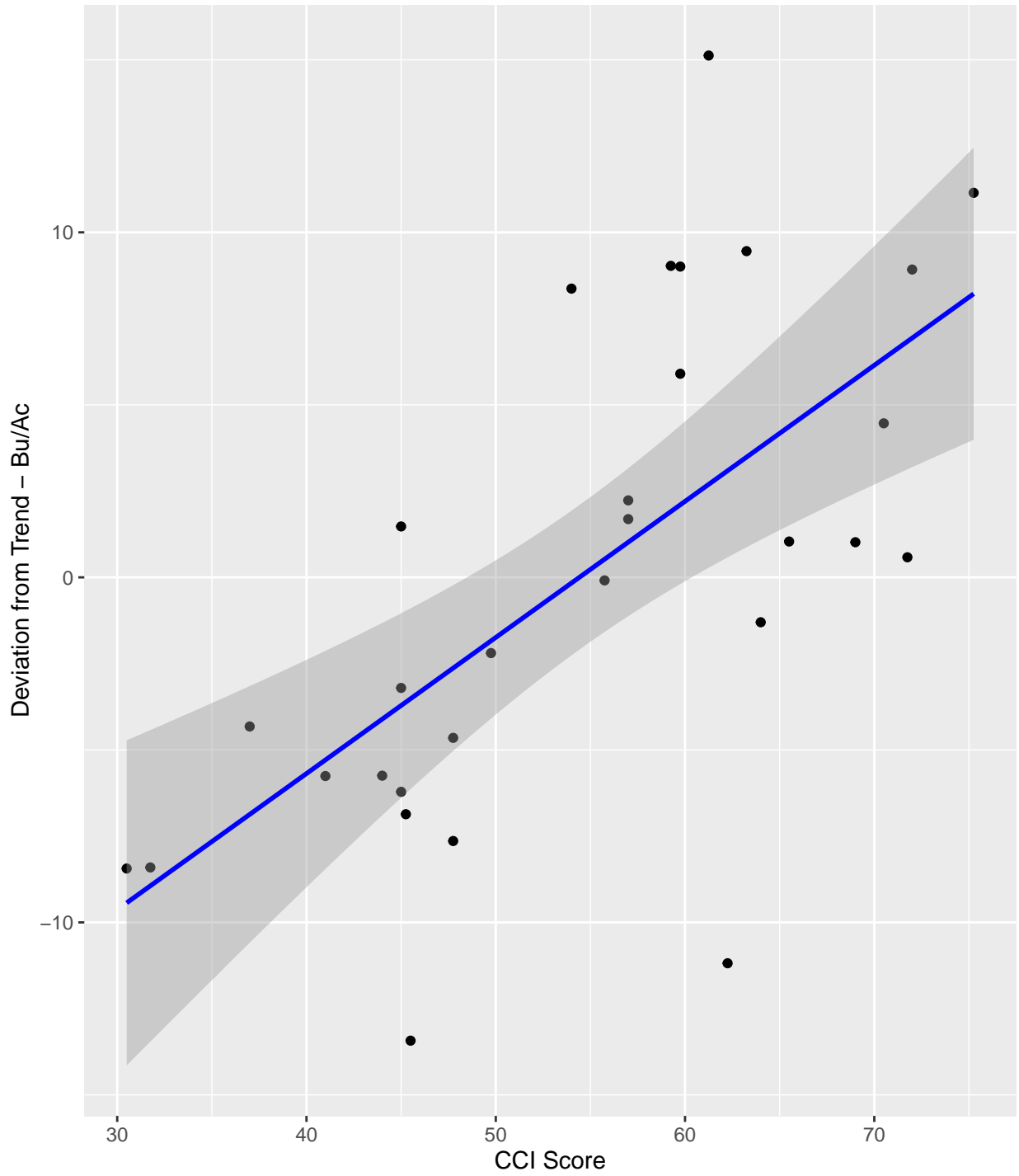


Figure 3: Expected Yield (Trend Deviation) for Various CCI Index Values for Specific Week

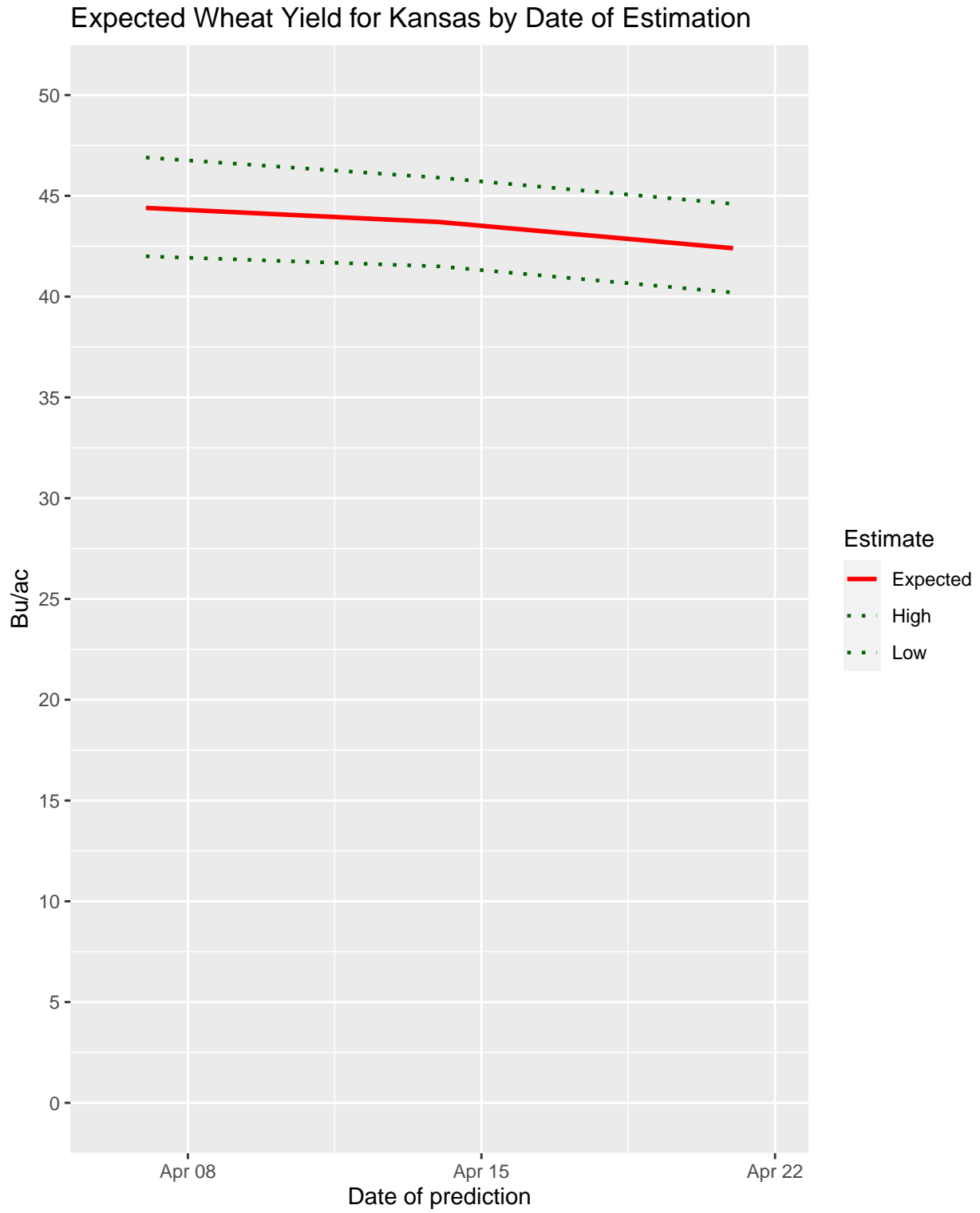


Figure 4: Weekly Model Predictions Since 4/7/24