Kansas Soybean Yield Outlook for 2024 (Week 35) using Drought Monitor Data

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Week 35 prediction[1]

Kansas soybean estimate for 8/30/24 Using Drought Monitor Data
Yield range from 33 to 38
Predicted yield of 35
This is 1 bu/ac lower from week #34 estimate using Drought Monitor data

Introduction

This paper uses data from the U.S. drought monitor website (https://droughtmonitor.unl.edu[2]) to predict yields on a crop reporting district (CRD) level for Kansas. These CRD level numbers are aggregated upward to get a state average yield. The individual CRD estimates are shown in Figure 1. This estimate should be compared with Ibendahl's 8/27/2024 estimate Condition of Kansas Soybeans - Week #34 (8/25/24) using NASS crop condition report. The NASS estimate was 5 bu/ac higher than the soil moisture estimate in this paper.

This will be the last yield estimate using the Drought Monitor data for the year. Because the model is based on soil moisture for a given week, the model likely produces a better estimate when soil moisture is more critical for the crop. Ibendahl is experimenting with combining weeks of Drought Monitor data to develop a new model and these results will be presented in future articles.

Data

The model developed here follows a similar procedure that Ibendahl used to estimate crop yields based on the USDA crop conditions report. Instead of the growing conditions report, the Drought Severity and Coverage Index (DSCI) is used to estimate soybean yields. The DSCI (Akyuz[3]) shares

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[2]U.S. Drought Monitor. (https://droughtmonitor.unl.edu).

[3]Akyuz, F. A. 2017. Drought Severity and Cover- age Index. United States Drought Monitor. droughtmonitor.unl.edu/About/AbouttheData/ DSCI.aspx

many similarities to the Crop Condition Index (CCI) (Bain and Fortenbery[4]). Where the CCIndex weights the best condition with the most points, the DSCI weights the worst condition with the most points.

The U.S. Drought Monitor labels droughts by the level of severity. There are 5 levels of drought ranging from D0 (least severe) to D4 (most severe). The DSCI is a computed by the formula:

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DSCI = (% acreage in D0) * 1    +
       (% acreage in D1) * 2    +
       (% acreage in D2) * 3    +
       (% acreage in D3) * 4    +
       (% acreage in D4) * 5
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The index ranges from [0, 500]. An index value of 500 corresponds to 100 percent of the crop acreage in the most extreme drought (D4), and a value of 0 indicates 100 percent of the crop acreage is not in any drought state. The U.S. Drought Monitor computes these values for various sized areas including at the county level. The site has weekly data back to the year 2000.

Model

The model used in this paper first computes the trend line yield on a crop reporting district basis from 2000 to 2023. Most CRDs have a small positive trend line increase in yields. Next, the deviation from trend line is calculated for each year. This deviation from trend is what the DSCI is used to estimate. Because NASS no longer reports CRD yields, Ibendahl generated the CRD yields by aggregating individual counties within a CRD.

A linear regression model is used to estimate the deviation from trend for a specific week using the data from 2000 to 2023. There is a separate regression model for each CRD. The regression model is unique to a specific week. For this paper, the lastest DSCI report for 2024 is week 33 (8/16/24). To estimate the linear model, the DSCI data is filtered to provide only the historical week 32 DSCI numbers and these are used as the independent variable to predict the final yield. Once the linear model is developed at the CRD level, the DSCI reading for 2024 and week 32 is plugged into the equation to estimate the deviation from trend for this year's CRD yield.

To generate the state yield estimate, Ibendahl weighted each of the individual CRD yields by the number of planted acres last year. NASS has not yet reported planted acres on a county level for 2024. Because NASS is not able to report on all counties, aggregating upward to a state yield is not fully complete. However as long as the missing county data is representative of the reported county data, results should not change very much.

[4]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)

Results

The CRD level results are shown in Figure 1. The second column in each of the tables is the trend line yield. This is the expected yield for a CRD in a "normal" year. The next three columns are the predicted yields based on the linear model using the DSCI to predict the yield deviation for this year. The yield deviation from the linear model is subtracted from the trend yield to get the predicted yields shown. While the most likely yield column is the point estimate of the model, the upper and lower range values should not be ignored. At this point, there is a wide range of yields that could occur and the confidence interval reflects this uncertainty.

The final column is the r-squared value and it tells how well the linear regression model fits the yield data. Values can range from -1 to 1 with a 0 value indicating the model doesn't predict yields at all. As Figure 1 shows, there is a wide variation in how well CRD level data works. While some CRDs show the model has no explanatory power, there are other CRDs with a strong fit. Those CRDs with an r-squared value close to zero will show a predicted yield close to trend line in most cases. In these CRDs more attention should be focused on the possible yield range. Figure 2 shows the drought conditions for the current week back to 2000.

Discussion

These yield predictions using the Drought Monitor data should be considered less reliable than the estimate using the NASS crop conditions. First, this model is still being developed and a better model may be found. Second, the drought monitor provides no information about the soil situation when there is a surplus of moisture. There is either no drought or various levels of drought in the Drought Monitor data. A better model to predict yields would likely have some information about surplus moisture. Still, developing a model using the DSCI index allows for a finer grained model than using the state moisture conditions from NASS. The Dought Monitor data is available at the CRD level and also at the county level.

Predicted CRD Yields week - 35					
		Predicted Yields			
CRD	Trend Yield	Lower Bounds	Most Likely Yield	Upper Bounds	R squared
NORTHWEST	48.6	46.3	48.6	50.9	−0.06
NORTH CENTRAL	41.8	30.8	34.0	37.2	0.66
NORTHEAST	51.1	47.5	50.0	52.5	0.43
WEST CENTRAL	47.6	41.6	47.0	52.3	0.00
CENTRAL	32.6	27.4	30.4	33.4	0.44
EAST CENTRAL	38.4	35.3	38.1	41.0	0.37
SOUTHWEST	65.2	63.5	65.3	67.0	0.35
SOUTH CENTRAL	30.2	23.1	25.8	28.5	0.50
SOUTHEAST	33.4	29.2	31.7	34.2	0.52

Figure 1: Kansas Crop Reporting Districts - Estimated Yields

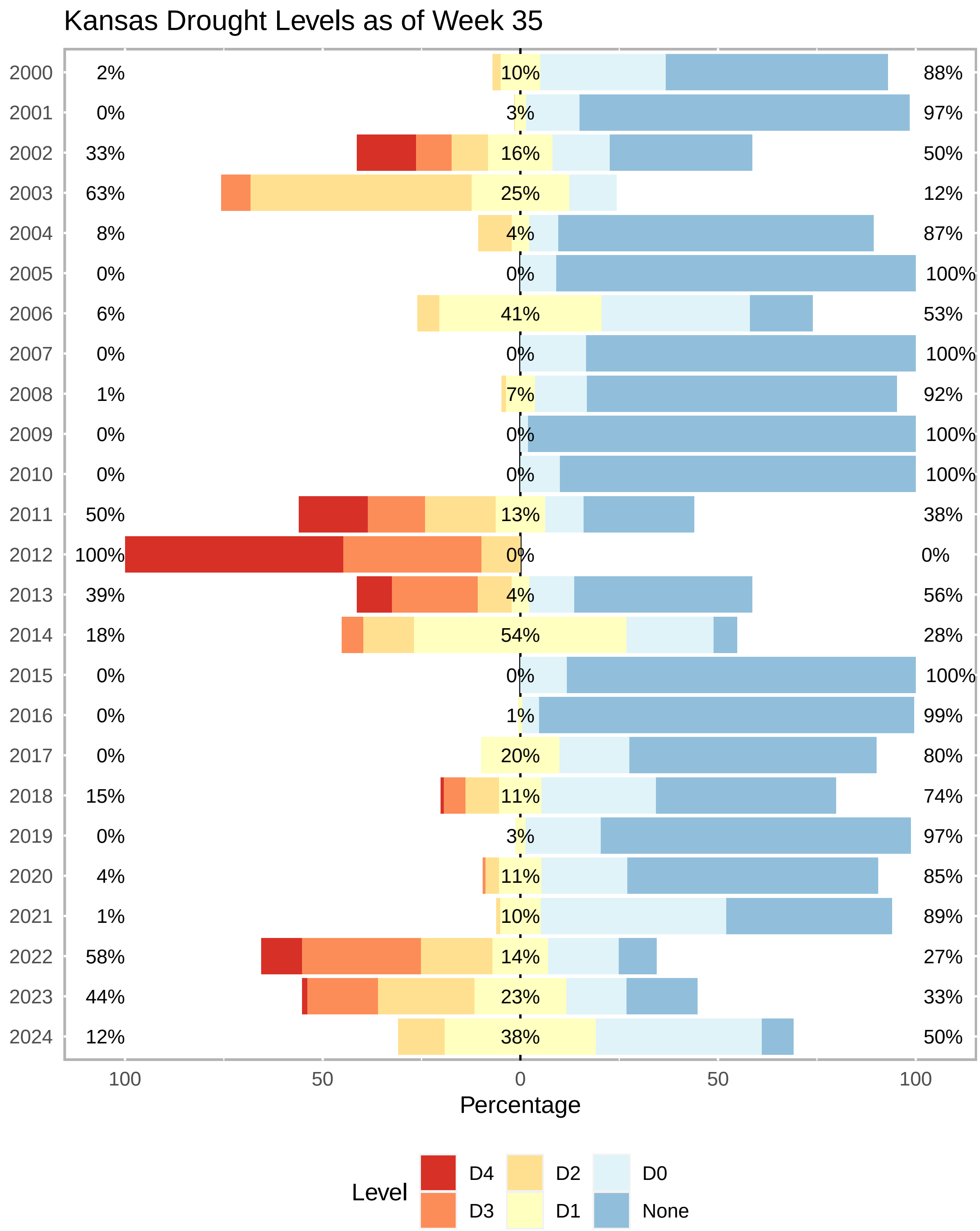

Figure 2: Historical Drought Conditions in Kansas