# Rainfed Corn Yield Prediction in Kansas: A Comparison of Regression and Process-based Crop Models


KANSAS STATE UNIVERSITY
Carl and Melinda Helwig Department of Biological and Agricultural Engineering

Meenakshi Rawat[1], Vaishali Sharda[1], Xiaomao Lin[2], Kraig Roozeboom[2]

Carl and Melinda Helwig Department of Biological & Agricultural Engineering[1], Department of Agronomy[2]

K-STATE ENGINEERING

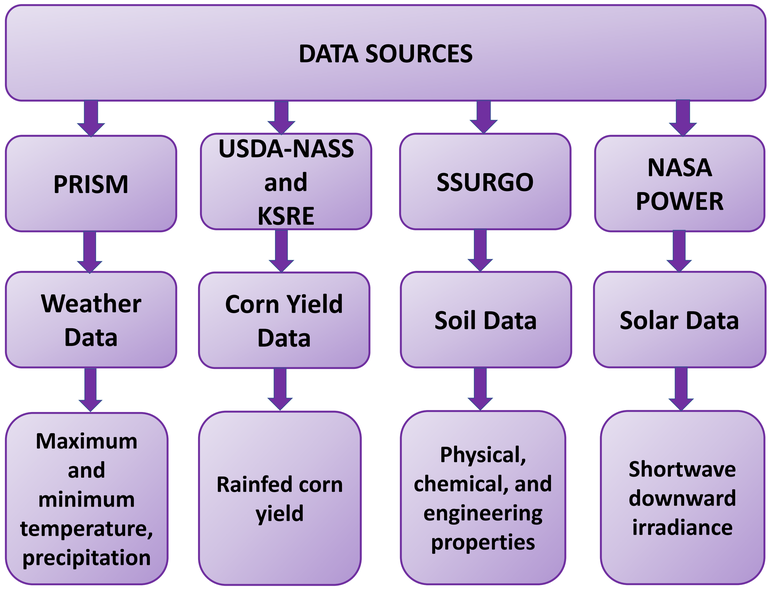

## INTRODUCTION

- Crop yield prediction is important because it provides valuable information to farmers, agronomists, and policymakers to make timely decisions
- Prediction of crop yield is dependent on several factors like weather, soil, environment, and crop parameters, so it is a challenging task
- Accurate crop yield prediction is crucial to address emerging challenges in food security due to climate change
- There are 3 main approaches used for crop yield prediction: Statistical models, Machine learning models, and Crop models and each has its own strengths and limitations

## OBJECTIVES

- To predict the rainfed corn yield in Kansas using multiple linear regression and the DSSAT crop model
- To compare the models' results in predicting the rainfed corn yield across the state

## METHODOLOGY




**Modeling approaches –**

- In this study, two models have been used for predicting historical yield–Regression and DSSAT Model

**Simulation and Analysis –**

- Regression model was developed by computing the relationship between weather variables and observed historic rainfed corn yield for the Kansas counties
- Rainfed corn yields were simulated using the DSSAT crop model which uses soil, weather, and crop management data as inputs
- Resulting yields simulated by the developed regression model and the DSSAT model were compared as shown in the results

## RESULTS

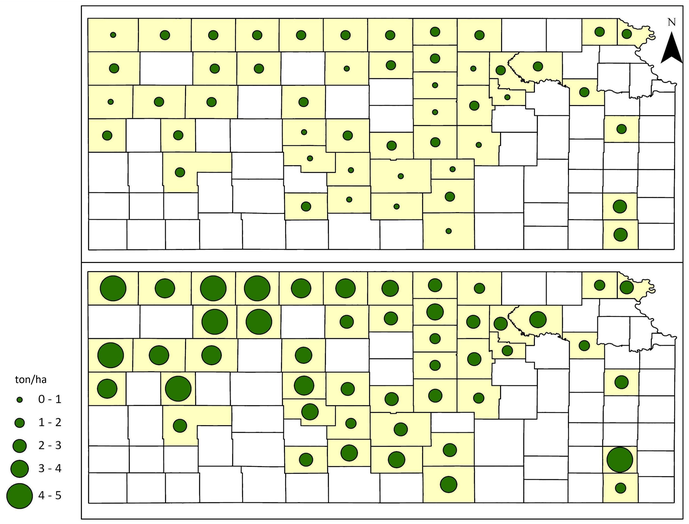



**Figure 1. Spatial distribution of root mean square error (RMSE) for Regression model (top) and DSSAT model (bottom)**

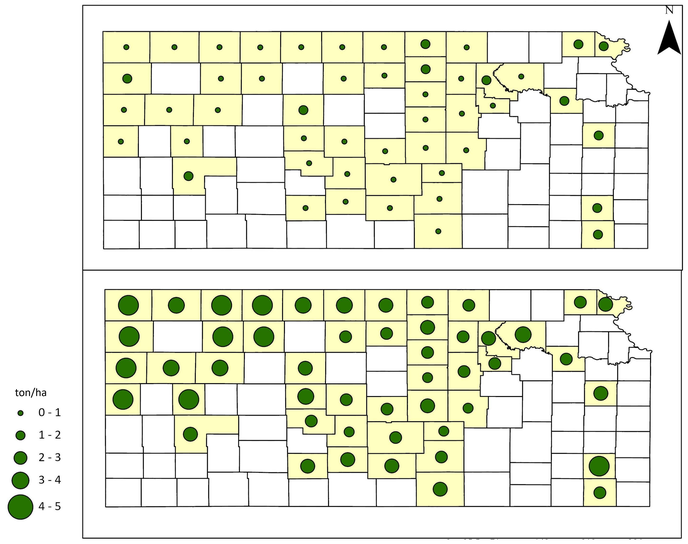



**Figure 2. Spatial distribution of mean absolute error (MAE) for Regression model (top) and DSSAT model (bottom)**

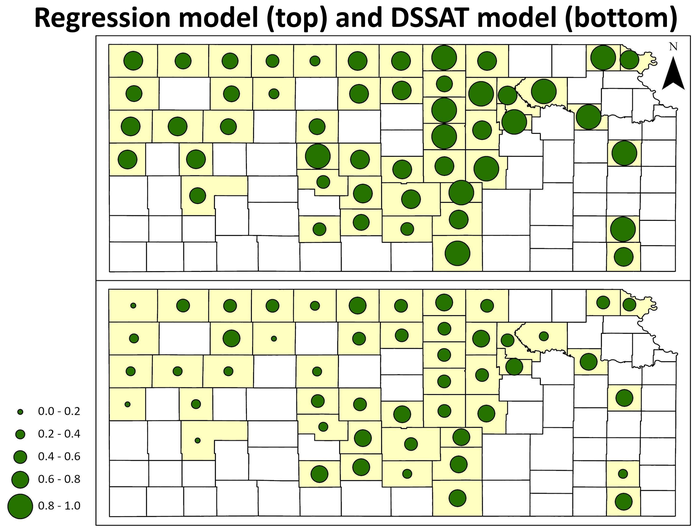



**Figure 3. Spatial distribution of Pearson's correlation coefficient (r) for Regression model (top) and DSSAT model (bottom)**

## RESULTS

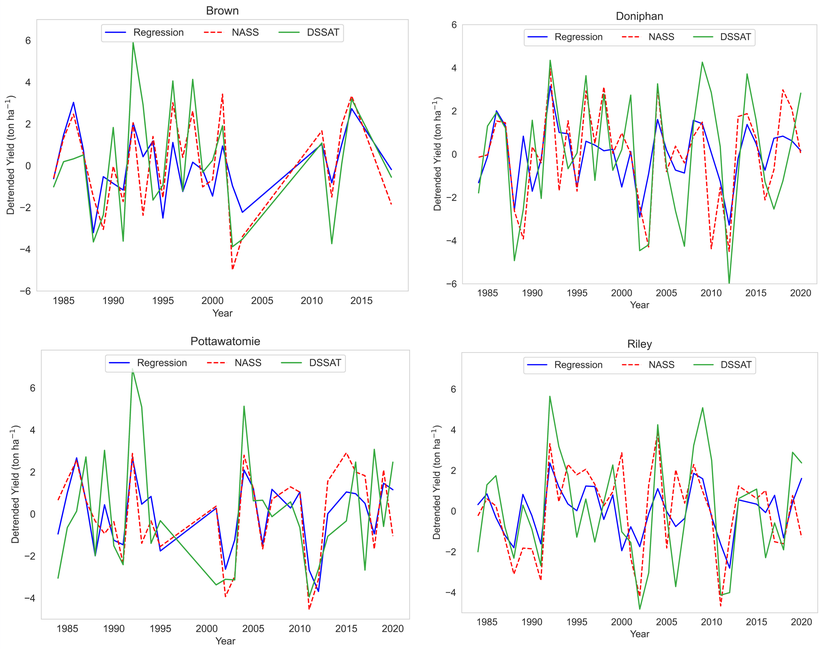



**Figure 4. Year-to-year variability in historical detrended corn yield from observation (red dotted line), simulation by DSSAT (solid green line), and regression (solid blue line) for 4 major corn-producing counties in Kansas**

- From Figures 1 and 2, we can observe that DSSAT has a large RMSE and MAE as compared to the regression model
- Predicted historic yield from the regression model is highly correlated with observed yield (Figure 3)
- Yields were detrended to assess the portion of year-to-year yield variability contributed by climate variations as presented in Figure 4
- It is clear that DSSAT is overestimating at peaks and tails, from figure 4, which shows that the impact of climate variability on yield is underestimated in DSSAT while the regression model is capable to capture year-to-year yield variability due to climate variation

## CONCLUSIONS

- This study shows that the regression model performs better in reproducing the observed corn yield, though it's important to note that DSSAT is not calibrated whereas the regression model is trained against observations

## FUTURE WORK

- Corn yield prediction for future climate scenarios using the regression model for Kansas counties


**For more information, contact: Meenakshi Rawat**
**rmeenakshi@ksu.edu**