Forecasting Analogue Years for Corn & Soybeans

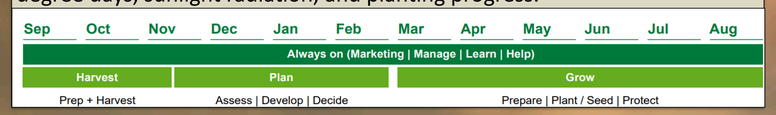
PURDUE UNIVERSITY | The Data Mine

Team Members - Elizabeth Peila , Christina Joslin, Tobi Ogunribido, Venkat Roy, Jayadeep Tagore, William Greenwood, Wenru He, Vineet Kumar, Xiaolong Wang

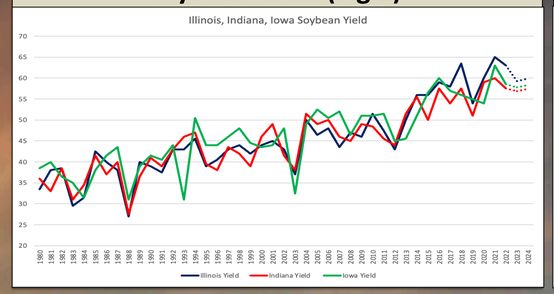
BASF We create chemistry

Introduction

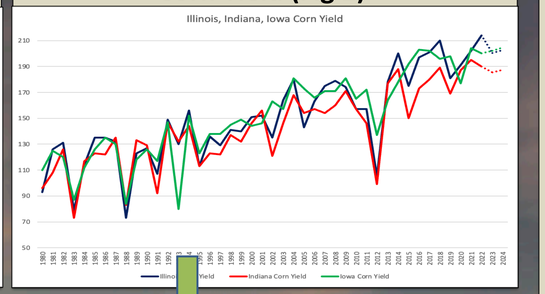
BASF creates chemistry for a sustainable future by combining economic success with environmental protection and social responsibility.
With publicly available data they tasked us with digitizing a model to help farmers forecast analogue years for corn and soybeans for the year 2023.
Some key factors we looked at were historic yield and production, growing degree days, sunlight radiation, and planting progress.



Soybean Yield (Fig 1)



Corn Yield (Fig 2)



Methodology

Production and Crop Progress (Fig 1, Fig 2)

- Soybean and Corn Yields follow the same trends in the 3 states for most years.
- Corn and soybean planting typically starts in southern states and progresses northward.

Climate (Fig 3, Fig 4)

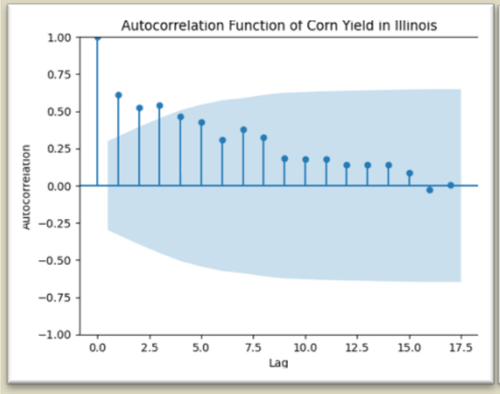
- Growing degree day trend remained consistent over all three states
- Average monthly precipitation had the greatest range in May through June

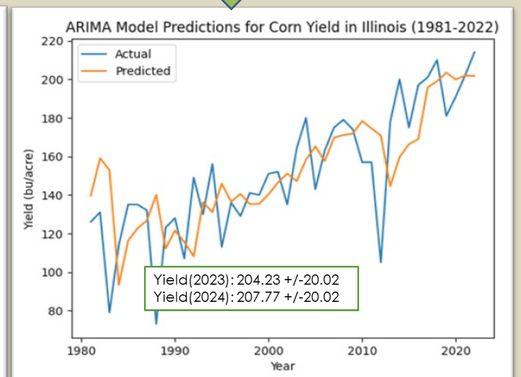
Sunlight Duration and Solar Radiation

- Sunlight duration time is the longest in summer, shortest in winter accordingly.
- An ascending and descending cycle of the sunlight duration time is about 20 years.

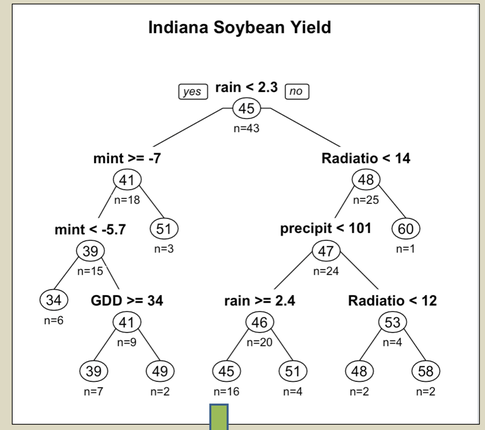
Time Series Analysis

Study Trend Deviations





Decision Tree – Indiana Soybean Yield

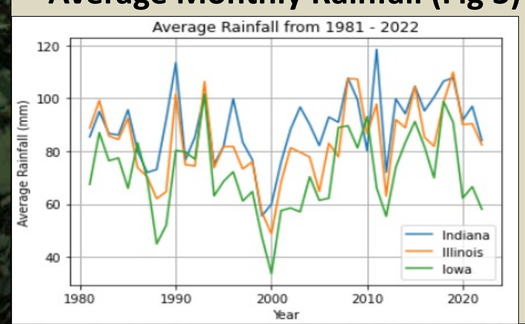


More Parameters

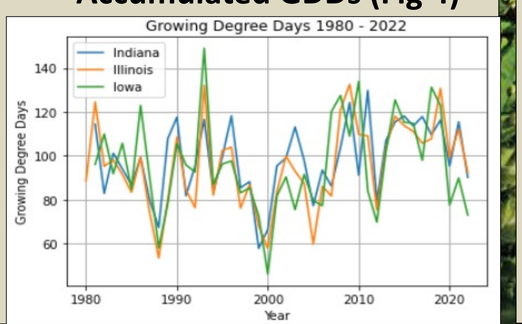
Interactive Excel Tool

State:	Indiana					
Bio-Climatic Factors (Year_wise average value):	Rainfall (mm)	Sunlight Radiation (MJ/m2)	Precipitation (mm)	Max temperature (°C)	Min temperature (°C)	GDD (deg-days)
Input Forecast Value:	3.58	8.55	106.17	8.51	-1.92	40.83
Soybean Yield Prediction:	53					
No. of observations used:	4					

Average Monthly Rainfall (Fig 3)



Accumulated GDDs (Fig 4)



Conclusions

- Based on Trendline and Time Series Analysis we can provide an estimate of the Yield using historical values.
- Climate Parameters and Crop Progress Parameters do not correlate highly with Yield Deviations
- ML Models like Decision Trees can help in sorting the data based on similarities that are not obvious from correlation/regression
- The Interactive Excel Tool can provide a Yield prediction that is updated based on a changing climate forecasts

Future Goals

- Predict the 2024 crop yield using our 2023 forecast
- Expand the Excel Tool to identify specific analog years based on the entered climate parameters

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