

# Forecast and Assessment of Plant Growth, Soil Water-Nitrogen, and Grain Yield for Central Iowa

## RFR-A18113

Sotirios Archontoulis, assistant professor  
Mark Licht, assistant professor  
Ashlyn Kessler, graduate student  
Department of Agronomy

### Introduction

In 2018, the Forecast and Assessment of Cropping sysTemS (FACTS) project was replicated to achieve the objective of forecasting and evaluating in-season soil-crop dynamics. This concept was initiated to help farmers and agronomists make in-season management decisions, plus identify management practices that could have been changed to improve grain yields, net profits, and also reduce environmental impacts.

### Materials and Methods

This project combines the use of the Agricultural Production Systems sIMulator (APSIM) cropping systems model, historical, current, and Climate Forecast System (CFS) forecasted weather data, and in-field data collection. Forecasts were initiated at planting and were updated every 10 days.

In-field data were collected from both corn and soybean planted under high- and normal-management regimes. Treatments were replicated three times for each crop. The crop varieties Pioneer 1197AMXT and P31A22X were used for corn and soybean, respectively. Planting date for corn and soybean was May 8. High-management corn was planted at 45,000 seeds/acre and normal-management corn was planted at 33,000 seeds/acre. High-management soybean was planted at 160,000 seeds/acre on a 15-in. row spacing and normal-management soybean was planted at 125,000 seeds/acre on a 30-in. row spacing. Nitrogen was broadcast applied pre-plant in

high- and normal-management corn at 150 lb N/acre. Field cultivation occurred thereafter. Nitrogen was applied at a rate of 81 lb N/acre July 10 and 75 lb N/acre August 15 to the high-management corn. Nitrogen was applied at a rate of 50 lb N/acre to the high-management soybean. No nitrogen was applied to the normal-management soybean. Irrigation was applied to high-management corn at a rate of 0.25 in./acre July 26. Irrigation was applied to high-management soybean at a rate of 0.25 in./acre August 14.

### Results and Discussion

The average corn yield was 194.5 and 238.3 bushels/acre in the normal- and high-management treatments, respectively (Table 1). The yield response to the high management was attributed to higher N fertilization rate and to a lesser extent the higher plant population. The N response was largely due to greater rainfall in July causing leaching and denitrification. The high-management plots had higher grain weight and leaf area index than normal (Table 1).

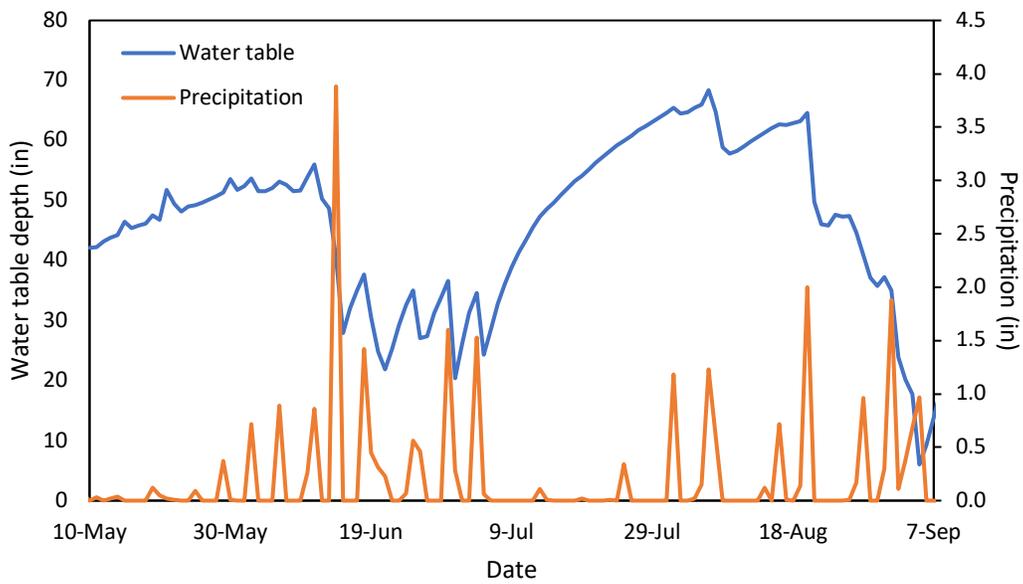
The average soybean yields were 56.5 and 56.2 bushels/acre in the normal and high, respectively (Table 1). However, in the high-management system, yield varied from 38 bushels/acre in low landscape positions to 70 bushels/acre in high landscape positions. In the lower landscape positions, flooded and saturated soils were experienced.

### Acknowledgements

This project received funding from Iowa Soybean Association and Foundation for Food and Agriculture Research, plus in-kind support from Corteva. This was a collaborative project involving many faculty, staff, and students. A special thanks to the farm superintendent and ag specialists.

**Table 1. The average yield in high- and normal-management crops.**

	<b>Corn, high management</b>	<b>Corn, normal management</b>	<b>Soybean, high management</b>	<b>Soybean, normal management</b>
Grain yield (bu/ac)	238.3	194.5	56.2	56.5
1,000 kernel weight (g)	274.4	260.6	120.2	119.2
Harvest index	0.55	0.56	0.53	0.55
Maximum leaf area index	7.3	5.4	4.1	3.3



**Figure 1. Depth to water table (blue) and precipitation events (orange) throughout the growing season.**