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

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

## Introduction

In 2017, 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, in addition to identifying the management practices that could have been changed to improve grain yields, net profits, and also reduce environmental impacts.

## Materials and Methods

This project uses the Agricultural Production Systems sIMulator (APSIM) cropping systems model, the Weather Research and Forecast (WRF) model, and in-field measurements. Forecast simulations were based on current year weather up to the date of the simulation, followed by a 10-day weather forecast. Then a 35-year historical weather file was used to forecast to the end of the season. In-season field data for model inputs was collected from corn and soybean experimental plots.

In these experiments, there were two planting date treatments (early and late). Treatments were replicated three times for each crop. The crop varieties Pioneer 1197AMXT and Pioneer P32T16R were used for corn and soybean, respectively. Planting dates for corn were April 24 and May 15. Planting dates for soybean were May 8 and May 30. Corn was planted at 35,000 seeds/acre and soybeans were planted at 140,000 seeds/acre. Local agronomic practices were implemented. Nitrogen was broadcast applied pre-plant in corn at a rate of 150 lb N/acre. Field cultivation occurred thereafter. Nitrogen was not applied to soybean plots. Crop and soil data collection included crop staging, soil temperature and moisture, soil nitrate-nitrogen, root depth, crop biomass, and grain yield. Weather data was collected from a weather station next to the experimental plots. The in-field data collection was used to validate the forecast simulations.

## Results and Discussion

The average corn yield was 218 bushels/acre in the early-planted plots and 206 bushels/acre in the late-planted plots (Table 1). The higher corn yields in the early planting date were attributed to higher biomass and biomass N at maturity. The soybean yields were 53.1 and 52.8 bushels/acre in the early and late plots, respectively. The lack of difference in yield is a result of ideal growing conditions for extended seed filling and similar biomass accumulation at maturity.

Water was a critical factor affecting yield during the 2017 growing season. Between June and September, soil moisture reached a low of nearly 2 in. of available water. Between July and September, the water table depth was deeper than the wells (100 in.; Figure 1).

## Acknowledgements

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**Table 1. The average yield in early- and late-planted crops.**

| | Corn, early planted | Corn, late planted | Soybean, early planted | Soybean, late planted |
|---|---|---|---|---|
| Grain yield (bu/ac) | 218 | 206 | 53.1 | 52.8 |
| Biomass at maturity (lb/ac) | 18,850 | 18,240 | 6,124 | 5,760 |
| Biomass N at maturity (lb/ac) | 164.4 | 152.1 | 188.7 | 175.3 |
| Grain N (lb/ac) | 93.4 | 98.8 | 165.5 | 148.6 |
| Stover biomass (lb/ac) | 8,475 | 8,443 | 2,759 | 2,743 |
| Crop residue CN ratio at harvest | 50.2 | 66.7 | 52.1 | 44.8 |

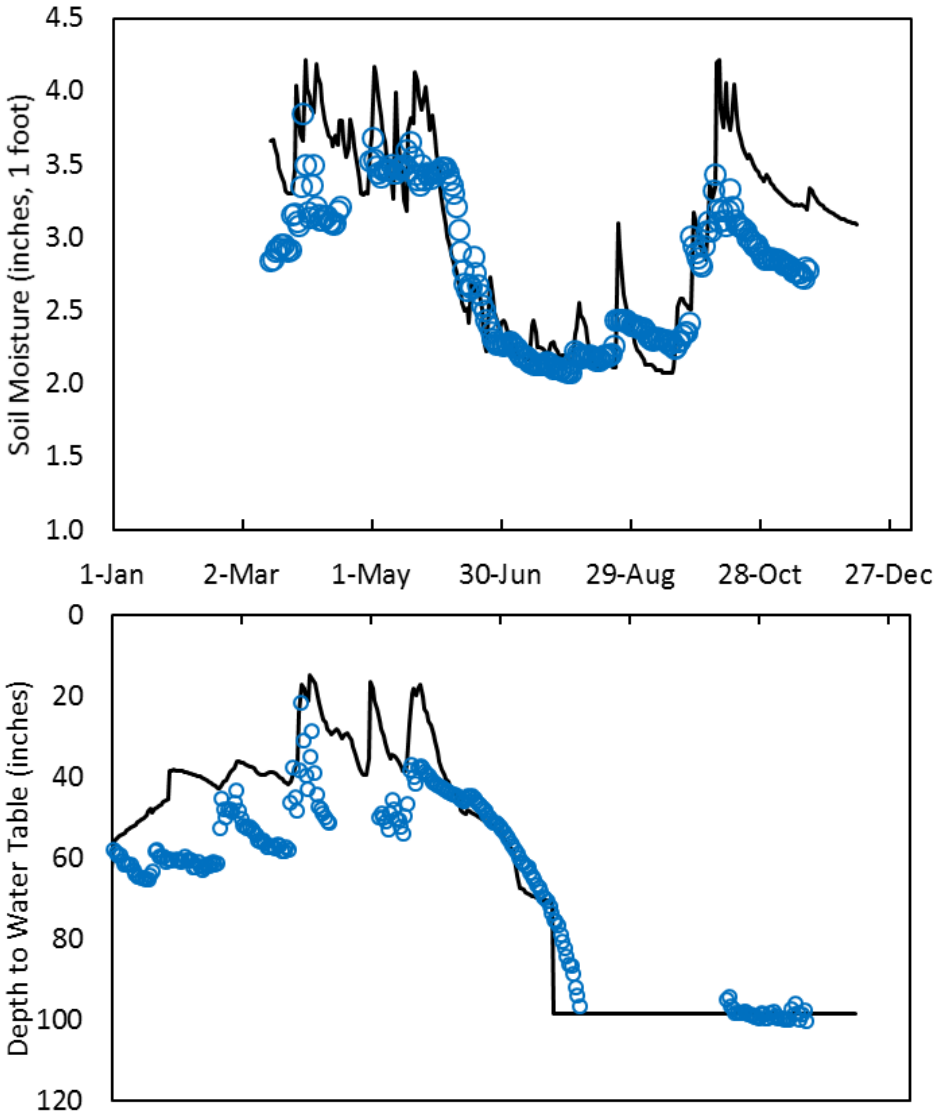


**Figure 1. Depth to water table (bottom) and soil moisture from sensors (circles) and APSIM simulations (black line) for early planted corn treatments in 2017.**