Forecast and Assessment of Cropping Systems in Northeast Iowa

RFR-A1763

Sotirios Archontoulis, assistant professor
Mark Licht, assistant professor
Rafael Martinez-Feria, graduate student
Department of Agronomy

Introduction

In 2017, the Forecast and Assessment of Cropping sysTemS (FACTS) project continued with the objective of forecasting in-season soil water-nitrogen dynamics, in-season plant growth, and end-of-season grain yields. This concept was initiated to help farmers and agronomists make in-season management decisions, plus look back on the growing season to see what management practices could have been changed to improve grain yields and net profits, but also reduce nitrogen loss.

Materials and Methods

This project combines the use of the Agricultural Production Systems sIMulator (APSIM) cropping systems model, the Weather Research and Forecast (WRF) model, and in-field data collection. Forecast simulations were based on current year weather up to the date of the simulation, followed by a 10-day weather forecast, and then a 35-year weather file to the end of the season. To validate the forecast simulations, in-field data were collected from 1-acre corn and soybean plots from the water quality drainage experiment. In these plots, corn hybrid P0157AMX was planted May 6, 2017, at 35,000 seeds/acre in 30-in. rows, and fertilized with 150 lb N/acre applied May 31, 2017, as UAN. Soybean variety P22T69R was planted May 8, 2017, at 200,000 seeds/acre with a 10-in. grain drill.

Results and Discussion

Corn yields were 237 (± 2.5) bushels/acre, and soybean yields were 66.4 (± 1.1) bushels/acre. Corn yields were near the long-term attainable yield average estimated for this location (240 bu/ac), and soybean yields were 14 percent below the long-term average (77 bu/ac; Figure 1). These yields reflected the relatively cool and wet weather conditions experienced during the growing season.

The water table was about 3 ft near the time of planting and was maintained at that level until late July, after which it gradually declined to 7 ft. We did not see indications that yields were limited by water availability or root growth restrictions.

Nitrogen (N) fertilization was sufficient to sustain crop N demand well into the grain fill stage, and very little residual N was present in the soil at maturity (~20 lb N/ac; Figure 2), limiting potential for N losses.

Acknowledgements

This project would not have been possible without the funding support from DuPont Pioneer, Iowa Soybean Association, ISU Department of Agronomy, and ISU Agriculture and Natural Resources Extension. This was a collaborative project that involved many faculty, students, and staff, especially Ken Pecinovsky.

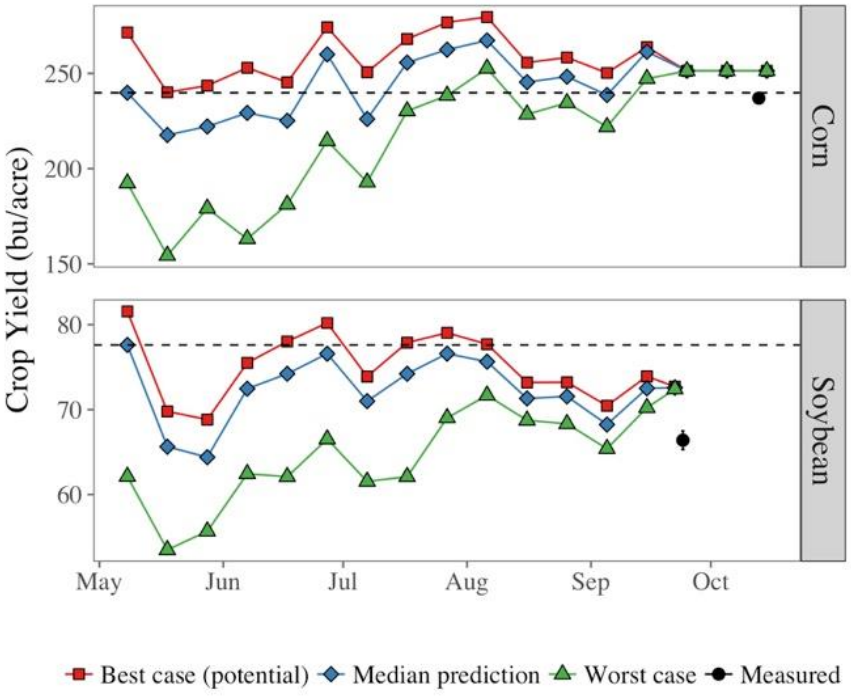

Figure 1. Yield forecasts of corn and soybean over the 2017 growing season. Triangles, diamonds, and squares show the probabilities of yield being above that level, in worst, median, and best cases, respectively. Measured yields (solid circle), harvested with a combine, are shown with error bars. Estimated long-term attainable yields mean are indicated with dashed horizontal lines.

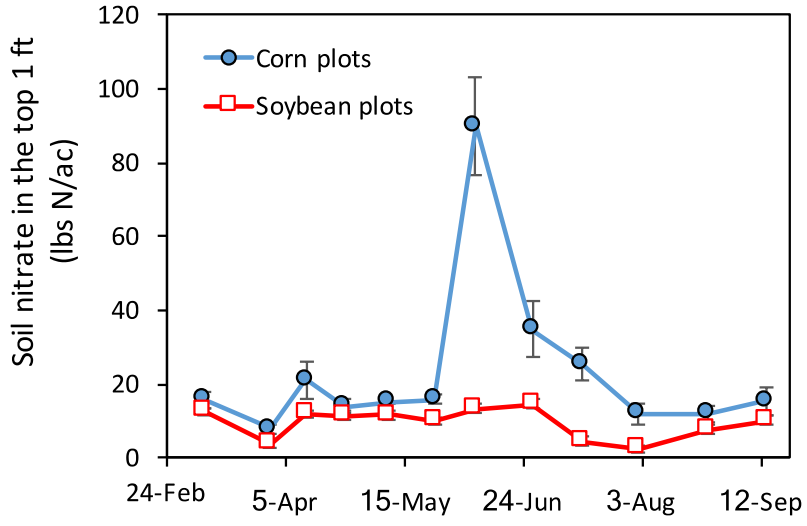

Figure 2. Soil nitrate dynamics for corn (circles) and soybean (squares) plots in the top 12 in. through the 2017 growing season.