Seasonal and Rotational Influences on Corn Nitrogen Fertilization in Southeast Iowa

RFR-A1669

John Sawyer, professor
Daniel Barker, assistant scientist
Department of Agronomy

Introduction

This project was designed to study the N fertilization needs in continuous corn (CC) and corn rotated with soybean (CS) as influenced by location and climate. Multiple rates of fertilizer N were spring applied, with the intent to measure yield response to N within each rotation on a yearly basis for multiple years at multiple sites across Iowa. This will allow determination of N requirements for each rotation, differences that exist between the two rotations, responses to applied N across different soils and climatic conditions, and evaluation of tools used to adjust N application.

Materials and Methods

The first year of this research at the Southeast Research Farm, Crawfordsville, Iowa, was 1999. The study area was cropped to soybean in 1998, therefore, in the initial year all yields followed soybean. The two rotations, CC and CS, were both present beginning in 2000. The soil at this location is Kalona silty clay loam.

Tillage is fall disk/chisel plowing after corn stalks are chopped, and spring field cultivation before planting. Rates of N applied to corn are 40 lb increments from 0 to 240 lb N/acre. The fertilizer N source is urea-ammonium nitrate solution (32% UAN) broadcast and incorporated before planting or injected after planting. No N is applied with the planter. The farm superintendent chose the corn hybrid and soybean variety.

Pest control practices are those typical for the region and crop rotations. Corn and soybean are harvested with a plot combine.

Results and Discussion

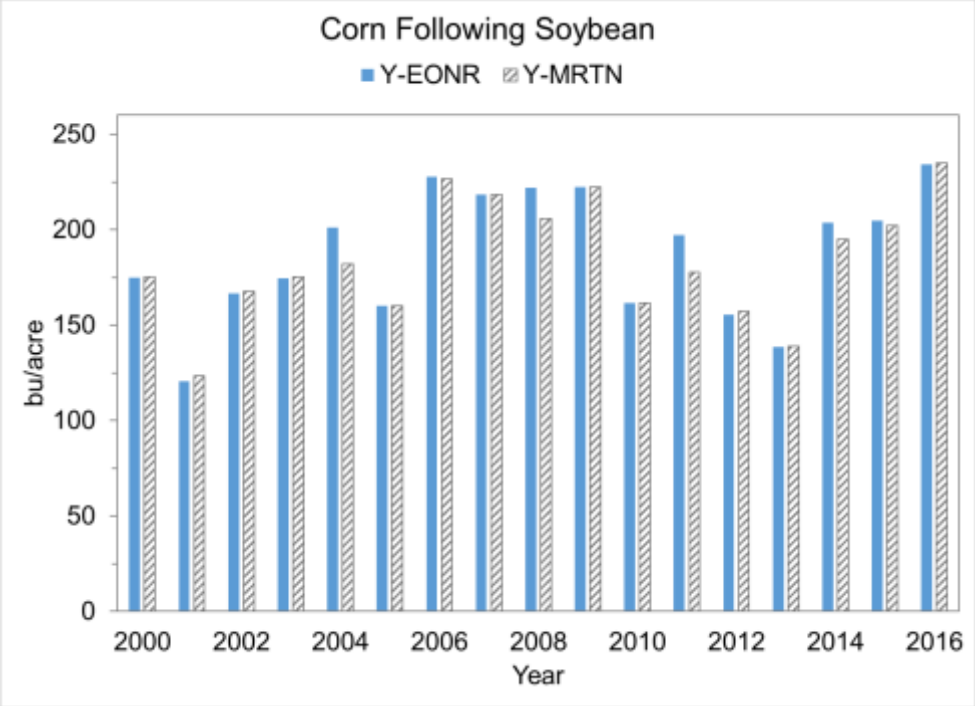
Corn yields in 2016 were the highest ever produced at this site, in spite of a damaging windstorm on June 22. Grain yield responded positively to applied N in each rotation. The calculated economic optimum N rate (EONR) from fitted response equations were 134 and 167 lb N/acre in the CS and CC rotations, respectively. These fertilizer N application requirements are at (CS) or lower (CC) than the long-term average for both rotations, despite the record high corn yields. The corn yield at the EONR was only 4 bushels/acre higher in the CS rotation compared with CC (234 vs. 230 bu/acre).

Across the years, if the current Maximum Return To N Rate (MRTN) from the Corn Nitrogen Rate Calculator (CNRC, http://cnrc.agron.iastate.edu/) had been applied each year, the corn yields are usually the same as the yields at the yearly EONR (Fig. 1). In 2016, the corn yield at the MRTN rate for both crop rotations was the same as the yield with the calculated EONR, even with the record high corn yields. In a few years, the corn yield with the MRTN rate was lower than at the EONR, often due to a higher N rate requirement associated with wet conditions.

Soybean yield in the CS rotation averaged 42 bushels/acre in 2016 and was not influenced by previous year N application to corn.

Acknowledgements

Appreciation is extended to Myron Rees, Southeast Farm superintendent, and his staff for their assistance with this research study.



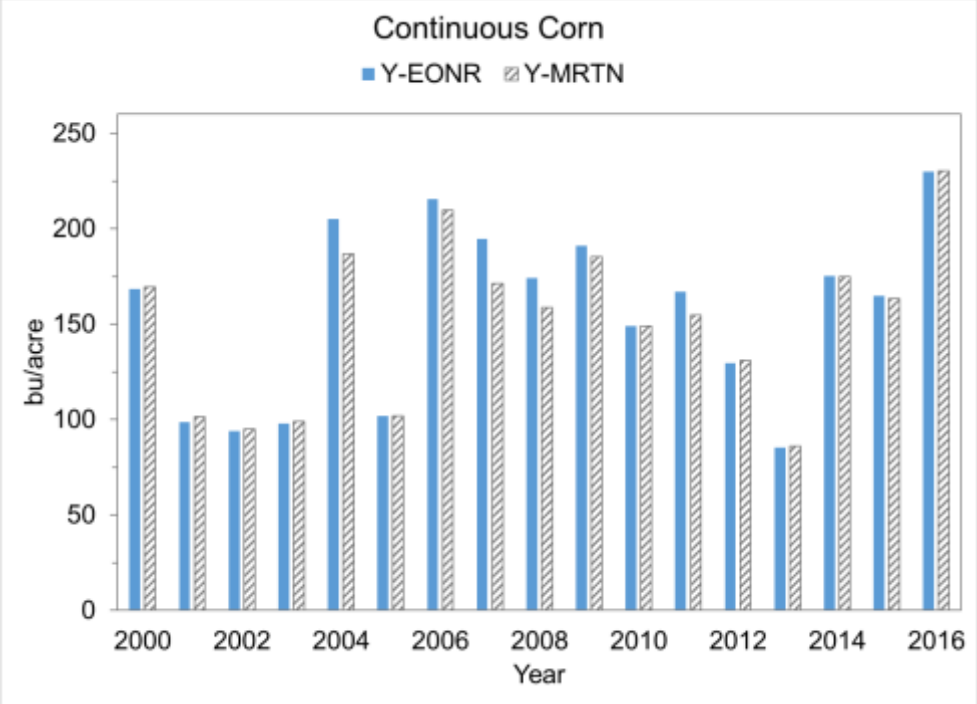


Figure 1. Corn yield at the yearly EONR (Y-EONR) and corn yield at the MRTN rate (Y-MRTN) if applied each year for each rotation (154 lb N/acre MRTN rate for corn following soybean and 207 lb N/acre for continuous corn), Southeast Research Farm, 2000–2016. The EONR and MRTN calculated at a 0.10 price ratio ($/lb N:$/bu corn grain).