2017

Seasonal and Rotational Influences on Corn Nitrogen Fertilization in South Central Iowa

John E. Sawyer
Iowa State University, jsawyer@iastate.edu

Daniel Barker
Iowa State University, dbarker@iastate.edu

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RFR-A16132

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 two rotations were established in 1999. The study area was cropped to no-till 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 Haig silty clay loam.

Tillage is fall chisel plowing and spring disk/field cultivation before planting. Rates of N applied to corn are 40 lb increments from 0 to 240 lb N/acre. Urea incorporated or urea-ammonium nitrate solution (28% UAN) injected after planting are the N fertilizer sources used across years. No N is applied with the planter. The farm superintendent chooses the corn hybrid and soybean variety. Pest control practices are those typical for the region and crop rotation. Corn and soybean are harvested with a plot combine.

Results and Discussion

Corn productivity at the site in 2016 was quite good, and above the record statewide average. Grain yield responded positively to applied N in each rotation. The calculated economic optimum N rate (EONR) from fitted response equations were 201 and 214 lb N/acre in CS and CC, respectively. The EONR for CS was well above the long-term site average and the Maximum Return To N (MRTN) suggested rate for CS from the Corn Nitrogen Rate Calculator for Southeast Iowa (CNRC, http://cnrc.agron.iastate.edu/) (Figure 1). The EONR for CC was only slightly greater than the long-term site average and the suggested MRTN rate for CC. The high N application rate requirement is a reflection of wet conditions in 2016. The corn yield at the EONR was only 4 bushels/acre higher in the CS rotation compared with CC (224 vs. 220 bu/ac).

Across years, if the MRTN rate had been applied each year (Figure 1), the corn yields would have been less than the yearly EONR about 40 percent of the years. This frequency occurs due to N losses in years with high springtime rainfall as a result of the very poorly drained soil and lack of tile drainage at the site. Nitrogen application rates should therefore be adjusted in years with high springtime rainfall.

Soybean yield in the CS rotation averaged 62 bushels/acre in 2016, the fourth time yield was above 60 bushels/acre.

Acknowledgements

Appreciation is extended to Nick Piekema, farm co-manager, and the farm staff for their work on this research study.

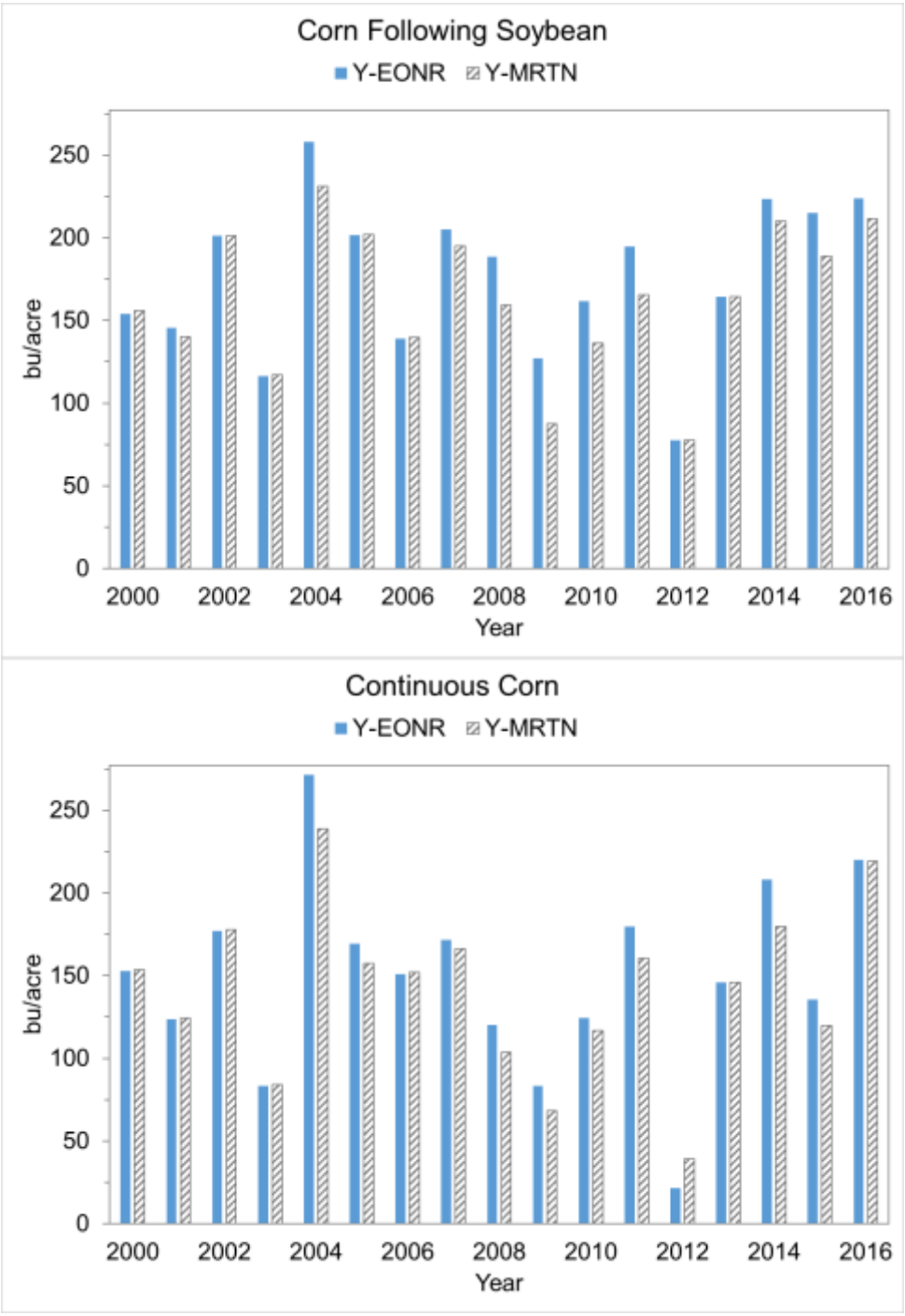

Figure 1. Corn yield at the yearly EONR (Y-EONR) and corn yield at the MRTN rate (Y-MRTN) if applied each year for each rotation (154 lb N/acre MRTN rate for corn following soybean and 207 lb N/acre for continuous corn), McNay Research Farm, 2000–2016. The EONR and MRTN calculated at a 0.10 price ratio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