Seasonal and Rotational Influences on Corn Nitrogen Fertilization in Northern Iowa

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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 Northern Research Farm was 2005. The study area was cropped to soybean in 2004. Therefore, in the initial year all yields followed soybean. The two rotations, CC and CS, both were present beginning in 2006. The soil at this location is Canisteo clay loam.

Tillage is fall chisel/disk corn residue after corn stalks are chopped 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 fertilizer is the N source and is broadcast and incorporated with secondary tillage before planting. 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 rotations. Corn and soybean are harvested with a plot combine.

Results and Discussion

Corn yields in 2016 were the highest ever produced at the site 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 215 and 189 lb N/acre in CS and CC rotations, respectively. The EONR with the CS rotation was much higher than typical. It was unusual that the CS-EONR was higher than with CC. The corn yield at the EONR was 16 bushels/acre higher in the CS rotation compared with CC (245 vs. 229 bu/acre).

Across 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 (Figure 1). In 2016, the corn yield at the MRTN rate with CS was lower than at the calculated EONR (due to the unusual EONR in 2016). However, the CC-MTRN rate was approximately equal to calculated CC-EONR, even with the high corn yield. 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 58 bushels/acre in 2016 and was not influenced by previous year N application to corn.

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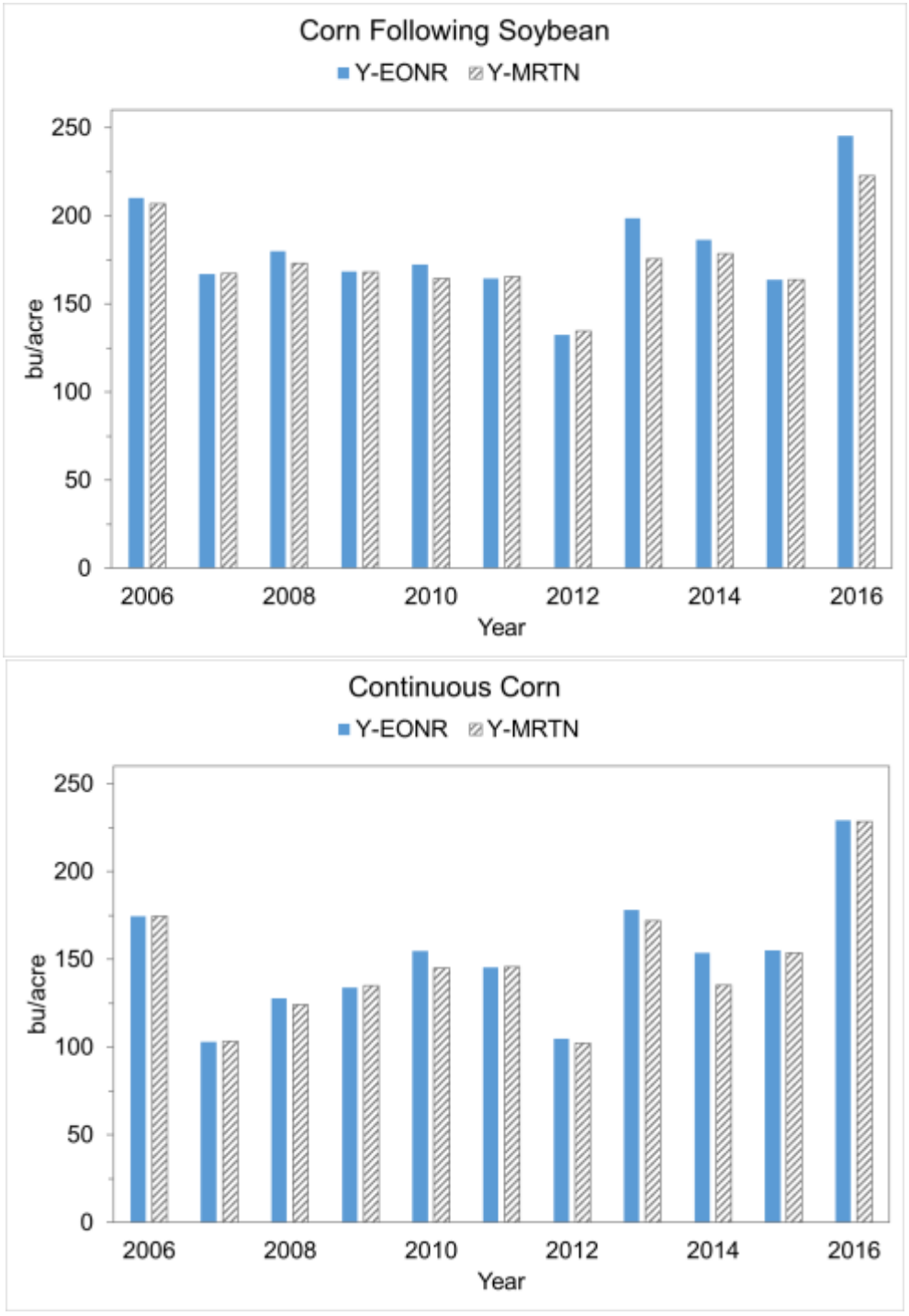

Figure 1. Corn yield at the yearly EONR (Y-EONR) and corn yield at the MRTN rate (Y-MRTN) if applied each year for each rotation (134 lb N/acre MRTN rate for corn following soybean and 184 lb N/acre for continuous corn), Northern Research Farm, 2006–2016. The EONR and MRTN calculated at a 0.10 price ratio ($/lb N:$/bu corn grain).