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Seasonal and Rotational Influences on Corn Nitrogen Fertilization in Central 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 are 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 Ag Engineering/Agronomy Research Farm was 1999. The study area was cropped to corn in 1998. Therefore, in the initial year all yields followed corn. The two rotations, CC and SC, were both present beginning in 2000. The soil at this location is Clarion loam.

Tillage is fall chisel plowing and disk/field cultivation before planting. Rates of N applied to corn are 60 lb increments from 0 to 240 lb N/acre. Urea incorporated before planting or urea-ammonium nitrate solution (32% UAN) injected after planting are the N fertilizer sources used across years. 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 yields were good in 2016 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 173 and 158 lb N/acre in CS and CC, respectively. The EONR with the CS rotation was higher than typical, and unusual to be higher than with CC. For CC, the EONR at 158 lb N/acre was lower than typical. The corn yield at the EONR was 7 bushels/acre higher in the CS rotation compared to CC (215 vs. 208 bu/ac).

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 with the MRTN rate for the CS rotation was slightly less than the yield at the EONR, likely an outcome of the unusual N rate response in 2016. The only other year where the yield with the MRTN rate was lower than the yield at the EONR was 2008 (with both rotations).

The soybean yield in the CS rotation averaged 72 bushels/acre in 2016, the highest yield produced at the site across years, and was not influenced by previous year N application to corn.

Acknowledgements

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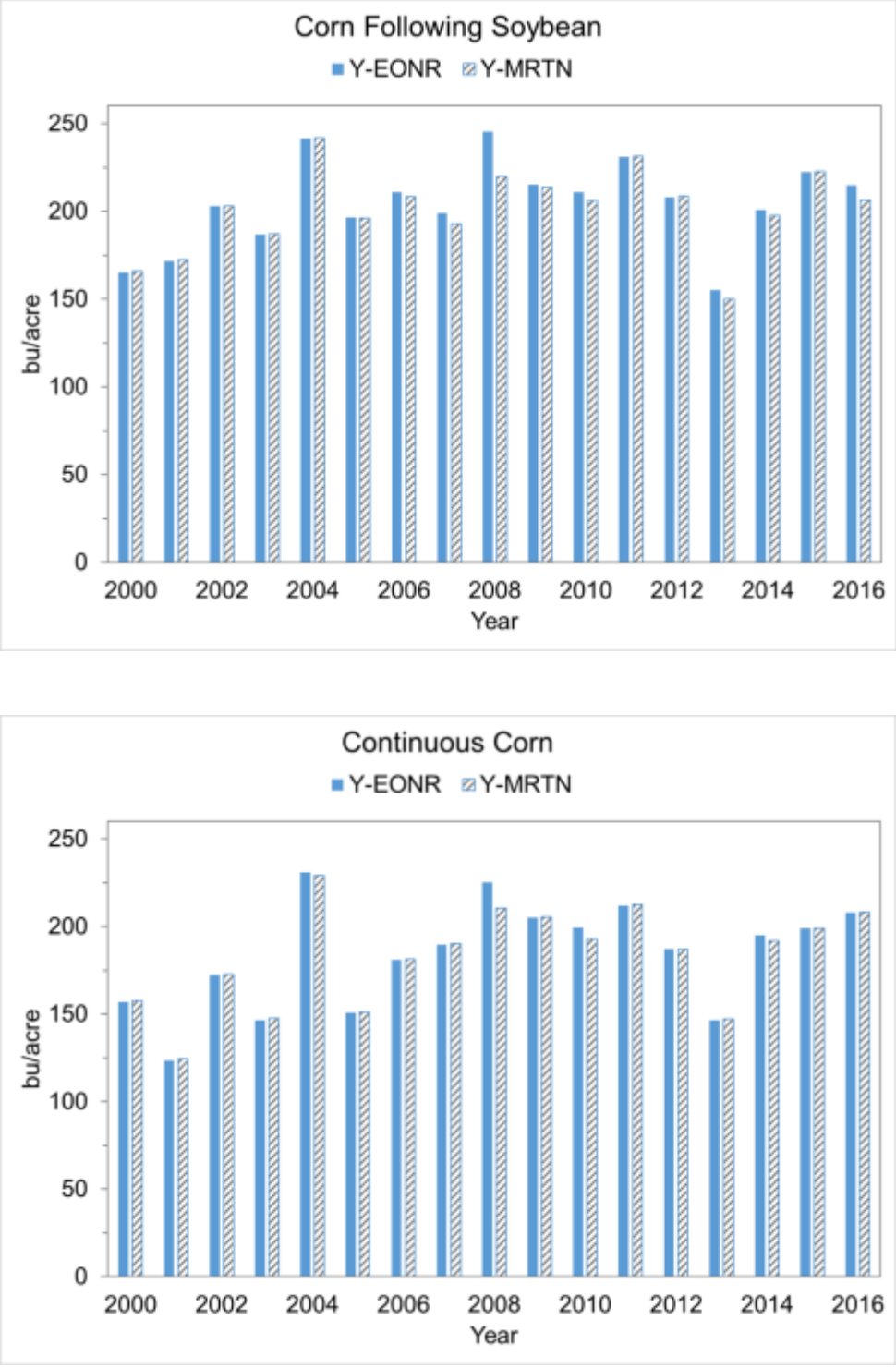

Figure 1. Corn yield at the yearly EONR (Y-EONR) and corn yield at the MRTN rate (Y-MRTN) if applied each year for each rotation (134 lb N/acre MRTN rate for corn following soybean and 184 lb N/acre for continuous corn), Ag Engineering/Agronomy Research Farm, 2000–2016. The EONR and MRTN calculated at a 0.10 price ratio ($/lb N:$/bu corn grain).