Seasonal and Rotational Influences on Corn Nitrogen Fertilization in Southwest Iowa

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Introduction

This project was designed to study the nitrogen (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 Armstrong Research Farm, Lewis, Iowa, was 2001. The study area was cropped to soybean in 2000. Therefore, in the initial year, all yields followed soybean. The two rotations, CC and CS, were both present beginning in 2002. The soil at this location is Marshall silty 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 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 in 2016 was 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 171 and 210 lb N/acre in CS and CC, respectively. These fertilizer N application requirements are higher than the long-term average for both rotations—a result of wet conditions in 2016. The corn yield at the EONR was 13 bushels/acre higher in the CS rotation compared with CC (219 vs. 206 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 were 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 lower than at the calculated EONR due to the higher N rate requirement in 2016. Also, the MRTN is based on many N rate trials and incorporates years where there are lower N fertilization requirements.

Soybean yield in the CS rotation averaged 68 bushles/acre in 2016, the third highest yield across years, and was not influenced by previous year N application to corn.

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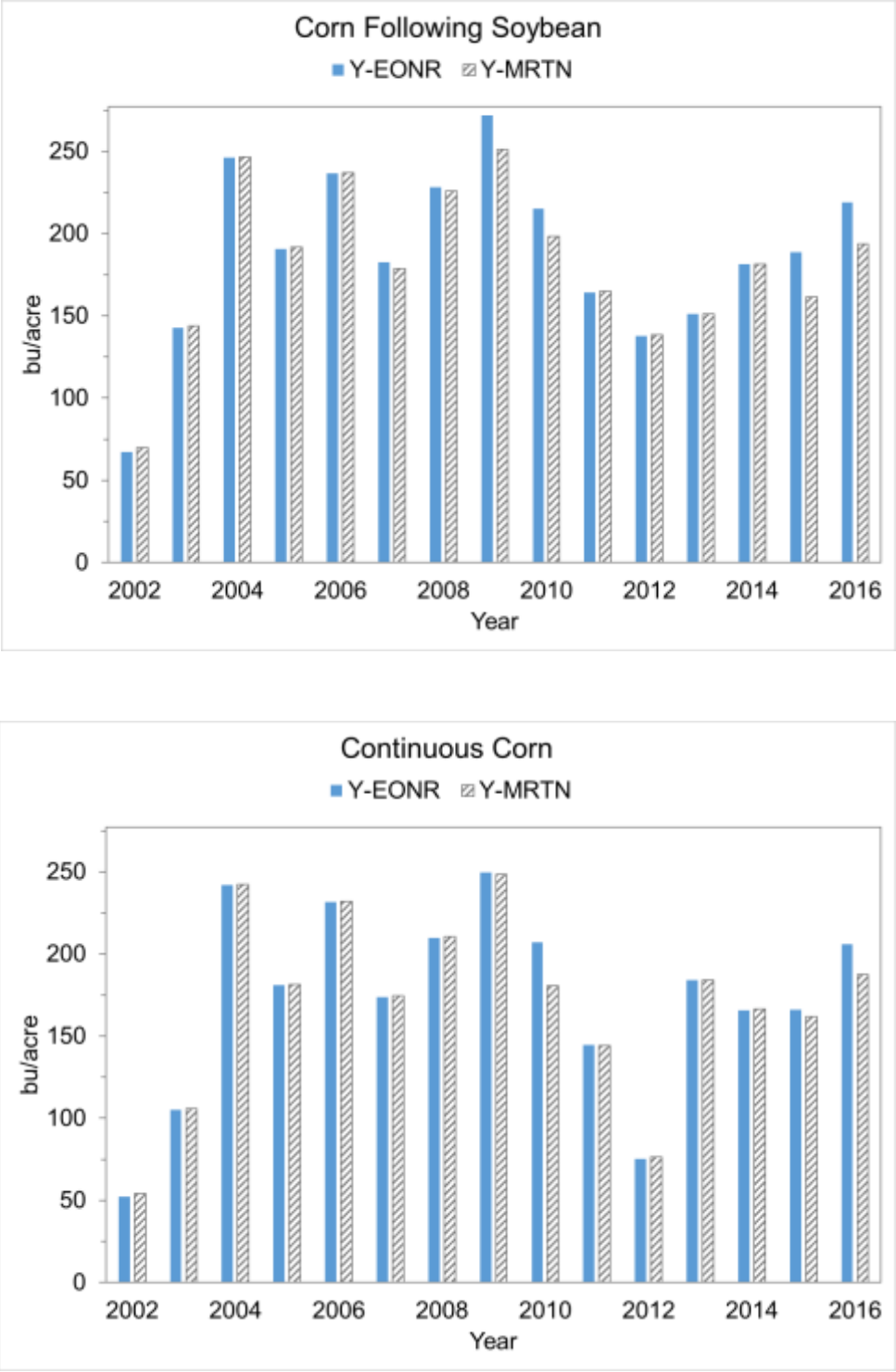

Figure 1. Corn yield at the yearly EONR (Y-EONR) and corn yield at the MRTN rate (Y-MRTN) if applied each year for each rotation (134 lb N/acre MRTN rate for corn following soybean and 184 lb N/acre for continuous corn), Armstrong Research Farm, 2002–2016. The EONR and MRTN calculated at a 0.10 price ratio ($/lb N:$/bu corn grain).