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Seasonal and Rotational Influences on Corn Nitrogen Requirements

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Abstract
This project was designed to study the N fertilization needs in continuous corn (CC) and corn rotated with soybean (SC) 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 the 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.

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Disciplines
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Seasonal and Rotational Influences on Corn Nitrogen Requirements

RFR-A9076

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Introduction

This project was designed to study the N fertilization needs in continuous corn (CC) and corn rotated with soybean (SC) 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 the 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 was 2001. The study area was cropped to soybean in 2000, therefore, in the initial year all yields follow soybean. The two rotations were initiated in 2001. The soil at this location is Marshall silty clay loam.

Tillage is fall chisel/disk corn residue and spring disk/field cultivation before planting. Rates of N applied to corn were 0 to 240 lb N/acre in 40 lb increments. Urea fertilizer was the N source and was broadcast and incorporated before planting. No N was applied with the planter. The farm superintendent chose the corn hybrid and soybean variety. Pest control practices are those typical for the region and rotations. Corn and soybeans were harvested with a plot combine, with yields corrected to standard moisture.

Results and Discussion

In 2009, corn productivity was exceptionally high (Table 1), with yields the highest since the project started (Figure 1). Grain yield responded positively to applied N in each rotation. Calculated economic optimum N rates (EONR) from fitted response equations were 167 and 193 lb N/acre in the SC and CC rotations, respectively. The corn yield at the EONR was 22 bushels/acre higher in the SC rotation (272 vs. 250 bu/acre). For the past eight years, corn yield averaged 8% higher in the SC rotation (196 vs. 181 bu/acre), including 2002, a year with low yield due to dry conditions.

Figure 1 shows the variation in yield and N response for the rotations across years. The EONR has averaged 30 lb N/acre higher in CC than SC. The EONR has been higher the last four years, likely due to wetter spring conditions. Soybean yield in the SC rotation averaged 74 bushels/acre in 2009, the highest yield since the project started, and was not influenced by previous year N application to corn.

This study will continue in the future, with greater value after accumulation of multiple years of data. The results presented in this report are not meant to represent N recommendations. They do, however, represent responses for the specific years and rotations at this site.

Acknowledgments

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Table 1. Corn grain yield as influenced by N fertilization rate in 2009, Armstrong Research Farm.

N Rate	SC[1]	CC[1]
lb N/acre	- - - - - - - bu/acre - - - - - - -	
0	163	79
40	187	133
80	232	188
120	244	218
160	260	246
200	273	254
240	271	244

[1]SC = corn following soybean; CC = corn following corn.

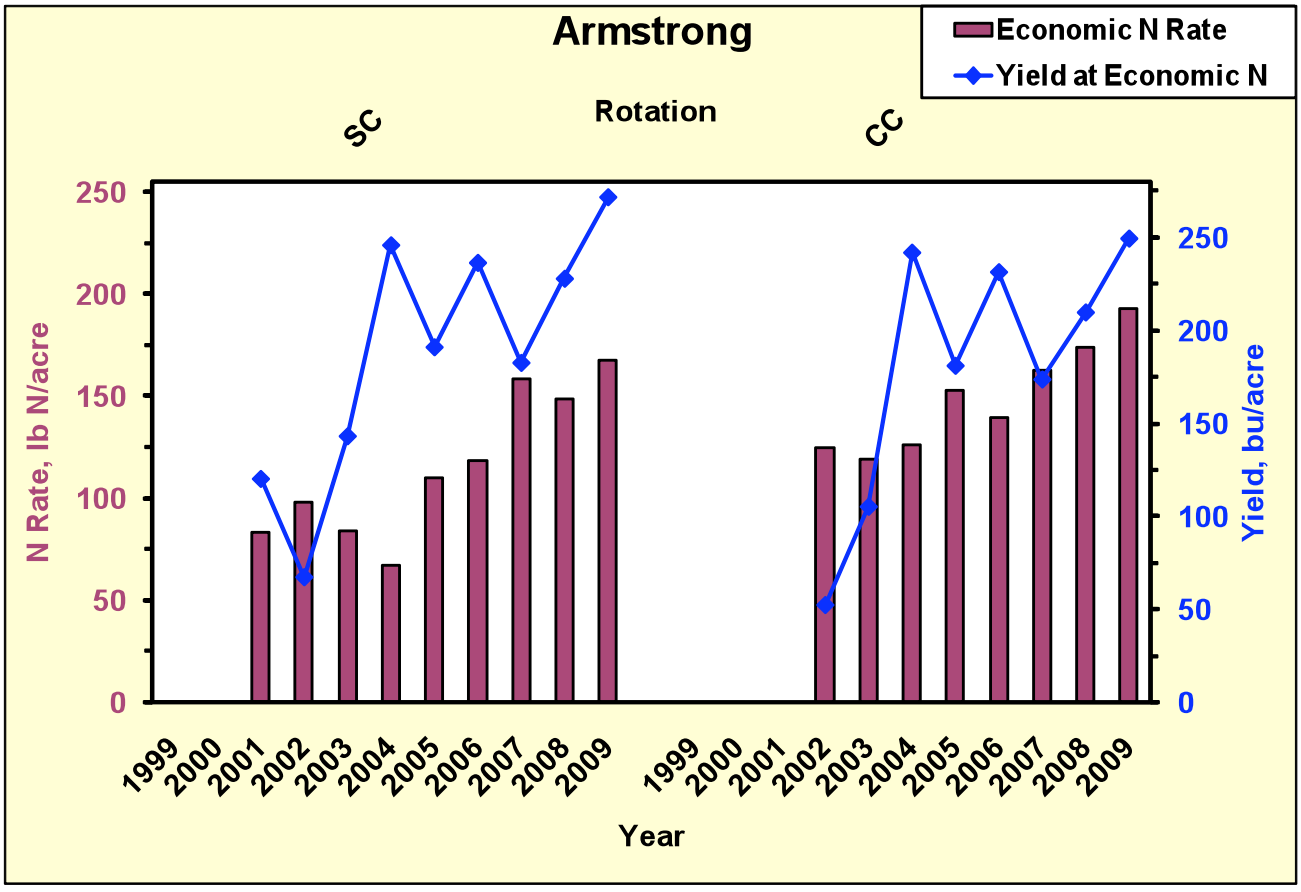

Figure 1. Economic optimum N rate (EONR) and corn yield at the EONR for each rotation and year, Armstrong Research Farm, 2009. The EONR was calculated at a 0.10 price ratio ($/lb N:$/bu corn grain).