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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-A1086

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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 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 are 0 to 240 lb N/acre in 40-lb increments. In 2010, urea-ammonium nitrate solution (32% UAN) was injected shortly after planting. No N was applied with the planter. The farm superintendent chose the corn hybrid and soybean variety. Pest control practices were those typical for the region and rotations. Corn and soybeans were harvested with a plot combine. Yields were corrected to standard moisture.

Results and Discussion

In 2010, corn yields were good, but lower than the past few years (Table 1), especially the exceptional 2009 year. Grain yield responded positively to applied N in each rotation. Calculated economic optimum N rates (EONR) in 2010 were the highest measured in this study, 207 and 240 lb N/acre in the SC and CC rotations, respectively (Figure 1). This is largely a result of the much wetter than normal spring conditions in 2010. The corn yield with 240 lb N/acre was 15 bushels/acre higher in the SC rotation compared with CC. For the past nine years, corn yield averaged 8 percent higher in the SC rotation (198 vs. 183 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 high the last four years, due to wetter growing seasons.

Soybean yield in the SC rotation averaged 69 bushels/acre in 2010 and was not influenced by previous year N application to corn.

This study will continue, 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.

Acknowledgements

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Table 1. Corn grain yield as influenced by N fertilization rate in 2010, Armstrong Research Farm.

N Rate	SC[1]	CC[1]
lb N/acre	- - - - - - - bushels/acre - - - - - - -	
0	116	57
40	147	86
80	179	117
120	192	142
160	204	170
200	210	190
240	220	205

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

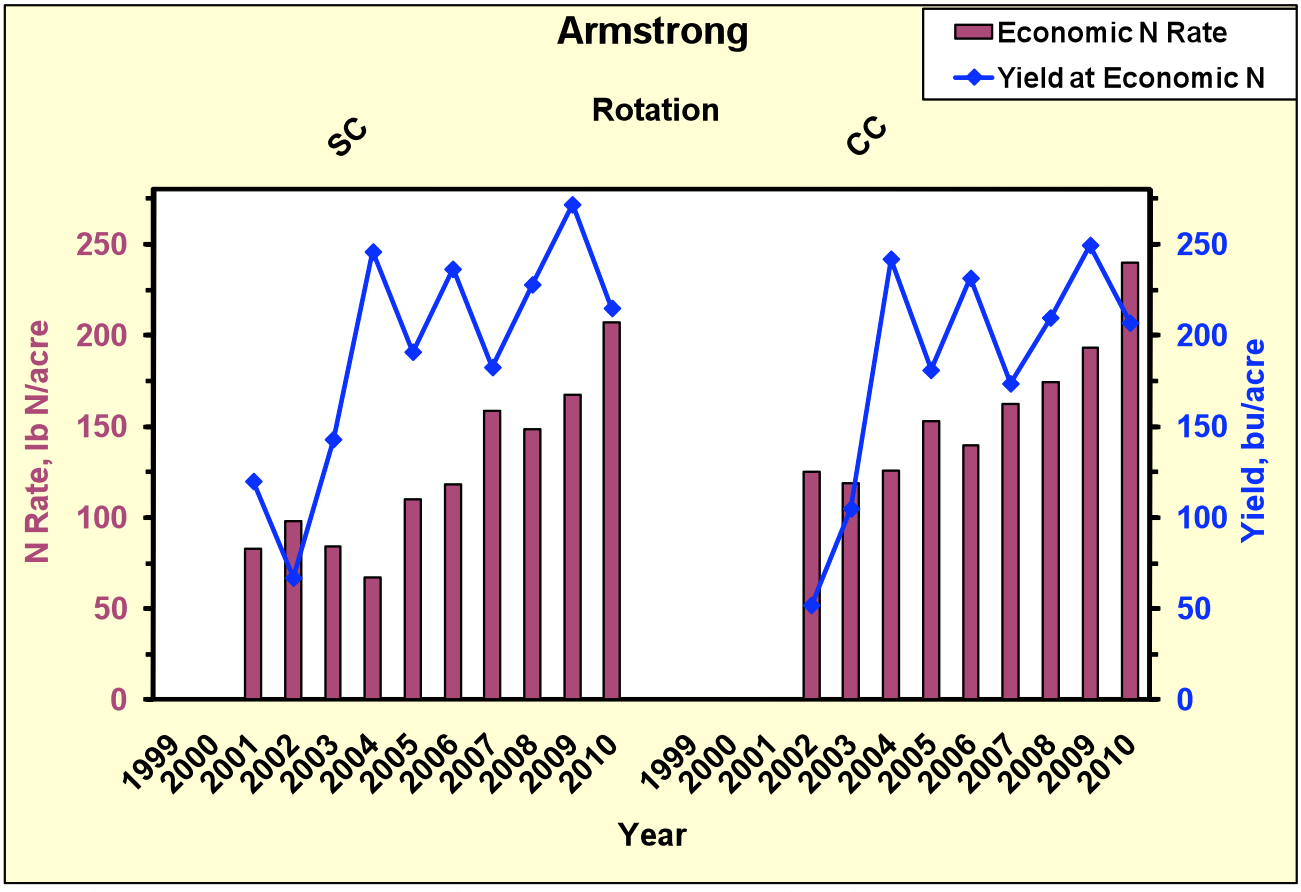

Figure 1. Economic optimum N rate (EONR) and corn yield at the EONR for each rotation and year, Armstrong Research Farm, 2010. The EONR was calculated at a 0.10 price ratio ($/lb N:$/bu corn grain).