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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 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 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-A9119

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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 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 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 Northeast Research Farm was 2005. The study area was cropped to both soybean and corn in 2004. Therefore, in the initial year (2005) results were available for both rotations. The soils at this location are Readlyn-Floyd-Kenyon loams.

Tillage is fall chisel plowing corn stalks and spring disk/field cultivation before planting each crop. Rates of N applied to corn were 0 to 240 lb N/acre in 40-lb increments. Urea fertilizer is the N source and is 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. Yields were corrected to standard moisture.

Results and Discussion

Yield levels were good in 2009 (Table 1). Calculated economic optimum N rates (EONR) in 2009 for the SC and CC rotations were 120 and 164 lb N/acre, respectively. These applied N requirements were lower than the previous two years, which were quite wet, and more normal for the rotations. Figure 1 shows the variation in corn yield and N response for the rotations across years. The EONR has been higher each year for CC compared with the SC rotation (2005-2009 average of 204 lb N/acre with CC and 155 lb N/acre with SC). The corresponding average yield for that time period for each rotation was 172 bushels/acre for CC and 201 bushels/acre for SC, with the corn yield in CC averaging 14% lower compared with SC. Yields have been lower each year with continuous corn.

The average soybean yield in 2008 was 65 bushels/acre, with a yield decline as previous year(s) N rate applied to corn increased (70 bu/acre soybean yield with the zero N rate down to 60 bu/acre with the 240 lb N/acre rate). This effect has not been seen in previous years or at other sites. Soil samples collected in fall 2009 may explain if low soil pH is the reason for the yield decline.

This study will continue in the future and the best value will occur after the accumulation of many 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 2009, Northeast Research Farm.

N Rate	SC[1]	CC[1]
lb N/acre	- - - - - - - bushels/acre - - - - - - -	
0	100	54
40	130	95
80	173	130
120	208	164
160	210	171
200	209	167
240	203	169

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

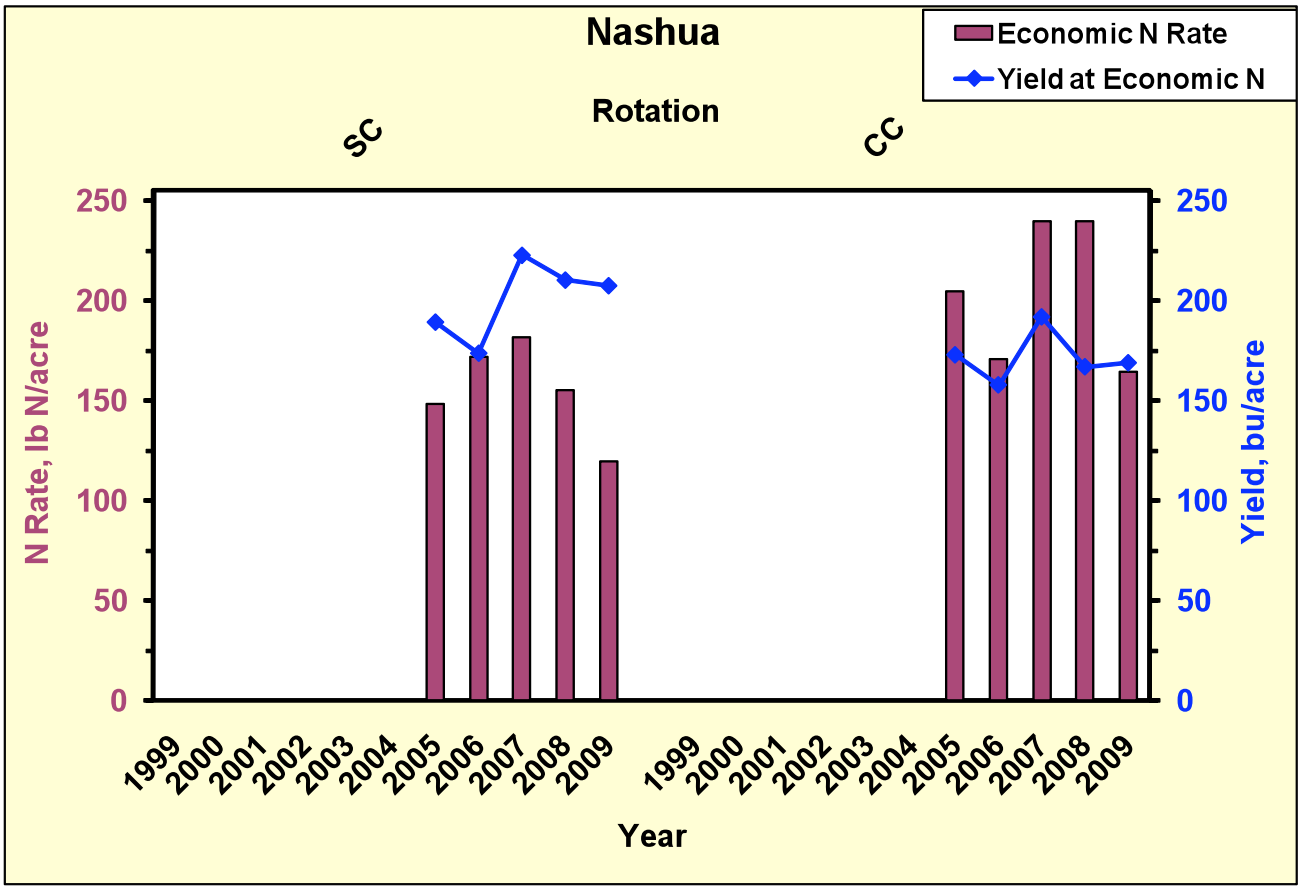

Figure 1. Economic optimum N rate (EONR) and corn yield at the EONR for each rotation and year, Northeast Research Farm, 2005–2009. The EONR was calculated at a 0.10 price ratio ($/lb N:$/bu corn grain).