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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 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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Seasonal and Rotational Influences on Corn Nitrogen Requirements

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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 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 ISU Northeast Research Farm, Nashua, Iowa 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 are Readlyn-Floyd-Kenyon loams.

Tillage was fall chisel plow corn stalks and spring 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 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 soybean were harvested with a plot combine and yields corrected to standard moisture.

Results and Discussion

Corn yields were very high in 2011 for both SC and CC (Table 1), by far the highest measured in this study. The calculated economic optimum N rate (EONR) in 2011 was high once again; for SC 168 lb N/acre, and for CC 219 lb N/acre. These applied N requirements were higher than normal for each rotation.

The corn yield at the economic optimum N rate (EONR) was 12 bushels/acre higher in the SC rotation compared with CC. For the past seven years, corn yield has averaged 12 percent higher in the SC rotation (206 vs. 182 bu/acre). Soybean yield in the SC rotation averaged a very high 81 bushels/acre in 2011, the highest recorded in this study.

Figure 1 shows the yield response to N rate each year for the SC and CC rotations. In addition, the graphs show the yield each year at the EONR and yield if a constant Maximum Return to N (MRTN) rate were applied each year. Despite the large variation in yield between years, the yearly EONR and the MRTN rate resulted in corn yields quite close to the maximum yield. Only in 2008 for SC and 2008 and 2010 for CC did the yield at the MRTN rate fall below the yearly EONR yield. These results indicate that the MRTN rate provides for optimal economic corn grain production, and like EONR, yields close to the maximum yields each year.

Acknowledgments

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Table 1. Corn grain yield as influenced by N fertilization rate.		
N Rate	**SC**	**CC**
lb N/acre	- - - - - - - bu/acre - - - - - - -	
0	118	69
40	171	113
80	195	156
120	231	199
160	244	211
200	244	224
240	236	231

SC = corn following soybean; CC = corn following corn.

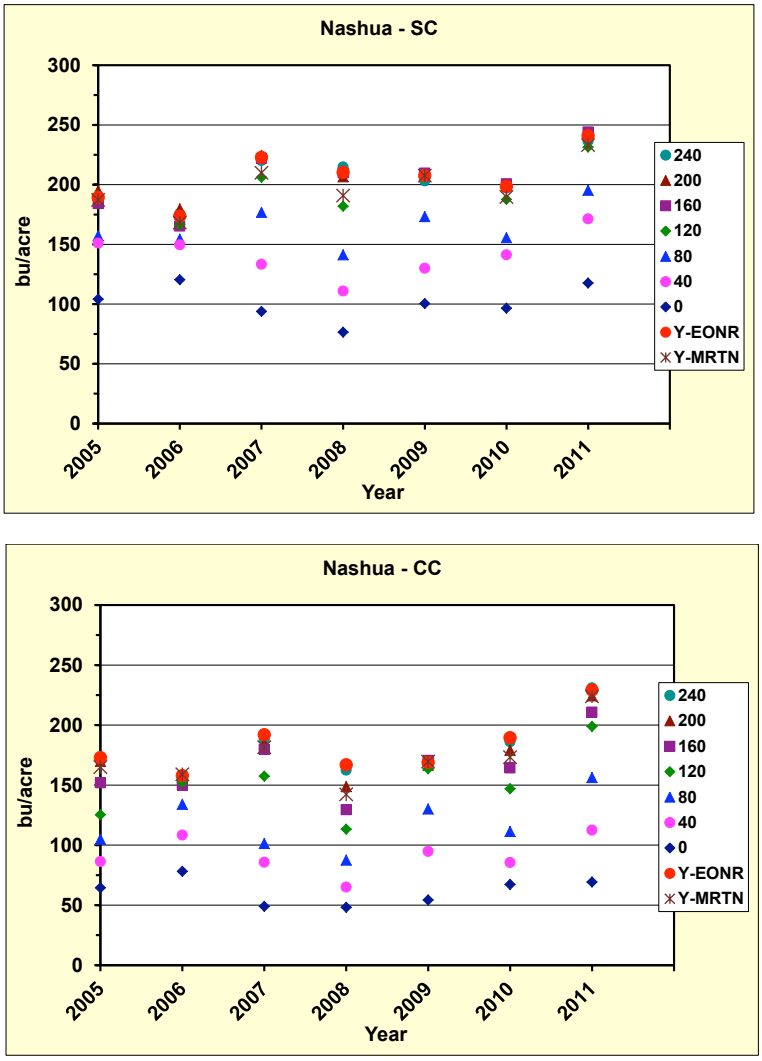

Figure 1. Nitrogen rate effect on corn yield over time for each rotation, yield at the economic optimum N rate (Y-EONR) each year, and corn yield if a constant maximum return to N (Y-MRTN) rate was applied each year, ISU Northeast Research Farm, 2005–2011. The MRTN rate used was 133 lb N/acre for SC and 190 lb N/acre for CC (rates from the 2011 Corn N Rate Calculator web site at a 0.10 price ratio, $/lb N:$/bu corn grain).