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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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Seasonal and Rotational Influences on Corn Nitrogen Requirements

RFR-A1065

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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 Southeast Research Farm was 1999. The study area was cropped to soybean in 1998; therefore, in the initial year all yields follow soybean. The two rotations were initiated in 1999. The soil at this location is Kalona silty clay loam.

In 2010 all tillage was in the spring before planting. Rates of N applied to corn are 0 to 240 lb N/acre in 40-lb increments. Urea-ammonium nitrate solution (28% UAN) fertilizer is the N source, and in 2010 was injected between corn rows. 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.

Wet conditions in 2010 resulted in corn planting being delayed until May 20. In addition, wet soils prevented UAN application until June 30. Corn was approximately two ft tall at N application and showed signs of excess water and significant N stress.

Results and Discussion

Corn yields were reduced in 2010 compared with recent years due to the prolonged spring and early summer wet conditions that delayed planting and N application (Table 1 and Figure 1). However, yields were not the lowest produced since the beginning of the study. For SC, yields were lower in 1999 and 2005. For CC, yields were lower in 2001–2003 and 2005.

By mid-June we wondered if the study would be a complete disaster. Surprisingly, despite the extended wet conditions and N stress, corn responded significantly to the late applied N, with yield increase above the no-N yields of 129 bushels/acre for CC and 115 bushels/acre for SC. Corn response to the fertilizer N was aided by continued rainfall after application. The corn yield with no N applied was the lowest ever at the site. The economic optimum N rates (EONR) were low, at 100 lb N/acre for CC and 77 lb N/acre for SC. Soybean yield averaged 49 bushels/acre.

Therefore, 2010 turned out to be an instructive year regarding corn productivity potential, response to applied N, and N rate need with extremely wet conditions, significant early season N stress, and late N application.

Acknowledgements

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

N Rate	SC[1]	CC[1]
lb N/acre	- - - - - - - bushels/acre - - - - - - -	
0	47	20
40	133	103
80	160	138
120	160	153
160	162	147
200	161	148
240	166	150

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

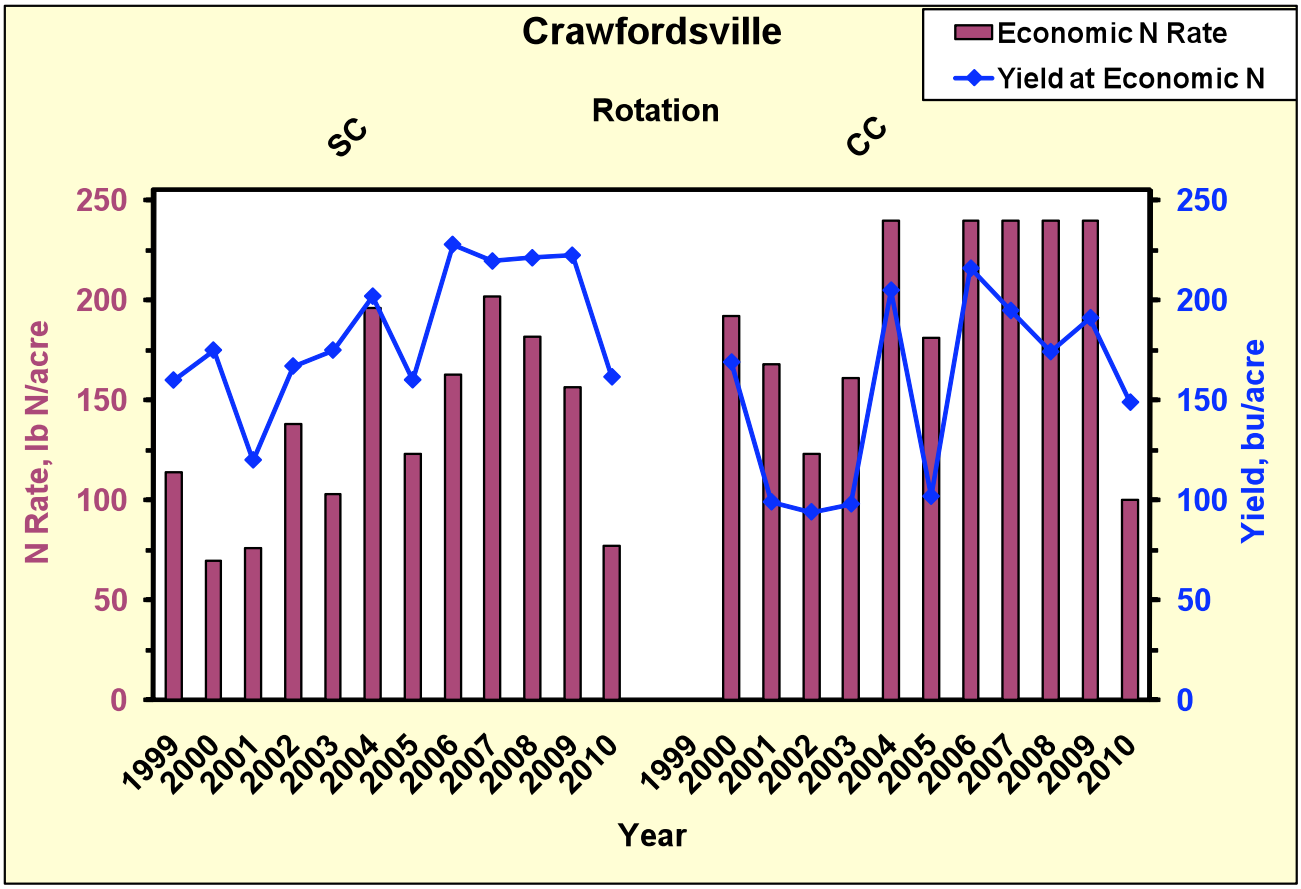

Figure 1. Economic optimum N rate (EONR) and corn yield at the EONR for each rotation and year, Southeast Research Farm, 1999–2010. The EONR was calculated at a 0.10 price ratio ($/lb N:$/bu corn grain).