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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-A9060

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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.

Tillage in 2009 was fall disk-chisel plowing after corn stalks were chopped, with no spring secondary tillage 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 2009 was injected between corn rows 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

Yield levels were good again in 2009 despite the wet season (Table 1). Calculated economic optimum N rates (EONR) for the SC and CC rotations were 156 and 240 lb N/acre, respectively. This is the fourth year in a row where the applied N requirement has been quite high, an indication of wet spring conditions and wet soils with slow internal drainage. For CC, grain yield increased to the maximum N rate applied, 240 lb N/acre, five of the last six years.

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 (2000–2009 average of 203 lb N/acre in CC and 141 lb N/acre in SC). The corresponding average yield for that time period for each rotation is 154 bushels/acre for CC and 189 bushels/acre for SC, with the corn yield in CC averaging 18% lower compared with SC. The average soybean yield in 2009 was 62 bushels/acre and was not influenced by previous year N application to corn.

This study will continue in the future and the best value will occur after the 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 2009, Southeast Research Farm.

N Rate lb N/acre	SC[1]	CC[1]
	- - - - - - - bu/acre - - - - - - -	
0	91	47
40	157	69
80	180	119
120	216	155
160	219	163
200	219	189
240	230	188

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

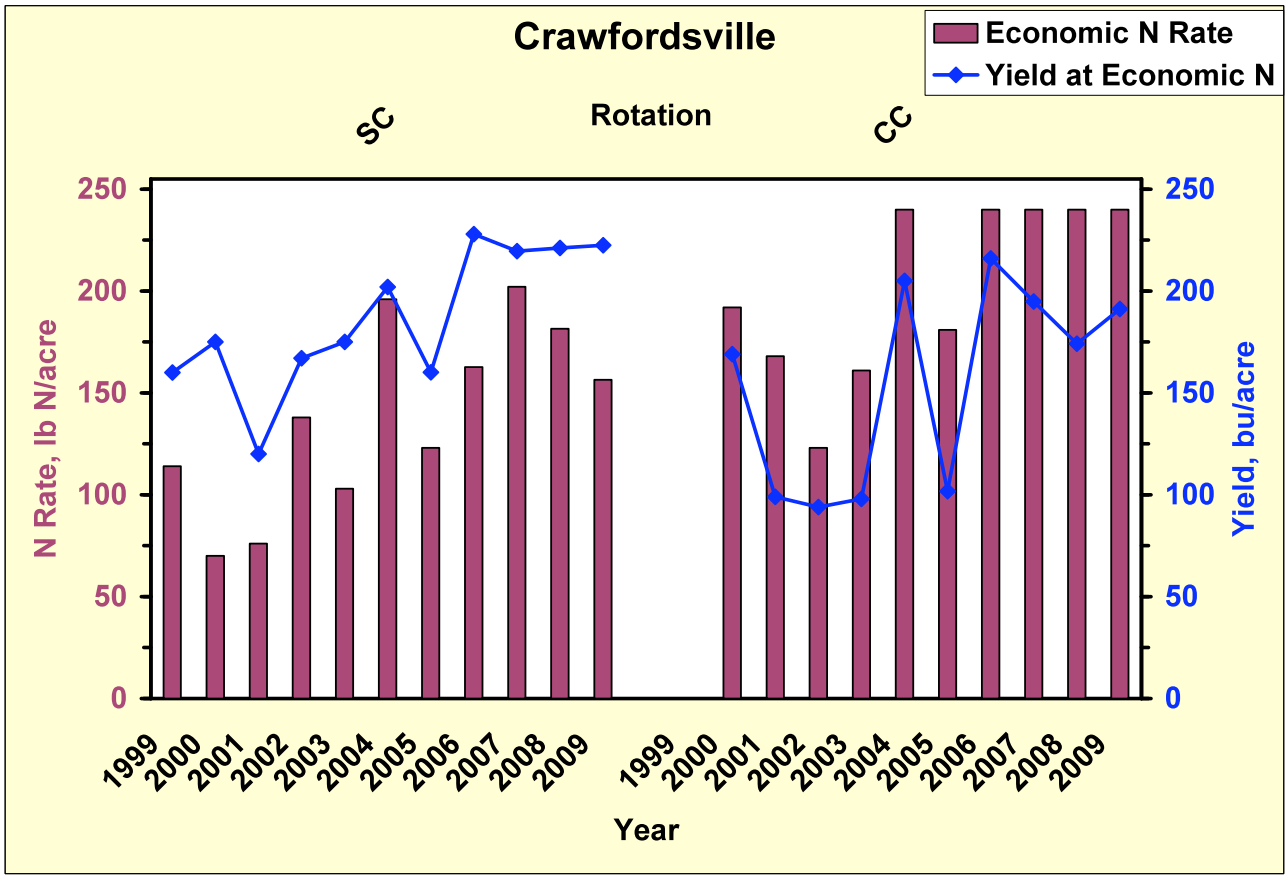

Figure 1. Economic optimum N rate (EONR) and corn yield at the EONR for each rotation and year, Southeast Research Farm, 1999–2009. The EONR was calculated at a 0.10 price ratio ($/lb N:$/bu corn grain).