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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.

**Keywords**
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**Disciplines**
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# Seasonal and Rotational Influences on Corn Nitrogen Requirements

**RFR-A10119**

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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 two rotations were established in 1999. The study area was cropped to no-till soybeans in 1998. Therefore, in the initial year all yields are following soybean. The soil at this location is Haig silty clay loam, and the field has tile drainage.

Tillage was fall chisel plowing and disk/field cultivation before planting. Rates of N applied to corn are 0 to 240 lb N/acre in 40 lb increments. In 2010, due to frequent rainfall, the plots were replanted on May 28 and the N was applied on July 14 as surface applied urea (prior to a rainstorm that day). No N was applied with the planter. Soybean was planted April 22. 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 and yields were corrected to standard moisture.

## Results and Discussion

The 2010 year was the fourth in a row with excessive rainfall and soil wetness. The effect of these conditions, late planting, and late N application in 2010 is evident in the yield levels and N responses. Considering the 2010 conditions, grain yield was good for SC (161 bu/acre) but not for CC (119 bu/acre) (Table 1). For both rotations, corn grain yield increased to the highest N rate. Nitrogen losses would be expected with the rainfall amounts and soil wetness in 2010.

Figure 1 shows the variation in yield and economic optimum N rate (EONR) for the rotations across years. Yields were typically higher in SC than CC. For 2000–2010, corn yields in CC averaged 13 percent lower compared with SC (150 vs. 173 bu/acre). The average soybean yield for 2010 was 57 bushels/acre, and was not influenced by N application to corn.

The average N fertilization requirement has been higher for CC compared with SC (average of 208 lb N/acre in CC and 163 lb N/acre in SC from 2000–2010). Several years with high precipitation during the past seven years has contributed to large N response and higher than normal expected N fertilization requirement at this location.

The 2010 season did turn out to be instructive regarding corn productivity potential, response to applied N, rate need with very wet conditions, significant N stress, and late N application.

## Acknowledgements

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

| N Rate | SC[1] | CC[1] |
|---|---|---|
| lb N/acre | - - - - - - - bushels/acre - - - - - - - | |
| 0 | 29 | 9 |
| 40 | 54 | 24 |
| 80 | 85 | 47 |
| 120 | 124 | 82 |
| 160 | 143 | 115 |
| 200 | 152 | 115 |
| 240 | 161 | 119 |

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

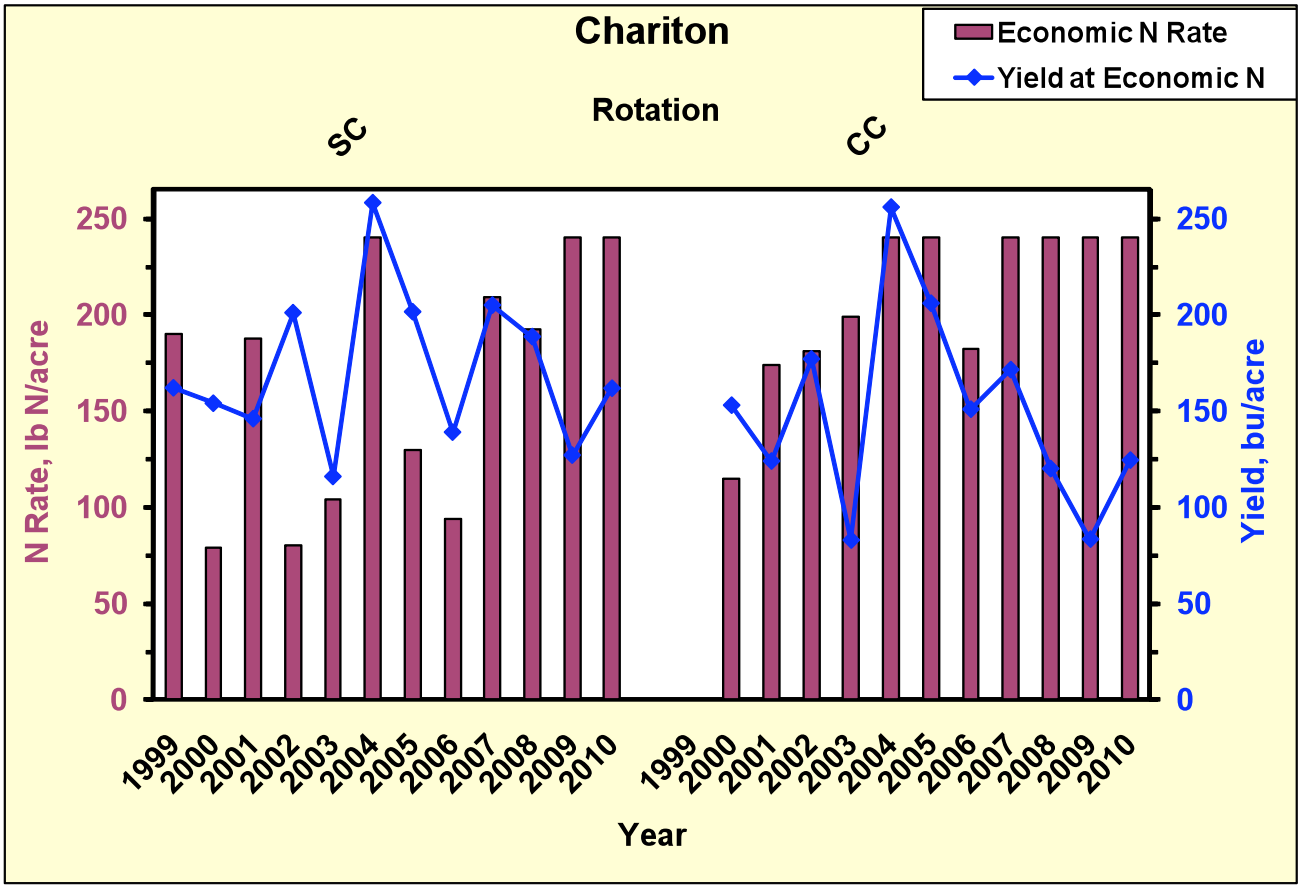


**Figure 1. Economic optimum N rate (EONR) and corn yield at the EONR for each rotation and year, McNay Memorial Research Farm, 1999–2010. The EONR was calculated at a 0.10 price ratio ($/lb N:$/bu corn grain).**