# Seasonal and Rotational Influences on Corn Nitrogen Requirements

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## Introduction

This project is designed to study the nitrogen (N) fertilization needs in continuous corn (C-C) and corn rotated with soybean (C-S) as influenced by location and climate. Multiple rates of N fertilizer applied in the spring, with the intent of measuring yield response to N within each rotation on a yearly basis for multiple years at multiple sites across Iowa. This system will allow the determination of N requirements for each rotation practice, differences that exist between the two rotations, responses to N applied across different soils and climatic conditions, and evaluation of tools used to adjust N applications.

## Materials and Methods

The first year of this research at the McNay Research Farm was 1999. The study area was cropped to no-till soybeans in 1998. Therefore, in the initial year of 1999, all yields followed soybean. The two rotations were, C-C and C-S. The soil at this location is Haig silty clay loam.

The tillage is fall chisel plowing (spring chiseling in 1999) and disk/field cultivation before planting. Rates of N applied to corn are 0–240 lb N/acre in 40-lb increments. Ammonium nitrate is the N fertilizer source, which is a surface sidedress application. The farm superintendent chooses the corn hybrid and soybean varieties. Weeds are controlled using practices typical of the region. Soil is sampled for routine soil testing. Phosphorus, potassium, and lime are applied as called for by test results. Corn and soybeans are harvested with a plot combine. Yields are corrected to standard moisture. Corn ear leaf greenness, which is an indicator of chlorophyll and nitrogen, is measured with a Minolta SPAD meter at the R1 growth stage. The SPAD meter will not indicate excess N; therefore, readings typically do not increase above a maximum greenness even with additional N.

## Results and Discussion

Corn grain yield and ear leaf greenness were highly responsive to N applied in 2004 (Table 1). Yields were quite high and were the same for both rotations at the high N rate. In prior years, corn in the C-C rotation yielded less than the C-S rotation and required more N (Figure 1). In 2004, response to N continued to the highest N rate for both rotations. This response is likely due to a wet spring and an exceptional year for high yields. The yield increase from 200 to 240 lb N/acre was not large for the C-S rotation and much smaller than the corresponding yield increase in the C-C rotation. Figure 1 shows the variation in yield and N response for the rotations over time. The average soybean yield for 2004 was 74 bushels/acre.

This study will continue in the future. The most useful results will be evident after the accumulation of multiple years of data. The results presented in this report are for only a few years and, therefore, are not meant as long-term N recommendations. They do, however, represent responses for the specific years.

## Acknowledgments

Appreciation is extended to Jim Secor, McNay Farm superintendent, and his staff for their assistance with this study.

**Table 1. Corn ear leaf greenness and corn grain yield as influenced by N fertilization rate, McNay Memorial Research Farm, 2004.**

| | C-S | | | | C-C | | | |
|---|---|---|---|---|---|---|---|---|
| N Rate | SPAD Value | Yield | Yield at Econ. N | Econ. N rate | SPAD Value | Yield | Yield at Econ. N[2] | Econ. N rate[1] |
| lb N/acre | | ----- bu/acre ----- | | lb N/acre | | ----- bu/acre ----- | | lb N/acre |
| | | | 258 | 240 | | | 272 | 240 |
| 0 | 34 | 115 | | | 28 | 42 | | |
| 40 | 42 | 150 | | | 28 | 50 | | |
| 80 | 53 | 193 | | | 32 | 91 | | |
| 120 | 57 | 216 | | | 49 | 183 | | |
| 160 | 60 | 226 | | | 55 | 219 | | |
| 200 | 61 | 249 | | | 58 | 223 | | |
| 240 | 63 | 261 | | | 58 | 256 | | |

[1]Economic optimum N calculated at a 10:1 corn:N price ratio.
[2]Yield at economic N calculated from the fitted response equation.

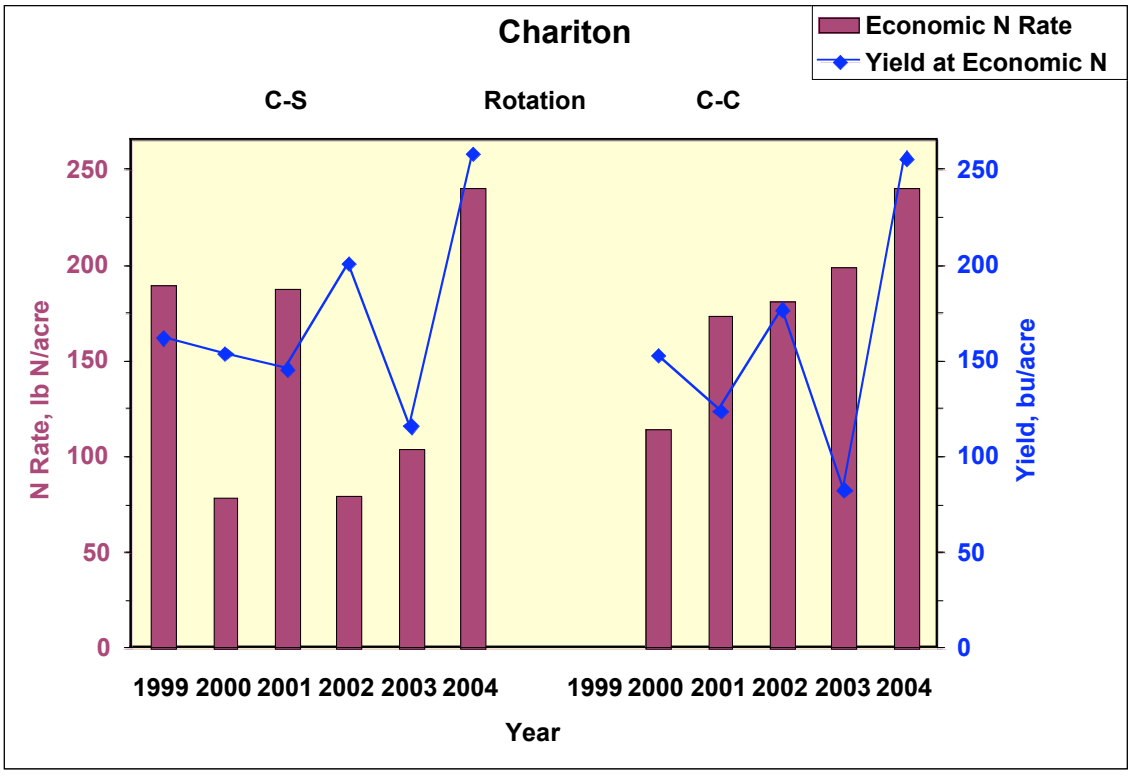


**Figure 1. Corn yield and economic optimum N rate for each rotation and season, McNay Memorial Research Farm.**