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# Seasonal and Rotational Influences on Corn Nitrogen Requirements

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# Seasonal and Rotational Influences on Corn Nitrogen Requirements

## **Abstract**

This project is designed to study the N fertilization needs in continuous corn and corn rotated with soybean as influenced by location and climate. Multiple rates of fertilizer N are spring applied, with the intent to measure yield response to this 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 continuous corn and rotated corn, differences that exist between the two rotations, responses to applied N across different soils and climatic trends, and evaluation of new tools for site adjustment of N application.

## **Keywords**

Agronomy

## **Disciplines**

Agricultural Science | Agriculture | Agronomy and Crop Sciences

# Seasonal and Rotational Influences on Corn Nitrogen Requirements

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## Introduction

This project is designed to study the N fertilization needs in continuous corn and corn rotated with soybean as influenced by location and climate. Multiple rates of fertilizer N are spring applied, with the intent to measure yield response to this 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 continuous corn and rotated corn, differences that exist between the two rotations, responses to applied N across different soils and climatic trends, and evaluation of new tools for site adjustment of N application.

## Materials and Methods

The first year of this research at the Armstrong Research Farm was 1999. The study area was cropped to corn in 1998. Therefore, in the initial year all yields follow corn. The two rotations, continuous corn and corn rotated with soybean, were initiated in 1999. The soil at this location is Marshall silty clay loam.

Tillage is 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. Urea fertilizer is the N source and is broadcast and incorporated with secondary tillage before planting. No N is applied with the planter. The farm superintendent chooses the corn hybrid and soybean variety. Weeds are controlled using practices typical of the region. Soil is sampled for routine soil tests, and phosphorus, potassium, and lime are applied as

called for by the soil tests. Soil P and K tests are quite high in the study area.

Corn and soybeans are harvested with a plot combine. Yields are corrected to standard moisture. Corn leaf greenness (ear leaf), which is an indicator of chlorophyll and nitrogen, is measured with a Minolta SPAD meter at the R1 growth stage. Relative SPAD readings are calculated using the reading at 240 lb N/acre as 100%. 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 yields and ear leaf greenness were not responsive (slight increase in SPAD reading in 1999) to applied N in either year (Tables 1 and 2). Relative SPAD values over 95 often indicate there will be no yield increase from additional N. The non-response was the same for both rotations. This site had a history of high manure application, which is apparently influencing response to applied N. This non-response provides a unique opportunity to study N effects on yield and soil and plant tests.

This study will continue in the future to see when the site begins to respond to applied N. The results presented in this report are for only a few years and therefore are not meant to represent N recommendations. They do, however, represent responses for the specific years and conditions at this site.

## Acknowledgments

Appreciation is extended to Bernie Havlovic, Armstrong Farm superintendent, and his staff for their assistance with this study.

**Table 1. Corn grain yield as influenced by fertilizer N rate, Armstrong Research Farm, 2000.**

N Rate lb N/acre	1999		2000	
	C-C	C-S	C-C	C-S
	----- bu/acre -----			
0	119	---	157	159
40	123	---	159	155
80	119	---	155	150
120	118	---	149	146
160	115	---	150	141
200	118	---	151	141
240	115	---	154	147
Optimum N, lb N/acre	0	---	0	0
Yield at Optimum N, bu/acre	118	---	157	159
LSNT, ppm	11	---	27	29
Soybean Yield, bu/acre	---	59	---	51

Optimum N calculated at a 10:1 corn:N price ratio.

Yield at optimum N calculated from the fitted response equation.

LSNT samples from the zero N rate.

Average soybean yield for the site.

**Table 2. Corn ear leaf greenness (Minolta SPAD readings at the R1 growth stage) as influenced by fertilizer N rate, Armstrong Research Farm, 2000.**

N Rate lb N/acre	1999				2000			
	SPAD Reading		Relative SPAD		SPAD Reading		Relative SPAD	
	C-C	C-S	C-C	C-S	C-C	C-S	C-C	C-S
0	55	---	90	---	57	57	95	97
40	58	---	95	---	58	58	97	98
80	60	---	98	---	59	58	98	98
120	60	---	98	---	58	58	97	98
160	61	---	100	---	59	58	99	97
200	62	---	102	---	61	60	101	102
240	61	---	---	---	60	59	---	---

Relative SPAD readings calculated relative to the value at 240 lb N/acre.