

Seasonal and Rotational Influences on Corn Nitrogen Requirements, Armstrong Farm

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Introduction

This project is designed to study the nitrogen (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 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 practice, 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 Armstrong Research Farm was 2001. The entire study area was cropped to soybean in 2000. Therefore, in the initial year, all yields followed soybean. In 2001, two rotations—continuous corn and corn rotated with soybean—were initiated. The soil at this location is Marshall silty clay loam.

There was no fall tillage, and the plot area was disked before planting. Rates of N applied to corn were 0–240 lb N/acre in 40 lb increments. Ammonium nitrate fertilizer was the N source and was broadcast before planting but not incorporated, and no N was applied with the planter. The farm superintendent chose the corn hybrid and soybean variety. Weeds were controlled using practices typical of the region. Soil was sampled for routine soil tests.

Phosphorus, potassium, and lime were applied as called for by the soil tests.

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 (silking) growth stage. Relative SPAD readings were 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 yield and ear leaf greenness (SPAD readings) responded to applied N (Tables 1 and 2). The response was not large, with yield and ear leaf greenness increasing to approximately 80 lb N/acre.

This site was initiated in order to better represent N response in this geographic area because the corn N study site located at the Swine Farm has a history of high manure application. 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 for only one year and therefore are not meant to represent N recommendations. It does, however, represent responses for the specific year and conditions at this site.

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Table 1. Corn grain yield as influenced by N fertilizer rate, Armstrong Research Farm, 2001.

N Rate lb N/acre	1999		2000		2001	
	C-C	C-S	C-C	C-S	C-C	C-S
	-----		bu/acre		-----	
0	---	---	---	---	---	106
40	---	---	---	---	---	121
80	---	---	---	---	---	118
120	---	---	---	---	---	121
160	---	---	---	---	---	125
200	---	---	---	---	---	129
240	---	---	---	---	---	123
Economic N, lb N/acre	---	---	---	---	---	83
Yield at Economic N, bu/acre	---	---	---	---	---	120
LSNT, ppm	---	---	---	---	---	---
Soybean Yield, bu/acre	---	---	---	---	---	49

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

Yield at Economic 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 N fertilizer rate, Armstrong Research Farm, 2001.

N Rate lb N/acre	1999				2000				2001			
	SPAD Reading		Relative SPAD		SPAD Reading		Relative SPAD		SPAD Reading		Relative SPAD	
	C-C	C-S	C-C	C-S	C-C	C-S	C-C	C-S	C-C	C-S	C-C	C-S
0	---	---	---	---	---	---	---	---	---	55	---	85
40	---	---	---	---	---	---	---	---	---	63	---	97
80	---	---	---	---	---	---	---	---	---	65	---	100
120	---	---	---	---	---	---	---	---	---	64	---	98
160	---	---	---	---	---	---	---	---	---	64	---	99
200	---	---	---	---	---	---	---	---	---	64	---	98
240	---	---	---	---	---	---	---	---	---	65	---	---

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