

Seasonal and Rotational Influences on Corn Nitrogen Requirements, Swine 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 1999. The study area was cropped to corn in 1998. Therefore, in the initial year, all yields followed 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 was fall chisel plowing and disk/field cultivation before planting. Rates of N applied to corn were 0–240 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 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. 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 ear leaf greenness, which is an indicator of chlorophyll and nitrogen, was 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 were not increased by applied N in any year (Tables 1 and 2). The lack of increase was similar for both rotations. However, the SPAD values with zero N in the C–C rotation indicate slight N deficiency at silking. Relative SPAD values over 95 often indicate that there will be no yield increase from additional N. This site has a history of high manure application, which is likely influencing the response to applied N. This site 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.

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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	119	---	157	159	103	154
40	123	---	159	155	113	152
80	119	---	155	150	109	143
120	118	---	149	146	108	145
160	115	---	150	141	95	145
200	118	---	151	141	122	140
240	115	---	154	147	104	146
Economic N, lb N/acre	0	---	0	0	0	0
Yield at Economic N, bu/acre	118	---	157	159	103	154
LSNT, ppm	11	---	27	29	---	---
Soybean Yield, bu/acre	---	59	---	51	---	66

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	---	90	---	57	57	95	97	54	60	92	95
40	58	---	95	---	58	58	97	98	58	62	98	98
80	60	---	98	---	59	58	98	98	60	62	102	98
120	60	---	98	---	58	58	97	98	59	61	100	97
160	61	---	100	---	59	58	99	97	61	63	103	100
200	62	---	102	---	61	60	101	102	61	61	103	97
240	61	---	---	---	60	59	---	---	59	63	---	---

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