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Seasonal and Rotational Influences on Corn Nitrogen Requirements, Swine Farm

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Abstract
This project is designed to study nitrogen (N) fertilization needs in continuous corn (C-C) and corn rotated with soybeans (C-S) as influenced by location and climate. Multiple rates of N fertilizer 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 help determine N requirements for each rotational practice, differences that exist between the two rotations, and responses to applied N across different soils and climatic conditions. It will also allow for the evaluation of tools used to adjust N application.

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Introduction

This project is designed to study nitrogen (N) fertilization needs in continuous corn (C-C) and corn rotated with soybeans (C-S) as influenced by location and climate. Multiple rates of N fertilizer 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 help determine N requirements for each rotational practice, differences that exist between the two rotations, and responses to applied N across different soils and climatic conditions. It will also allow for the 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, C-C and C-S, 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 0–240 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 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 showed no increase to applied N before 2002 (Table 1). There has been a tendency each year for corn yield in the C-S rotation to decline with added N. The ear leaf greenness (SPAD) readings and corn yield in the C-C rotation are beginning to show a N response, up to 40 lb N/acre in 2002. This is likely due to continuous corn crop demands for N and reduced N mineralization in the soil to plant available forms. The site has a history of high manure application, which is influencing the response to applied N. Soybean yield in the C-S rotation averaged 57 bushels/acre in 2002.

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 ear leaf greenness (Minolta SPAD reading at the R1 growth stage) and corn grain yield as influenced by N fertilizer rate, Armstrong Research Farm, 2002.

Year	N rate lb N/acre	C-S				C-C			
		SPAD	YIELD	Econ. N yield	Econ. N rate	SPAD	YIELD	Econ. N yield	Econ. N rate
			----- bu/acre -----		lb N/acre		----- bu/acre -----		lb N/acre
1999				---	---			118	0
	0	---	---			55	119		
	40	---	---			58	123		
	80	---	---			60	119		
	120	---	---			60	118		
	160	---	---			61	115		
	200	---	---			62	118		
	240	---	---			61	115		
2000				159	0			157	0
	0	57	159			57	157		
	40	58	155			58	159		
	80	58	150			59	155		
	120	58	146			58	149		
	160	58	141			59	150		
	200	60	141			61	151		
	240	59	147			60	154		
2001				154	0			103	0
	0	60	154			54	103		
	40	62	152			58	113		
	80	62	143			60	109		
	120	61	145			59	108		
	160	63	145			61	95		
	200	61	140			61	122		
	240	63	146			59	103		
2002				170	0			128	35
	0	57	170			49	87		
	40	60	174			57	136		
	80	63	166			57	114		
	120	61	143			60	131		
	160	62	160			59	131		
	200	60	140			59	128		
	240	62	150			59	130		

Economic N calculated at a 10:1 corn:N price ratio.
Yield at Economic N calculated from the fitted response equation.