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Seasonal and Rotational Influences on Corn Nitrogen Requirements, Armstrong 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.

Keywords
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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 2001. The study area was cropped to soybeans in 2000. Therefore, in the initial year all yields followed soybeans. The two rotations, C-C and C-S, were initiated in 2001. The soil at this location is Marshall silty clay loam.

Tillage is 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 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.

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

In 2002, corn grain yield was significantly reduced due to drought conditions during the growing season. A grasshopper infestation was also present during the VT to R1 corn stage. Despite the dry conditions, corn ear leaf greenness (SPAD readings) and grain yield did respond positively to applied N in each rotation (Table 1). Calculated economic N rates from fitted response equations were 98 lb N/acre in the C-S rotation and 125 lb N/acre in the C-C rotation. The overall corn yield average was 20 bushels/acre lower in the C-C rotation than the C-S rotation. Soybean yield in the C-S rotation averaged 19 bushels/acre.

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 the first two years and therefore are not meant to represent N recommendations. They do, however, represent responses for the specific years and rotation.

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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			---	---	---		---	---	---
	0	---	---			---	---		
	40	---	---			---	---		
	80	---	---			---	---		
	120	---	---			---	---		
	160	---	---			---	---		
	200	---	---			---	---		
	240	---	---			---	---		
2000				---	---			---	---
	0	---	---			---	---		
	40	---	---			---	---		
	80	---	---			---	---		
	120	---	---			---	---		
	160	---	---			---	---		
	200	---	---			---	---		
	240	---	---			---	---		
2001				120	83			---	---
	0	55	106			---	---		
	40	63	121			---	---		
	80	65	118			---	---		
	120	64	121			---	---		
	160	64	125			---	---		
	200	64	129			---	---		
	240	65	123			---	---		
2002				67	98			52	125
	0	54	52			39	21		
	40	58	50			53	36		
	80	61	73			58	50		
	120	62	67			59	43		
	160	61	68			61	59		
	200	62	70			61	55		
	240	62	71			60	52		

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