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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 of continuous corn (C-C) and corn rotated with soybeans (C-S) 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 help determine N requirements for each rotational practice, differences that exist between the two rotations, and responses to applied N across different soils and different climatic conditions. It will also allow for the evaluation of tools used to adjust 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 of continuous corn (C-C) and corn rotated with soybeans (C-S) 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 help determine N requirements for each rotational practice, differences that exist between the two rotations, and responses to applied N across different soils and different 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 McNay Research Farm was 1999. The study area was cropped to no-till soybeans in 1998. Therefore, in the initial year all yields follow soybean. The two rotations, C-C and C-S, were initiated in 1999. The soil at this location is Haig silty clay loam.

Tillage is fall chisel plowing (spring chiseling in 1999) and disk/field cultivation before planting. Rates of N applied to corn are 0–240 lb N/acre in 40 lb increments. Ammonium nitrate fertilizer is the N source and is surface sidedress applied. No N is applied before planting or 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

Corn grain yield and ear leaf greenness were responsive to applied N in 2002 (Table 1). Yields were quite high for both rotations this year. Economic N rates for the C-S and C-C rotations were 80 and 182 lb N/acre, respectively. The Minolta SPAD meter readings increased to approximately 80 lb N/acre in the C-S rotation, and 160-200 lb N/acre in the C-C rotation. Since 2000, corn in the C-C rotation has yielded less than the C-S rotation and over the years usually required more applied N. Average soybean yield for 2002 was 49 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 only a few years and, therefore, are not meant to represent N recommendations. They do, however, represent responses for the specific years.

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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, McNay Memorial 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	----- bu/acre	lb N/acre		----- bu/acre	----- bu/acre	lb N/acre
1999				163	190			---	---
	0	42	80			---	---		
	40	51	98			---	---		
	80	55	129			---	---		
	120	57	146			---	---		
	160	59	162			---	---		
	200	60	165			---	---		
	240	60	160			---	---		
2000				154	79			153	115
	0	57	138			38	85		
	40	61	149			53	123		
	80	63	154			58	143		
	120	63	154			62	154		
	160	63	161			63	154		
	200	63	153			64	155		
	240	65	156			63	151		
2001				147	188			125	174
	0	40	64			39	20		
	40	48	81			49	61		
	80	56	120			55	85		
	120	58	135			58	109		
	160	59	136			59	128		
	200	61	143			62	125		
	240	60	151			60	121		
2002				201	80			177	182
	0	50	142			38	60		
	40	56	186			46	106		
	80	56	195			52	133		
	120	59	205			56	163		
	160	59	206			57	170		
	200	59	196			58	174		
	240	60	203			59	182		

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

Yield at Economic N calculated from the fitted response equation.