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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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for routine soil tests, and phosphorus, potassium, and lime are applied as called for by the soil tests.

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 Southeast Research Farm was 1999. The study area was cropped to soybeans in 1998. Therefore, in the initial year all yields followed soybeans. The two rotations, C-C and C-S, were initiated in 1999. The soil at this location is Kalona 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-ammonium nitrate solution (28% UAN) 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

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). Calculated economic N rates for the C-S and C-C rotations were 138 lb N/acre and 123 lb N/acre, respectively. The Minolta SPAD meter readings increased to approximately 120–160 lb N/acre for each rotation in 2002. Corn in the C-C rotation has increasingly yielded less than the C-S rotation and over the years usually required more applied N. The average soybean yield for 2002 was 59 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, Southeast 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				160	114			---	---
	0	37	121			---	---		
	40	40	141			---	---		
	80	44	155			---	---		
	120	45	160			---	---		
	160	47	165			---	---		
	200	47	157			---	---		
	240	47	163			---	---		
2000				175	70			169	192
	0	46	116			34	55		
	40	51	163			38	81		
	80	53	173			47	127		
	120	53	179			50	145		
	160	57	179			53	169		
	200	56	175			55	170		
	240	58	170			56	165		
2001				116	3			102	168
	0	57	110			48	66		
	40	59	112			49	69		
	80	61	110			55	90		
	120	62	126			54	93		
	160	62	112			58	99		
	200	61	126			59	98		
	240	62	104			61	104		
2002				167	138			94	123
	0	45	124			33	47		
	40	49	142			39	68		
	80	53	157			44	89		
	120	55	160			50	90		
	160	57	178			51	96		
	200	56	166			52	96		
	240	56	164			52	95		

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

Yield at Economic N calculated from the fitted response equation.