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Seasonal and Rotational Influences on Corn Nitrogen Requirements

John E. Sawyer

Iowa State University, jsawyer@iastate.edu

Daniel W. Barker

Iowa State University, dbarker@iastate.edu

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Abstract

This project is designed to study the 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 this 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 continuous corn and rotated corn, differences that exist between the two rotations, responses to applied N across different soils and climatic trends, and evaluation of tools for site adjustment of N application.

Keywords

Agronomy

Disciplines

Agricultural Science | Agriculture | Agronomy and Crop Sciences

Seasonal and Rotational Influences on Corn Nitrogen Requirements

John E. Sawyer, associate professor
Daniel Barker, research associate
Department of Agronomy

Introduction

This project is designed to study the 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 this 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 continuous corn and rotated corn, differences that exist between the two rotations, responses to applied N across different soils and climatic trends, and evaluation of tools for site adjustment of N application.

Materials and Methods

The first year of this research at the Northwest Research Farm was 2000. The study area was cropped to corn in 1999. Therefore, in the initial year all yields follow corn. The two rotations, continuous corn and corn rotated with soybean, were initiated in 2000. The soil at this location is Galva silty clay loam.

Tillage is fall chisel plowing and disk/field cultivation before planting. Rates of N applied to corn are 0 to 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 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 leaf greenness (ear leaf), which is an indicator of chlorophyll and nitrogen, is measured with a Minolta SPAD meter at the R1 growth stage. Relative SPAD readings are 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 yields and ear leaf greenness were responsive to applied N (Tables 1 and 2), but the yield response was not large. SPAD readings leveled off at a somewhat lower N rate than did yield, and SPAD readings were relatively high at all N rates. Relative SPAD values above 95 often indicate there will be no yield increase from additional N. Variation in response to applied N and rotation will be monitored in future years.

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 one year and therefore are not meant to represent N recommendations. They do, however, represent responses for the specific year and rotation.

Acknowledgments

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Table 1. Corn grain yield as influenced by N fertilizer rate, Northwest Research Farm, 2000.

N Rate lb N/acre	1999		2000	
	C-C	C-S	C-C	C-S
	----- bu/acre -----			
0	---	---	114	---
40	---	---	133	---
80	---	---	125	---
120	---	---	143	---
160	---	---	136	---
200	---	---	137	---
240	---	---	140	---
Optimum N, lb N/acre	---	---	97	---
Yield at Optimum N, bu/acre	---	---	135	---
LSNT, ppm	---	---	14	---
Soybean Yield, bu/acre	---	---	---	45

Optimum N calculated at a 10:1 corn:N price ratio.
Yield at optimum 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, Northwest Research Farm, 2000.

N Rate lb N/acre	1999				2000			
	SPAD Reading		Relative SPAD		SPAD Reading		Relative SPAD	
	C-C	C-S	C-C	C-S	C-C	C-S	C-C	C-S
0	---	---	---	---	49	---	96	---
40	---	---	---	---	51	---	99	---
80	---	---	---	---	53	---	102	---
120	---	---	---	---	52	---	102	---
160	---	---	---	---	52	---	101	---
200	---	---	---	---	52	---	100	---
240	---	---	---	---	51	---	---	---

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