

2001

Seasonal and Rotational Influences on Corn Nitrogen Requirements

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Recommended Citation

Sawyer, John E. and Barker, Daniel W., "Seasonal and Rotational Influences on Corn Nitrogen Requirements" (2001). *Iowa State Research Farm Progress Reports*. 1745.

http://lib.dr.iastate.edu/farms_reports/1745

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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

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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 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, continuous corn and corn rotated with soybean, 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 to 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 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), with differences in yield and response to applied N between years and rotations. The 1999 early season was much wetter than 2000. SPAD readings leveled off at a similar N rate as did yield. Relative SPAD values over 95 often indicate there will be no yield increase from additional N.

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.

Acknowledgments

Appreciation is extended to Jim Secor, McNay Farm superintendent, and his staff for their assistance with this study.

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

N Rate lb N/acre	1999		2000	
	C-C	C-S	C-C	C-S
0	---	80	85	138
40	---	98	123	149
80	---	129	143	154
120	---	146	154	154
160	---	162	154	161
200	---	165	155	153
240	---	160	151	156
Optimum N, lb N/acre	---	190	115	79
Yield at Optimum N, bu/acre	---	163	153	154
LSNT, ppm	---	4	10	18
Soybean Yield, bu/acre	---	47	---	41

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 fertilizer N rate, McNay Memorial 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	---	42	---	70	38	57	60	88
40	---	51	---	85	53	61	83	95
80	---	55	---	92	58	63	92	97
120	---	57	---	95	62	63	97	97
160	---	59	---	98	63	63	99	97
200	---	60	---	100	64	63	101	97
240	---	60	---	---	63	65	---	---

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