

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 variation. 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 Southeast Research Farm was 1999. The study area was cropped to soybean 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 Kalona 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-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 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. SPAD readings tended to level off at a similar N rate as did yield, except for the 2000 corn-soybean rotation where the SPAD readings continued to increase up to 160 lb N/acre. 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.

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

N Rate lb N/acre	1999		2000	
	C-C	C-S	C-C	C-S
	-----bu/acre-----			
0	--	121	55	116
40	--	141	81	163
80	--	155	127	173
120	--	160	145	179
160	--	165	169	179
200	--	157	170	175
240	--	163	165	170
Optimum N, lb N/acre	--	114	192	70
Yield at Optimum N, bu/acre	--	160	169	175
LSNT, ppm	--	11	7	9
Soybean Yield, bu/acre	--	52	--	48

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, Southeast 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	--	37	--	79	34	46	61	80
40	--	40	--	85	38	51	68	88
80	--	44	--	94	47	53	84	92
120	--	45	--	96	50	53	89	92
160	--	47	--	100	53	57	95	98
200	--	47	--	100	55	56	99	97
240	--	47	--	--	56	58	--	--

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