

# Seasonal and Rotational Influences on Corn Nitrogen Requirements

John E. Sawyer, associate professor  
Daniel Barker, assistant scientist  
John Lundvall, extension program specialist  
Department of Agronomy

## 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 follow 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 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 2003 (Table 1). Calculated economic N rates for the C-S and C-C rotations were 103 and 161 lb N/acre, respectively. The SPAD meter readings increased to approximately 120 lb N/acre for the C-S rotation and 160 lb N/acre for the C-C rotation in 2003. Corn in the C-C rotation has increasingly yielded less than the C-S rotation (with a yield difference of 77 bu/acre in 2003) and required more applied N (58 lb N/acre more in 2003). The average soybean yield for 2003 was 43 bushels/acre.

This study will continue in the future, and the most useful results 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 Kevin Van Dee, Southeast Farm superintendent, and his staff for their assistance with this study.

**Table 1. Corn ear leaf greenness (Minolta SPAD reading at the R1 growth stage) and corn grain yield as influenced by N fertilizer rate and rotation, Southeast Research Farm, 2003.**

Year	N Rate lb N/acre	C-S				C-C			
		SPAD	Yield ---- bu/acre ----	Economic Yield ----	N Rate lb N/acre	SPAD	Yield ---- bu/acre ----	Economic Yield ----	N Rate 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			
2003			175	103			98	161	
	0	48	132		39	33			
	40	54	160		44	50			
	80	56	167		50	79			
	120	58	186		51	91			
	160	59	166		55	102			
	200	58	179		55	98			
	240	58	172		54	97			

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

Yield at economic N calculated from the fitted response equation.