

Seasonal and Rotational Influences on Corn Nitrogen Requirements

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Introduction

This project is designed to study the nitrogen (N) fertilization needs in continuous corn (C-C) and corn rotated with soybean (C-S) as influenced by location and climate. Multiple rates of N fertilizer 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 allow the determination of N requirements for each rotation practice, differences that exist between the two rotations, responses to applied N across different soils and climatic conditions, and 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 soybean in 1998. Therefore, in the initial year all yields follow soybean. 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. Pest control practices are those typical for the region and rotation. 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 N, 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 quite high N rates in 2004 (Table 1). Calculated economic optimum N rates for the C-S and C-C rotations were 196 and 240 lb N/acre, respectively. The SPAD meter readings increased to these same N rates for each rotation. Figure 1 shows the variation in corn yield and N response for the rotations across years. Corn in the C-C rotation yielded much less than the C-S rotation in 2001–2003, but the same in 2000 and 2004. The N requirement has been higher each year for the C-C rotation. The average soybean yield for 2004 was 68 bushels/acre and was not influenced by the previous year N application to corn.

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 as long-term N recommendations. They do, however, represent responses for the specific years.

Acknowledgments

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Table 1. Corn ear leaf greenness and corn grain yield as influenced by N fertilization rate, Southeast Research Farm, 2004.

N Rate lb N/acre	C-S				C-C			
	SPAD Value	Yield bu/acre	Yield at Econ. N bu/acre	Econ. N rate lb N/acre	SPAD Value	Yield bu/acre	Yield at Econ. N ² bu/acre	Econ. N rate ¹ lb N/acre
			201	196			205	240
0	38	110			33	71		
40	41	128			36	84		
80	49	158			43	124		
120	51	165			47	136		
160	54	181			54	176		
200	57	204			56	181		
240	57	198			58	197		

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

²Yield at economic N calculated from the fitted response equation.

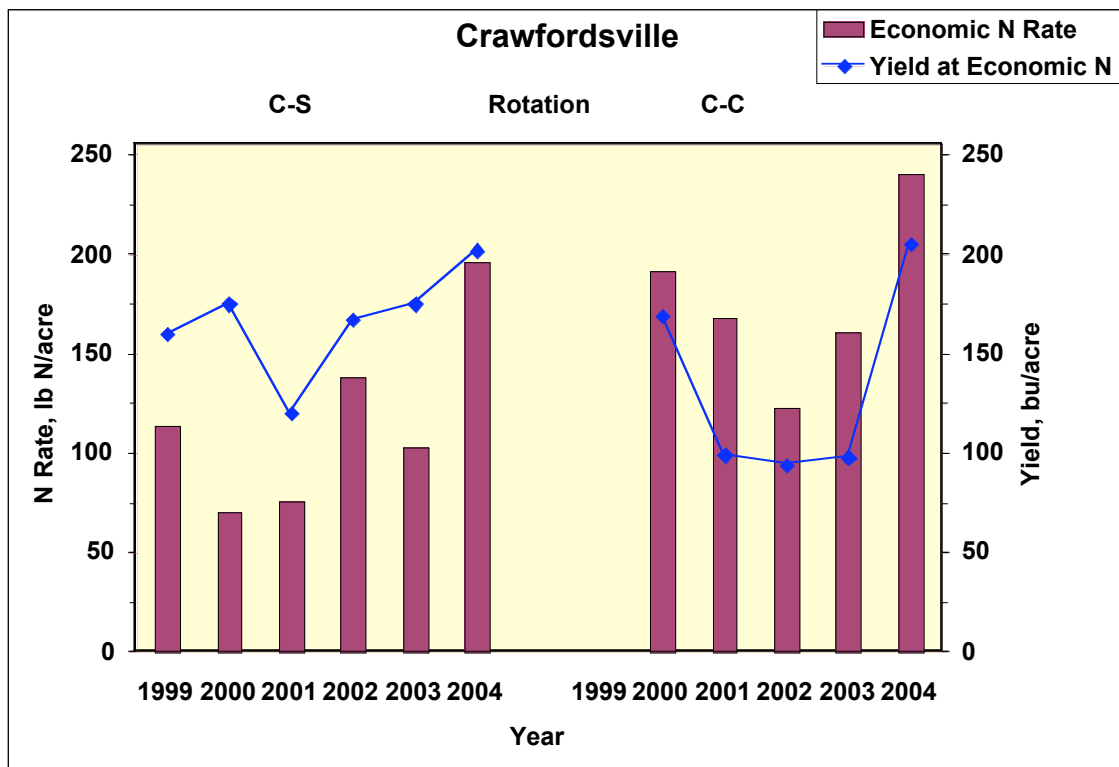


Figure 1. Corn yield and economic optimum N rate for each rotation and season, Southeast Research Farm, 2004.