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 (C-C) and corn rotated with soybean (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 rotation practice, differences that exist between the two rotations, 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 McNay Research Farm was 1999. The study area was cropped to no-till 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 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 0–240 lb N/acre in 40 lb increments. Ammonium nitrate fertilizer is the N source and is surface sidedress applied. 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). Yields were low this year due to poor growing conditions, especially for the C-C rotation. Economic N rates for the C-S and C-C rotations were 104 and 199 lb N/acre, respectively. The Minolta SPAD meter readings increased to approximately 120 lb N/acre in the C-S rotation, and 200 lb N/acre in the C-C rotation. Since 2000, corn in the C-C rotation has yielded less than the C-S rotation and over years required more applied N. Figure 1 shows the variation in yield and N response for the rotations each year. Average soybean yield for 2003 was 34 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 Jim Secor, McNay Farm superintendent, and his staff for their assistance with this study.

Table 1. Corn ear leaf greenness and corn grain yield as influenced by N fertilization rate, McNay Memorial Research Farm, 2003.

	C-S				C-C			
N Rate	SPAD Value	Yield	Yield at Econ. N	Econ. N rate	SPAD Value	Yield	Yield at Econ. N	Econ. N rate
lb N/acre		----- bu/acre -----		lb N/acre		----- bu/acre -----		lb N/acre
			116	104			83	199
0	45	69			29	9		
40	54	93			43	31		
80	59	114			53	54		
120	60	123			58	70		
160	61	112			58	73		
200	61	120			60	83		
240	61	112			60	87		

Economic optimum N calculated at a 10:1 corn:N price ratio.
Yield at economic N calculated from the fitted response equation.

Figure 1. Corn yield and economic optimum N rate for each rotation and season, McNay Memorial Research Farm, 2003.