Nitrogen Fertilization of Corn Grown with a Cover Crop

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Introduction

Objectives of this project are to study corn nitrogen (N) fertilization requirement and corn-soybean yield response when grown in a cover crop system. Multiple rates of N fertilizer are applied, with measurement of corn yield response to applied N and soybean yield with and without a fall planted winter rye cover crop. The study is being conducted at several research farms, with the intent for study across multiple years to allow comparison of with and without a cover crop system across varying soil and climatic conditions.

Materials and Methods

The first year was in 2009, with locations at the Ag Engineering/Agronomy Research Farm, Ames (Webster silty clay loam); Armstrong Research Farm, Lewis (Marshall silty clay loam); Southeast Research Farm, Crawfordsville (Mahaska silty clay loam); and the Northeast Research Farm, Nashua (Floyd loam). Each location is in a corn-soybean rotation.

The winter rye cover crop was no-till drill planted at 1 bu/acre in the fall of 2008 as soon as possible after corn and soybean harvest (Oct. 2-Oct. 20 across locations). The rye variety was “Wheeler”. The rye cover crop growth was controlled with Roundup in the spring (April 22-May 20 across locations), with the targeted control one to two weeks prior to corn planting, and at or within one week of soybean planting. The corn and soybean crops were no-till planted in 30-inch rows (April 23-May 20 across locations). Actual rye control and corn-soybean planting occurred as conditions allowed.

Nitrogen fertilizer rates were 0, 40, 80, 120, 160, and 200 lb N/acre applied early sidedress as urea-ammonium nitrate (UAN) solution. The UAN was coulter-injected on 60-inch spacing. The corn hybrid and soybean variety were early season adapted for the location. Pest management practices were those typical for the region and rotations. Corn and soybean were harvested with a plot combine and yields corrected to standard moisture.

Results and Discussion

Rye growth and aboveground biomass production (Table 1) was limited due to cold spring temperatures in 2009. At Crawfordsville before soybean, the rye was controlled much later due to wet soil conditions and therefore the rye biomass was greater with that extended spring growth period. Limited rye growth would restrict the absorption of nutrients, like nitrate-N, from the soil profile.

Soybean yield was not adversely affected by the rye cover crop in 2009, and across all locations there was no difference in yield with or without the cover crop (62.3 bu/acre with and 61.9 bu/acre without the cover crop). At one location, Ames, the soybean yield was greater following the rye cover crop than without the cover crop (Table 2).

Across all locations, corn yield was reduced by 7 bu/acre when planted in conjunction with the rye cover crop. This difference can be seen in the lower yield at each N rate (Fig. 1). The corn grain yield was the same at two locations (Crawfordsville and Nashua) and lower with the cover crop at two locations (Ames and Lewis). There was no interaction between N rate and rye cover crop, indicating that the N response was the same either with or without the rye cover crop (Fig. 1). This may have been due to the low rye biomass. The economic optimum N rate (0.10

price ratio) was the same with or without the rye cover crop (156 lb N/acre with and 158 lb N/acre without the cover crop; 197 bu/acre with and 203 bu/acre without the cover crop).

This (2009) is the first year of the project, and a year with minimal rye cover crop growth. More information regarding corn and soybean productivity, and corn N fertilization requirement, in a rye cover crop system will be determined in future years and with additional cycles of the cover crop-row crop system.

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Table 1. Aboveground winter rye biomass before controlling growth with herbicide, spring 2009.

Cover Crop	Ames	Crawfordsville	Lewis	Nashua
	- lb/acre -			
Before corn	149	86	309	35
Before soybean	289	1109	197	188

Average dry matter of four replicates.

Table 2. Soybean grain yield with and without rye cover crop, 2009.

Cover Crop	Ames	Crawfordsville	Lewis	Nashua
	- bu/acre -			
With cover crop	58.4a	69.0a	65.2a	56.5a
Without cover crop	54.2b	69.8a	66.0a	57.8a

Yields at a location followed by the same letter are not significantly different.

Figure 1. Corn grain yield response across locations to N rate with and without rye cover crop, 2009.