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Nitrogen Fertilization of Corn Grown with a Cover Crop

John E. Sawyer
Iowa State University, jsawyer@iastate.edu

Jose L. Pantoja
Iowa State University, jpantoja@iastate.edu

Daniel W. Barker
Iowa State University, dbarker@iastate.edu

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Abstract
Objectives of this project were to study corn nitrogen (N) fertilization requirement and corn-soybean yield response when grown in a rye cover cropping 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 multiple research farms, with the intent for comparison of with and without a cover crop system across varying soil and climatic conditions in Iowa.

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John Sawyer, professor
Jose Pantoja, graduate assistant
Daniel Barker, assistant scientist
Department of Agronomy

Introduction

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Materials and Methods

The first year was 2009, with locations at the Ag Engineering/Agronomy Research Farm, Boone (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 (Wheeler variety) was no-till drill planted at 1 bushel/acre in the fall of 2009 as soon as possible after corn and soybean harvest (Sept. 25–Oct. 9 after soybean and Sept. 30–Oct. 28 after corn). The rye cover crop growth was controlled with Roundup in the spring (Apr. 19–23 before corn and Apr. 28–May 10 before soybean), with the targeted control at least seven days prior to corn planting and at or within one week of soybean planting. The corn and soybean crops were no-till planted in 30-in. rows (April 28–29 for corn and May 4–20 for soybean). Actual rye control and corn-soybean planting occurred as conditions allowed.

Nitrogen fertilizer rates were applied early sidedress as urea-ammonium nitrate (UAN) solution (0, 40, 80, 120, 160, and 200 lb N/acre). The UAN was coulter-injected on 60-in. 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 (Table 1) was greater in 2010 than 2009 due to warmer spring temperatures (2009 results presented in the 2009 farm reports). In general, the rye biomass production was greatest following soybean except at Crawfordsville where the rye control before soybean planting was much later due to wet soil conditions.

At each location and averaged across locations there was no difference in soybean yield with or without the cover crop (Table 2). The average yield was 60.7 bushels/acre with and 61.0 bushels/acre without the rye cover crop.

Across locations and N rates in 2010, corn yield averaged 20 bushels/acre lower when planted in conjunction with the rye cover crop. This difference can be seen in the lower yield at each N rate (Figure 1) and at each location (Table 3). The yield difference was smallest at Nashua and largest at Ames. In 2009, the yield difference was 7 bushels/acre lower with the cover crop. In 2010, lower corn yield with the cover crop was due to reduced stand establishment (Ames) and cold/wet conditions

after planting (especially Ames and Crawfordsville). At Ames and Lewis, a fall armyworm infestation in the corn planted into the rye resulted in some plant damage and necessitated insecticide control.

There was no interaction between N rate and cover crop, indicating that the N response was the same either with or without the rye cover crop (Figure 1). In 2010, the economic optimum N rate (EONR, 0.10 price ratio) was the same with or without the rye cover crop (180 lb N/acre). The EONR was high due to the wet 2010 season.

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Table 1. Winter rye biomass dry matter before controlling growth with herbicide, spring 2010.[1]

Cover Crop	Ames	Crawfordsville	Lewis	Nashua
		lb/acre		
Before corn	1,460a	1,000b	1,245a	1,020a
Before soybean	765b	2,345a	590b	665b

[1]Means followed by the same letter within a location are not significantly different, $P \leq 0.05$.

Table 2. Soybean grain yield with and without rye cover crop, 2010.[1]

Cover Crop	Ames	Crawfordsville	Lewis	Nashua
		bu/acre		
With cover crop	53.7a	63.2a	61.0a	64.9a
Without cover crop	53.3a	61.9a	62.9a	65.9a

[1]Yields at a location followed by the same letter are not significantly different, $P \leq 0.05$.

Table 3. Corn grain yield at the maximum N rate response with and without rye cover crop, 2010.[1]

Cover Crop	Ames	Crawfordsville	Lewis	Nashua
		bu/acre		
With cover crop	109	172	171	216
Without cover crop	151	201	190	226

[1]Yields at the point of maximum N response for each location determined from regression equations.

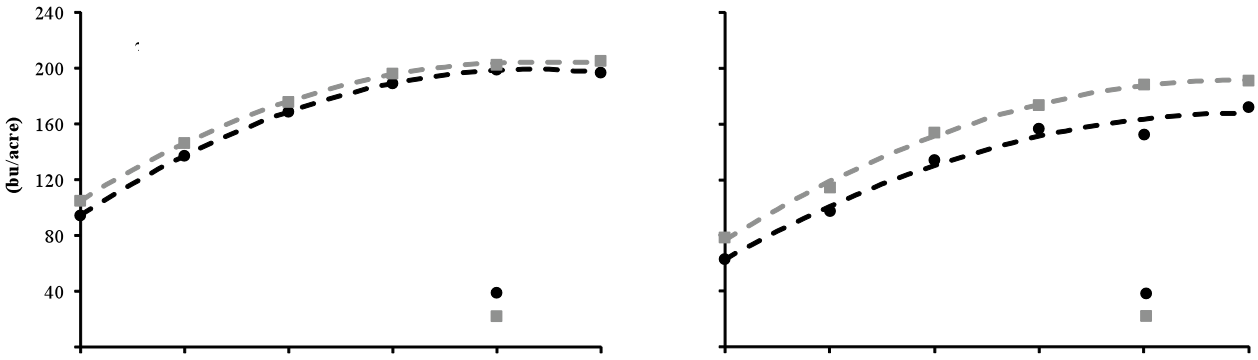

Figure 1. Corn grain yield response to N rate across locations with and without rye cover crop.