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Corn and Soybean Production with a Winter Rye Cover Crop

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Abstract

The objective of this project was 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 were 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 was 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.

Keywords

Agronomy

Disciplines

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Corn and Soybean Production with a Winter Rye Cover Crop

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Introduction

The objective of this project was 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 were 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 was 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.

Materials and Methods

The first year of the study was 2009. Sites were 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). In 2011, an additional site was added at the Northwest Research Farm, Sutherland (Primghar silty clay loam). Each site is in a no-till corn-soybean rotation.

For 2012, the winter rye cover crop (Wheeler variety) was no-till drill planted at 1 bushel/acre in the fall of 2011 after soybean and corn harvest (Sept. 21-Oct. 20 after soybean and Sept. 30-Oct. 20 after corn). The rye cover crop growth was controlled with Roundup in the spring (Apr. 6-10 before corn and Apr. 23-May 9 before soybean), with the targeted control at least 14 days before corn

planting and at or within one week of soybean planting. The corn and soybean crops were no-till planted in 30-in. rows (Apr. 23-26 for corn and May 11-17 for soybean). Rye control and corn/soybean planting occurred on a timely basis and as soil conditions allowed.

Fertilizer N rates were applied sidedress within two weeks after planting as urea-ammonium nitrate (UAN) solution (0, 40, 80, 120, 160, and 200 lb N/acre). The UAN was coultter-injected on 60-in. spacing. The corn hybrid and soybean variety were early season adapted for each site. 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 have varied between years and sites due to differences in spring conditions and the prior-year crop. In 2012, rye biomass dry matter (DM) was greatest before soybean planting (Table 1). Rye biomass was also greater with increasing prior-year N rate applied to corn (1,090 lb/acre with no N, 1,300 lb/acre with 120 lb N/acre, and 1,690 lb/acre with 200 lb N/acre).

As in past years, soybean grain yield was not affected by the rye cover crop (Table 2). Across sites, average yield was the same; 55.2 bushels/acre with and 55.9 bushels/acre without rye.

Across sites in 2012, corn yield at the maximum N response rate was 3 bushels/acre lower when planted in conjunction with the rye cover crop (Table 3). However, yield was greater with rye at Crawfordsville but lower at all other sites with rye. Corn grain yield has been lower each year with the rye cover crop,

5, 20, and 7 bushels/acre in 2011, 2010, and 2009, respectively.

In 2012, the response to N rate was different with or without the rye cover crop (Figure 1). Yield with no or low N rate was less with the rye, but at optimal and higher N rates yields were similar. The economic optimum N rate, however, was 21 lb N/acre higher with the rye cover crop (135 vs. 114 lb N/acre). Across the four years of study, there was an average 10 lb N/acre higher economic optimum N rate (156 vs. 146 lb N/acre) and a 5 percent lower corn yield (178 vs. 187 bu/acre) with the rye cover crop.

Acknowledgements

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Table 1. Winter rye biomass dry matter before controlling growth with herbicide, spring 2012.

Cover Crop	Ames	Crawfordsville	Lewis	Nashua	Sutherland
	----- lb DM/acre -----				
Before corn	960	1,460	710	510	280
Before soybean	1,950	1,380	1,150	850	1,460

Table 2. Soybean grain yield with and without rye cover crop, 2012.¹

Cover Crop	Ames	Crawfordsville	Lewis	Nashua	Sutherland
	----- bu/acre -----				
With cover crop	62.4a	56.7a	41.7a	53.1a	62.3a
Without cover crop	63.7a	56.3a	40.3a	56.0a	63.3a

¹Yields at a site followed by the same letter are not significantly different, p ≤ 0.05.

Table 3. Corn grain yield at the maximum N rate response with and without rye cover crop, 2012.¹

Cover Crop	Ames	Crawfordsville	Lewis	Nashua	Sutherland
	----- bu/acre -----				
With cover crop	173	195	110	197	161
Without cover crop	183	165	122	207	168

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

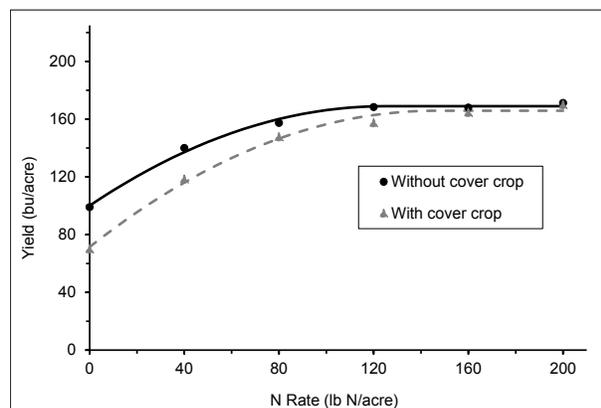


Figure 1. Corn yield response to N rate across sites with and without a rye cover crop in 2012.