2012

Soybean Production Research: Breaking the Yield Barrier, Objective 2

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Abstract

In previous research, physiological responses to agronomic variables to help us explain yield responses to our management decisions were identified. This is critical because the grower can see and understand not just from the yield but also from the physiological variables, what management decisions are important to achieve high yields. This project is a continuation of that work. The overall goal of this research is to increase soybean yield and profit faster than it currently is accomplished by intensive management. This component of the project contributes to that goal by developing information on the impacts of tillage and crop rotation on soybean growth and development, soil borne diseases, and yield. This study was conducted at two locations—the ISU Agronomy (Bruner) Farm, Ames and the ISU Northwest Research Farm, Sutherland, Iowa.

Keywords

RFR A11136, Plant Pathology and Microbiology

Disciplines

Agriculture | Plant Pathology

Soybean Production Research: Breaking the Yield Barrier, Objective 2

RFR-A11136

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Introduction

In previous research, physiological responses to agronomic variables to help us explain yield responses to our management decisions were identified. This is critical because the grower can see and understand not just from the yield but also from the physiological variables, what management decisions are important to achieve high yields. This project is a continuation of that work. The overall goal of this research is *to increase soybean yield and profit faster than it currently is accomplished by intensive management.* This component of the project contributes to that goal by developing information on the impacts of tillage and crop rotation on soybean growth and development, soil borne diseases, and yield. This study was conducted at two locations–the ISU Agronomy (Bruner) Farm, Ames and the ISU Northwest Research Farm, Sutherland, Iowa.

Materials and Methods

The experimental design was a randomized complete block in a split-split plot arrangement with four replications. Main plots were a no-tillage system (NT) and a conventional tillage system (CT) that were established in 2003. Tillage operations for conventional tillage were chisel plowing in the fall and field cultivation in the spring before planting. For no-tillage, crops were planted directly in the residue of the previous crop. Subplots consisted of six rotation sequences involving soybean and corn. The sequences were initiated in 2003 on land previously planted to corn. The sequences allow comparisons to be made of 1) first-year soybean (1SB), (after four consecutive years of corn), 2) soybean alternated annually with corn (SB/C), and 3) 2, 3, and 4 years of soybean (2SB, 3SB, 4SB) and continuous soybean (Ss). The sub-sub-plots were either ten rows of soybeans treated with a Poncho/Votivo fungicide package (PVF) or ten rows left untreated (NA).

Results and Discussion

During the growing season, there were no symptoms of sudden death syndrome, white mold, or brown stem rot found in the plots at Ames. Treatments had strong effects on several of the measured traits. Spring and fall soil samples had low SCN egg counts. Seed samples of each plot showed no presence of *Phomopsis* spp. The seed treatment seemed to contribute to a more rapid canopy development, especially from the R2 to R4 growth stages (Figure 1). We saw some significant effects of rotation, tillage, and rotation by tillage on root characteristics at the V6 growth stage, an example was that NT plots had a larger average root diameter than the CT plots. Rotation, and rotation by tillage, had an effect on percent protein, with the CT plots having higher protein, except for 1st year soybean. Rotation by tillage had a significant effect on yield (Table 1). Also included are the corn yields showing the rotation by tillage interaction (Table 2). Seed treatment had a significant effect, with the treated plots yielding more than the non-treated plots (PVF=61.3 vs. NA=57.1 bu/a). The experiment will be repeated in 2012.

Acknowledgements

We would like to thank Mike Fiscus and Jim Lee for their assistance. This work was funded by the Iowa Soybean Association under a grant initiated by Dr. Palle Pedersen, former ISU Extension Soybean Agronomist.

Table 1. Soybean yields by tillage system and rotation sequences at Ames.

			Yield (bu/a)			
CT	58.9	55.8	58.1	59.3	56.3	60.4
NT	54.3	64.2	61.9	67.4	55.8	58.2
	1SB	2SB	3SB	4SB	SB/C	Ss

1SB = first year soybean; 2SB = 2 years of soybean; 3SB = 3 years of soybean;
4SB = 4 years of soybean; SB/C = soybean/corn rotation; Ss = continuous soybean.
CT = conventional tillage; NT = no tillage.

Table 2. Corn yields by tillage system and rotation sequences at Ames.

			Yield (bu/a)			
CT	236.6	218.4	218.9	215.4	244.9	211.0
NT	226.1	200.1	207.6	195.9	216.8	200.6
	1C	2C	3C	4C	C/SB	Cc

1C = first year corn; 2C = 2 years of corn; 3C = 3 years of corn;
4C = 4 years of corn; C/SB = corn/soybean rotation; Cc = continuous corn.
CT = conventional tillage; NT = no tillage.

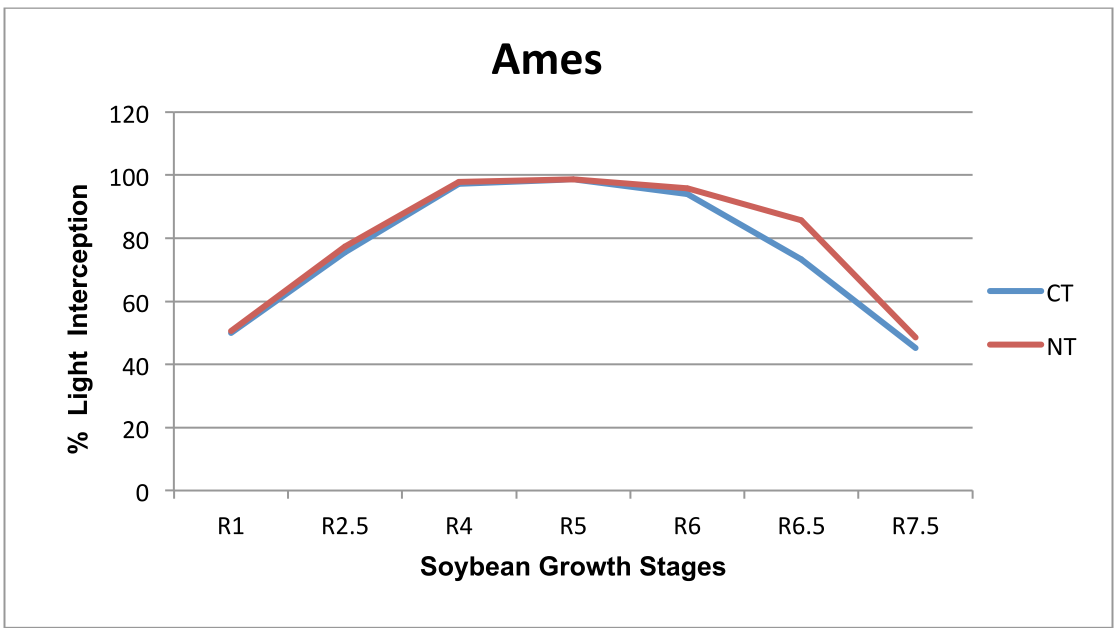

Figure 1. Percent light interception by soybean growth stages over two tillage systems