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Corn and Soybean Rotation Study

Palle Pedersen
Iowa State University

Jason De Bruin
Iowa State University

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Abstract
Crop rotation and tillage systems have an impact on both production cost and yield. The use of an alternating corn and soybean rotation rather than continuous corn or soybean typically results in higher net return and lower variability since the economics of crop rotation are largely tied to the effect of introducing a break crop. However, limited research exits in Iowa with just corn and soybean in the rotations. The objective of this study was to determine the long-term effect on yield and profitability with continuous corn or soybean vs. rotated corn and soybean using different tillage systems. The study is conducted at two locations—Ames and the ISU Northwest Research Farm, Sutherland, IA.

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Palle Pedersen, assistant professor
Jason De Bruin, program manager
Department of Agronomy

Introduction

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Materials and Methods

The experimental design was a randomized complete block in a split-split plot arrangement with four replications. Main plots were no-tillage systems and conventional tillage systems 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 12 rotation sequences involving corn and soybean. The sequences were initiated in 2003 on land previously planted to corn. The sequences allow comparisons to be made during 2008 of 1) first-year corn and soybean (after four consecutive years of the other crop), 2) corn and soybean alternated annually with the other crop, and 3) 2, 3, and 4 years of continuous corn and soybean. Plot size of the sub-sub plots was 10 ft by 25 ft that for corn was the hybrid H-8803BT, H-8803BT with Aztec insecticide applied at 7.6 lb per 1,000 ft, and H-8805BT/RW. For soybean, no treatments were applied to the sub-sub plots and the soybean variety NK-S28Y2 was planted in all plots. Plots were sprayed with herbicide and insecticide as needed. In the fall 50 lb of P and 80 lb of K was applied to all plots. After planting, 180 lb of N was applied to all corn plots. Soybean plots were harvested with a small-plot combine on September 30 and seed yields were adjusted to 13% moisture. Corn plots were harvested on October 30 and grain yields were adjusted to 15.5% moisture. Data are presented in Tables 1 and 2. No data on any of the interactions will be presented here in order to simplify the tables and this report.

Results and Discussion

Average corn yield was 179.3 bushels/acre and average soybean yield was 57.2 bushels/acre. Tillage did not influence either corn or soybean yield. For corn, moisture increased and lodging increased using a no-tillage system. Tillage did not influence soybean moisture. Both first-year corn and soybean produced the highest yields at 204.7 bushels/acre and 61.7 bushels/acre compared with the other five rotation sequences that averaged 174.1 bushels/acre and 56.3 bushels/acre, respectively. Second-year corn and soybean produced 15% and 5% less yield, respectively, than the traditional annual rotation of corn and soybean. For corn, the hybrid H-8805BT/RW yielded 4.1 and 8.6 bushels/acre more across tillage system and rotation sequences than H-8803BT and H-8803BT with Aztec insecticide. This rotation study will continue in 2009.

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Table 1. Effect of crop rotation and tillage system on corn yield, moisture, and lodging.

Tillage	Rotation	Hybrid	Yield (bu/a)	Moisture (%)	Broken/lodged (%)
Conventional tillage			176.6a†	26.1b	16.5a
No tillage			181.4a	26.3a	5.4b
	1st year corn		204.7a	26.0a	0.5d
	2nd year corn		167.2b	25.7b	36.4a
	3rd year corn		165.9b	27.1a	14.4b
	4th year corn		173.8b	26.7a	9.2bc
	Continuous corn		168.0b	24.9b	2.8cd
	C/SB rotation		195.8a	26.6a	0.9d
		H-8803Bt	179.1b	26.4a	21.2a
		H-8803Bt + Aztec	174.6c	26.4a	1.9c
		H-8805Bt/RW	183.2a	25.7b	9.8b

†Values in each column within tillage system, rotation sequence, or hybrid followed by the same letter are not significantly different at the 0.10 probability level.

Table 2. Effect of crop rotation and tillage system on soybean moisture and yield.

Tillage	Rotation	Moisture (%)	Yield (bu/a)
No tillage		11.8a	56.9a†
Conventional tillage		11.8a	57.5a
	1st year soybean	11.8b	61.7a
	2nd year soybean	11.9ab	56.7bc
	3rd year soybean	11.9ab	56.7bc
	4th year soybean	11.8b	54.6c
	Continuous soybean	11.6c	53.8c
	SB/C rotation	12.0a	59.7ab

†Values in each column within tillage system and rotation sequence followed by the same letter are not significantly different at the 0.10 probability level.