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Tillage Study for Corn and Soybean: Comparing Vertical, Deep, and No-Till

E. A. Adee
Kansas State University, eadee@ksu.edu

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Abstract

The need for tillage in corn and soybean production in the Kansas River Valley continues to be debated. The soils of the Kansas River Valley are highly variable, with much of the soil sandy to silty loam in texture. These soils tend to be relatively low in organic matter (<2%) and susceptible to wind erosion. Although typically well drained, these soils can develop compaction layers under certain conditions. A tillage study was initiated in the fall of 2011 at the Kansas River Valley Experiment Field near Topeka to compare deep vs. shallow vs. no-till vs. deep tillage in alternate years. Corn and soybean crops are rotated annually. This is intended to be a long-term study to determine if soil characteristics and yields change in response to a history of each tillage system.

Keywords

no-till, vertical tillage, deep tillage, shallow tillage, corn, soybean, Kansas River Valley Experiment Field

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Introduction

The need for tillage in corn and soybean production in the Kansas River Valley continues to be debated. The soils of the Kansas River Valley are highly variable, with much of the soil sandy to silty loam in texture. These soils tend to be relatively low in organic matter (<2%) and susceptible to wind erosion. Although typically well drained, these soils can develop compaction layers under certain conditions. A tillage study was initiated in the fall of 2011 at the Kansas River Valley Experiment Field near Topeka to compare deep vs. shallow vs. no-till vs. deep tillage in alternate years. Corn and soybean crops are rotated annually. This is intended to be a long-term study to determine if soil characteristics and yields change in response to a history of each tillage system.

Procedures

A tillage study was laid out in the fall of 2011 in a field that had been planted with soybean. The tillage treatments were (1) no-till, (2) deep tillage in the fall and shallow tillage in the spring every year, (3) shallow tillage in the fall following both crops, and (4) deep tillage followed by a shallow tillage in the spring only after soybean, and shallow tilled in the fall after corn. The fall of 2010, prior to the soybean crop, the entire field was subsoiled with a John Deere (John Deere, Moline, IL) V-ripper. After soybean harvest, 30-ft × 100-ft individual plots were tilled with a Great Plains (Great Plains Mfg., Salina, KS) TurboMax vertical tillage tool at 3 in. deep or a John Deere V-ripper at 14 in. deep. Spring tillage was with a field cultivator. In the fall of 2012, the treatments were with the TurboMax or a Great Plains Sub-Soiler Inline Ripper SS0300. Spring tillage in 2013 and 2014 was with the TurboMax on the required treatments. Each tillage treatment had four replications. Dry fertilizer (11-50-0 and 0-0-60 nitrogen-phosphorus-potassium, or NPK) was applied at 200 lb/a for each product to the entire field prior to fall tillage. Nitrogen (150 lb in 2012 and 2013, 185 lb in 2014) was applied in March prior to corn planting. Corn hybrid Pioneer 1395 was planted at 30,600 seeds/a on April 12, 2012; P1498HR on April 30, 2013; and P1105 at 32,000 seeds/a on April 21, 2014. Soybean variety Pioneer 93Y92 was planted at 155,000 seeds/a on May 14, 2012; P94Y01 on May 15, 2013; and Asgrow 3833 at 140,000 on May 21, 2014. Soybean were planted after soybean in the setup year. Irrigation to meet evapotranspiration (ET) rates began May 26 and concluded August 1 for corn, and began July 5 and concluded August 23 for soybean in 2012. Irrigation for corn started June 24, 2013, and concluded August 1. Irrigation for soybean in 2013 started June 30 and concluded September 8. Irrigation in 2014 started July 1 and ended Aug 16 for corn, and started

July 22 and ended Aug 22 for soybeans. Two yields were taken from each plot from the middle 2 rows of planter passes. Corn was harvested on August 31, 2012; September 25, 2013; and September 11, 2014. Soybean were harvested on October 5, 2012; October 10, 2013; and October 9, 2014.

Results

Yields of corn or soybean did not differ due to tillage in the setup year of the study (Table 1). The yields were respectable considering the extreme heat and drought experienced this growing season. Growing conditions were better in 2013, resulting in higher yields in both corn and soybean, but no significant differences were detected among tillage treatments (Table 2). In 2014, corn yields were very good and soybean yields were lowered by sudden death syndrome (SDS), but no differences were detected among tillage treatments (Table 3). Combining data from 2013 and 2014 for analysis did not result in any differences among tillage treatments (Table 3). We anticipate that it will take several years for any characteristics of a given tillage system to build up to the point of influencing yields.

Table 1. Effects of tillage treatments on corn and soybean yields, Kansas River Valley Experiment Field, 2012

Tillage treatment	Corn yield	Soybean yield
	---------- bu/a ----------	
No-till	196	57.2
Fall subsoil/spring field cultivation	202	58.1
Fall vertical till	198	58.1
LSD 0.05	NS[1]	NS

[1] Not significant.

Table 2. Effects of tillage treatments on corn yields, Kansas River Valley Experiment Field, 2013 and 2014

	Corn yield		
Tillage treatment	2013	2014	Average
	---------- bu/a ----------		
No-till	221	243	232
Fall subsoil/spring field cultivation	217	259	238
Fall vertical till	196	259	228
Fall subsoil after soybean/vertical till after corn	219	256	238
LSD 0.05	NS[1]	NS	NS

[1] Not significant.

Table 3. Effects of tillage treatments on soybean yields, Kansas River Valley Experiment Field, 2013 and 2014

	Soybean yield		
Tillage treatment	2013	2014	Average
	---------- bu/a ----------		
No-till	62.4	52.8	57.6
Fall subsoil/spring field cultivation	64.3	54.6	59.4
Fall vertical till	64.4	55.5	60.0
Fall subsoil after soybean/vertical till after corn	66.3	53.4	59.8
LSD 0.05	NS[1]	NS	NS

[1] Not significant.