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Tillage Study for Corn and Soybeans: Comparing Vertical, Deep, and No-till

E.A. Adee

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 will be 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 V-ripper. After soybean harvest, 30-ft × 100-ft individual plots were tilled with a Great Plains TurboMax vertical tillage tool at 3 in. deep or a John Deere V-ripper at 14 in. deep. Spring tillage was done with a field cultivator. Starting in the fall of 2012 the treatments were done with the TurboMax or a Great Plains Sub-soiler Inline Ripper SS0300. Spring tillage in 2013-2015 was with the TurboMax on the required treatments. Each tillage treatment had 4 replications. Dry fertilizer (11-52-60 NPK) was applied to the entire field prior to fall tillage in 2012 and to the soybean stubble in 2013 and 2014. In fall of 2015, 14-52-40-10 (NPKS) was applied prior to fall tillage. Nitrogen (150 lb in 2012 and 2013, 185 lb in 2014 and 2015) 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; P1105 at 32,000 on April 21, 2014, and April 14, 2015. Soybean variety Pioneer 93Y92 was planted at 155,000 seeds/a on May 14, 2012; P94Y01 on May 15, 2013; Asgrow 3833 at 140,000 on May 21, 2014; and Midland 3884NR2 with ILeVO seed treatment at 144,000 seeds/a on June 1, 2015. Soybeans were planted after soybeans in the setup year. Irrigation to meet evapotranspiration (ET) rates was started May 26 and concluded August 1 for corn, and started July 5 and concluded August 23 for soybean in 2012. Irrigation for corn started June 24, 2013 and concluded August 1. Irrigation for soybeans in 2013 started June 30 and concluded September 8. Irrigation in 2014 started July 1 and ended

August 16 for corn, and started July 22 and ended August 22 for soybeans. In 2015, the first irrigation for both crops was June 23, and the last on August 24. 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, September 11, 2014, and September 10, 2015. Soybeans were harvested on October 5, 2012, October 10, 2013, October 9, 2014, and October 3, 2015.

Results

Yields of corn or soybeans 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. The growing conditions were better in 2013, resulting in higher yields in both corn and soybeans but no significant differences between tillage treatments (Table 2 and 3). In 2014, the corn yields were very good and Sudden Death Syndrome (SDS) lowered soybean yields, but there were no differences between tillage treatments (Tables 2 and 3). The cool and rainy start to the season in 2015 slowed corn growth and lowered yields, while the soybeans had very good yields (Tables 2 and 3). Combining data from 2013-2015 for analysis did not result in any differences between tillage treatments in corn or soybean yields (Tables 2 and 3). Averages of stand counts taken at the V5 stage in the corn for 2014 and 2015 did not show any differences (Table 2). 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 in 2012 at Kansas River Valley Experiment Field

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

*Not significant.

Table 2. Effects of tillage treatments on corn yields and plant stands in 2013-2015 at Kansas River Valley Experiment Field

Tillage treatment	Corn yield			Average corn yield	Average stand 2014 and 2015
	2013	2014	2015		
	----- bu/a -----				plants/a
No-till	221	243	205	223	32,125
Fall subsoil/spring field cultivate	217	259	213	230	31,313
Fall vertical till	196	259	207	221	31,531
Fall subsoil after sb/vertical till after corn	219	256	214	230	32,000
LSD 0.05	NS*	NS	NS	NS	NS

*Not significant.

Table 3. Effects of tillage treatments on soybean yields in 2013-2015 at Kansas River Valley Experiment Field

Tillage treatment	Soybean yield			Average soybean yield
	2013	2014	2015	
	----- bu/a -----			
No-till	62.4	52.8	69.7	61.6
Fall subsoil/spring field cultivate	64.3	54.6	73.1	64.0
Fall vertical till	64.4	55.5	72.8	64.2
Fall subsoil after sb/vertical till after corn	66.3	53.4	70.9	63.5
LSD 0.05	NS*	NS	NS	NS

*Not significant.