DRYLAND STRIP-TILL IN WESTERN KANSAS

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ABSTRACT

Interest in strip-till has risen over the past few years. Questions about whether strip-till is beneficial on dryland fields is a major concern for producers in western Kansas evaluating this process. To provide answers to some of these questions, a farmer assisted field study was initiated in the fall of 2003. The objectives of this research were to compare no-till to strip-till fertilizer treatments applied at various timings. No response to strip-till was observed with grain sorghum in 2004 and 2005. Grain sorghum root development was likely more influenced by soil moisture than tillage system. For sunflower, a spring applied liquid strip-till and winter applied anhydrous ammonia strip-till yielded more than no-till over both years. Sunflower root development was probably more influenced by tillage than by soil moisture.

INTRODUCTION

Strip-till is a tillage process by which a six to ten inch strip of ground is tilled. The basic configuration consists of a coulter, disks, and a sub-surface knife for injecting fertilizer. Questions from farmers about whether dryland strip-till is a viable production option in Northwest Kansas have arisen over the past few years. Some of the benefits to strip-till may include warming of the ground in the spring which provides an ideal environment for seedling crops and destruction of compaction zones which are prevalent in western Kansas fields. However, by working the ground, moisture loss could negate any benefit strip-till could provide on dryland fields. Therefore, the objectives of this research were to compare no-till to strip-till fertilizer treatments applied at various timings.

MATERIALS AND METHODS

A two year farmer assisted field research study was conducted on fields of wheat stubble ½ mile east of Quinter, KS. In 2004, previous cropping history indicated the field had been no-till for the previous five years, whereas for the 2005 site, the previous cropping history indicated the field had been no-till for the previous four years. Treatment 1 consisted of a fall applied strip-till treatment of 50 lbs/A of N applied as 28% UAN which was strip-tilled on December 1, 2003 and December 13, 2004. Treatment 2 was anhydrous ammonia strip-tilled on January 23, 2004 and December 13, 2004 at 50 lbs/A of N. For Treatment 3, 50 lbs/A of N applied as 32% UAN was strip-tilled on April 19, 2004 and April 27, 2005. At planting, an additional 25 lbs/A of N was applied as urea in a 2x2 (two inches over from the planted row and two inches in the soil) for all strip-till treatments. For Treatment 4 (the no-till treatment), 75 lbs/A of N was applied as urea in a 2x2 at planting. All treatments had a total of 75 lbs/A of N applied. Plot size was 8-30 inch rows wide by 600 feet long. Treatments were randomized across three replications for each crop. DeKalb DKF 3880 CL (sunflower) was planted on May 28, 2004 at 17,300 seeds/A and

May 20, 2005 at 18,900 seeds/A. Appropriate pest management measures were taken to control weeds and head moth in the sunflower. NC+ 5B89 (grain sorghum) was planted on May 28, 2004 at 51,800 seeds/A and May 20, 2005 at 55,000 seeds/A. Plots were harvested on October 9, 2004 and October 7, 2005.

In 2004, the site had higher than normal average rainfall for the period of April to September (2004 - 20.51 inches, Average - 17.79 inches). The higher than average rainfall along with the cooler than normal temperatures for June and July allowed for adequate moisture to be available to meet the needs of the crops even though the crops were planted on eighteen inches of subsoil containing available moisture. In 2005, rainfall was near normal for the growing season with adequate subsoil moisture available at planting.

Root measurements were taken on five randomly selected plants from each plot after grain harvest. Roots were extracted carefully from the soil for Treatment 2 and 4 for grain sorghum and Treatment 3 and 4 for sunflower. Roots were then washed, tagged, and air dried.

Root scores were obtained by evaluating all of the roots from the plot. For sunflower, taproot mass was assessed on a scale of 1 to 5 with 1 equal to greatest taproot mass and 5 equal to least taproot mass. Straightness of taproot was gauged on a scale of 1 to 5 with 1 equal to very straight while 5 equals significant turning. For grain sorghum, root mass was assessed on a scale of 1 to 5 with 1 equal to greatest root mass and 5 equal to least root mass. Straightness of root mass was gauged on a scale of 1 to 5 with 1 equal to very straight while 5 equals significant turning. Lateral roots were scored on a scale of 1 to 5 with 1 equal to abundant lateral roots and 5 equal to sparse lateral roots, while secondary roots were evaluated on a scale of 1 to 5 with 1 equal to abundant and 5 equal to sparse.

RESULTS AND DISCUSSION

Results from 2004 and 2005 suggest a benefit to strip-tilled sunflowers compared to no-tilled sunflowers, while there were no difference observed for grain sorghum. With sunflowers, two of the three strip-till treatments yielded more than no-till when results were combined across years (Table 1). The number of plants per acre were higher in these treatments compared to no-till in 2004 while the difference in population between strip-till treatments compared with no-till is not as dramatic in 2005. Higher numbers of seedling survival may be one reason why strip-till yielded more. Another reason for the higher yields for the strip-till treatments could be better root development (Table 2). Roots examined from the strip-till treatment had straighter roots with more lateral and secondary root growth than those extracted from the no-till treatment. Although the field had been in no-till prior to the study for four to five years, root growth was still impeded which in turn likely affected yield.

For grain sorghum, there was no difference in grain yield (Table 3). Root measurements in 2004 indicated root mass and straightness of the root mass was higher in the strip-till treatment, whereas there was no difference in root development for straightness, mass, laterals, and secondary roots in 2005 (Table 4). The difference in development between the two years possibly could explained by the difference in soil conditions at planting. The increased straightness of root mass with more root mass in the 2004 strip-till treatment was probably due to the grain sorghum root more easily exploring the loosened soil in the strip-till treatment verus the no-till treatment. However, in 2005, soil moisture was prevalent the first few weeks after planting which probably allowed for roots in both treatments to adequately develop.

In summary, there was a positive response to strip-tilling sunflower with Treatment 2 and 3 yielding more than Treatment 4 (no-till) over both years. Sunflower root development was likely influenced by tillage than by soil moisture. For grain sorghum. no response to strip-till was observed in either 2004 and 2005. Grain sorghum root development was probably more influenced by soil moisture than tillage system.

Table 1. Sunflower Yield - 2004 and 2005

Trts	Tillage	Test weight	Population (plts/A)		Lbs/A
			2004	2005	adj. 10.0% moisture
2	Strip-till	29.6	12900	18000	2225
3	Strip-till	28.9	15700	17500	2218
4	No-till	29.8	11200	16500	2008
1	Strip-till	29.4	13600	16800	1984
	LSD (0.05)	NS	1084		167

Table 2. Sunflower Root Scores - 2004 and 2005

Trts	Tillage	Root Mass	Tap Root Straightness	Lateral Roots	Secondary Roots
3	Strip-till	2.9	1.9	2.1	2.4
4	No-till	2.9	3.1	3.0	3.3
	LSD (0.05)	NS	0.77	0.48	0.55

Table 3. Grain Sorghum Yield - 2004 and 2005

Trts	Tillage	Test weight	bu/A adj. 14.0% moisture
1	Strip-till	56.7	114
4	No-till	56.4	113
2	Strip-till	56.2	113
3	Strip-till	55.7	111
	LSD (0.05)	NS	NS

Table 4. Grain Sorghum Root Scores - 2004 and 2005

Trts	Tillage	Root Mass		Root Mass Straightness		Lateral Roots		Secondary Roots	
		2004	2005	2004	2005	2004	2005	2004	2005
2	Strip-till	1.3	3.3	1.3	3.1	1.3	3.0	1.3	3.1
4	No-till	4.0	3.0	3.0	2.6	2	2.7	2	2.7
	LSD (0.05)	1.85	NS	0.93	NS	NS	NS	NS	NS