Row Crop Performance with Tillage Systems and Placement of Fertilizer

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Field trials were conducted at the NDSU Carrington Research Extension Center to examine row crop response to tillage systems, with emphasis on strip till. Crop and test years included: soybean, 2005-06, 2009-10; sunflower, 2006-09; corn, 2007-10; and pinto bean, 2007 and 2009-10. The dryland trials were established on a Heimdal-Emrick loam soil with spring wheat as the previous crop. Conventional-till treatments were tilled at a 2- to 4-inch depth in the fall and spring before planting, and also between plant rows during the growing season. Strip-till treatments were established in the fall (October or November) and in the spring (April, 2006-07) using a Yetter strip-till unit set at a depth of 3 to 7 inches that produced 8- to 12-inch wide tilled strips. Soybean was planted in 21-inch rows in 2005, and all crops were planted in 30-inch rows during 2006-10. In 2008-10 for corn and 2008-09 for sunflower, treatments included 4- to 6-gal/ac of 10-34-0 liquid fertilizer applied deep-band (5-7 inches) in the previous fall, and in-furrow and 2- by 2-inch band during planting. In 2010, an additional corn fertilizer treatment was 3 gal/ac of fall deep band 10-34-0 followed by 3 gal/ac in-furrow applied during planting. During 2009-10, fertilizer placement treatments were added to dry bean and soybean trials, which included 4-6 gal/ac of 10-34-0 liquid fertilizer band applied as in-furrow, 2- by 2-inch, and mid-row during planting.

Table 1 summarizes seed yield of the four crops. Soybean yield in 2010 with strip till was greater than conventional till. Across years, reduced till averaged 2 to 2.5 bu/ac greater yield than conventional till, likely due to more stored soil moisture available for the crop with no-till (direct seed) and strip till. Corn and sunflower seed yield were similar among tillage systems each year. The four-year average corn yield tended to be highest with conventional till compared to reduced till. Fall strip-tilled pinto bean had a greater seed yield compared to other tillage treatments in 2007. In 2009, conventional-till pinto bean yield was greater than yield with no-till. Across years, conventional- and strip-till pinto bean yield tended to be greater than yield with no-till.

Fertilizer applied as mid-row during soybean planting.

Table 1. Crop yield with tillage systems, Carrington, 2005-10.

	Soybean					Sunflower					Corn					Dry bean			
Tillage system	2005	2006	2009	2010	Avg.	2006	2007	2008	2009	Avg.	2007	2008	2009	2010	Avg.	2007	2009	2010	Avg.
	bu/ac					lb/ac					bu/ac					lb/ac			
Conventional	21.7	16.2	35.7	47.5	30.3	1160	1040	1173	733	1027	155.8	109.5	94.7	163.8	131.0	1820	2533	2949	2434
No-till	22.6	18.1	38.5	50.1	32.3	1338	956	1253	730	1069	140.1	104.0	93.4	171.6	127.3	1886	2074	2824	2261
Strip till (fall)	23.4	18.4	37.7	51.7	32.8	1134	1086	1501	870	1148	160.8	96.2	90.8	166.7	128.6	2129	2286	3069	2495
Strip till (spring)	x	18.4	x	x	x	1379	942	x	x	x	166.9	x	x	x	x	1745	x	x	x
LSD (0.05)		NS		3.0	N/A		NS			N/A		NS			N/A	209	306	NS	N/A

Discussion on crop response to fertilizer placement will be focused on corn. Table 2 indicates 2008-10 corn performance with tillage systems and placement of fertilizer. Due to a high level of soil phosphorus (20 ppm) in 2008, crop response with fertilizer placement did not occur except with days to silk. Silk date was delayed one to two days without banded fertilizer. In 2009, soil phosphorus was at a medium level (9 ppm). Plant emergence slightly varied among treatments. In-furrow fertilizer resulted in taller plants early in the season (data not shown) and earlier silk date compared to other strip-till fertilizer treatments. Corn seed yield and quality were similar among treatments. This likely was due to less than adequate level of soil nitrogen available during the growing season. However, yield tended to be highest with strip till with fall deep-banded fertilizer. Also, test weight tended to be highest and seed moisture lowest with in-furrow placed fertilizer in strip till. In 2010, soil phosphorus was at a medium level (10 ppm). Plant development and stand were similar among treatments. Seed yield and quality were similar among methods of fertilizer application but yield tended to be highest with the sequential fall deep band and in-furrow application of fertilizer.

Table 2. Corn response to tillage systems and placement of fertilizer, Carrington, 2008-10.

Tillage system/ fertilizer placement[1]	2008 Plant Emerge	2008 Silk Date	2008 Stand	2008 Seed Yield	2008 TW	2008 Seed Moisture	2009 Plant Emerge	2009 Silk Date	2009 Stand	2009 Seed Yield	2009 TW	2009 Seed Moisture	2010 Plant Emerge	2010 Silk Date	2010 Stand	2010 Seed Yield	2010 TW	2010 Seed Moisture
	-- Jday --		plt/ac	bu/ac	lb/bu	-- % --	-- Jday --		plt/ac	bu/ac	lb/bu	-- % --	-- Jday --		plt/ac	bu/ac	lb/bu	%
Conventional/ 2x2 inch band	149	217	29,880	109.5	55.5	22.7	152	222	31210	94.7	51.4	22.0	144	207	29880	163.8	55.7	17.0
No-till/ 2x2 inch band	150	218	27,890	104.0	54.6	22.5	153	223	30545	93.4	50.2	22.1	144	209	30215	171.6	55.8	16.9
Strip till/ 2x2 inch band	150	218	31,875	96.2	54.9	23.6	152	222	31210	90.8	51.3	21.5	144	208	30875	166.7	55.5	16.9
Strip till/in-furrow	151	217	24,570	100.5	55.1	21.9	152	219	29215	88.0	52.9	19.6	144	208	28885	162.6	55.3	17.3
Strip till/ fall band	150	218	26,560	95.6	54.0	24.2	151	222	33535	102.2	51.9	20.8	144	208	31540	165.4	55.6	17.0
Strip till/fall band in-furrow	x	x	x	x	x	x	x	x	x	x	x	x	144	208	28220	174.2	55.5	17.1
Strip till/none	150	219	26,560	92.8	54.5	24.4	152	222	29550	94.0	51.3	20.4	144	209	28220	167.0	55.1	17.3
LSD (0.05)	NS	1		NS			1	1		NS		1.3				NS		

[1]Strip till = fall (October 23, 2007; October 31, 2008); 10-34-0 applied at 5 gal/ac in 2008 and 6 gal/ac in 2009-10.

Tillage and fertilizer placement trials have been initiated during the fall of 2010 to continue testing corn, dry bean and soybean performance in 2011.