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Conservation Tillage Study

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Abstract

The project goal was to compare yields of three different tillage systems on a sloping, moderately well drained soil (Nira) and on a nearly level, poorly drained soil (Kalona) in a continuous corn and a corn-soybean system. The plots began in 1990.

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Introduction

The project goal was to compare yields of three different tillage systems on a sloping, moderately well drained soil (Nira) and on a nearly level, poorly drained soil (Kalona) in a continuous corn and a corn-soybean system. The plots began in 1990.

Materials and Methods

In the chisel-disk system, the plots previously in corn were chiseled in the fall. Both corn and soybean plots in this system were spring disked and field cultivated.

In the “alternative” tillage system, the continuous corn ground was fall chiseled and then planted in the spring without further tillage. In the corn-soybean rotation, the soybeans were no-till drilled on 10-in. rows and the corn was planted following one spring pass of the soybean stubble with a field cultivator.

No fall or spring tillage was done in the no-till system. For planting in the no-till system, the planter was equipped with a knife and coulter for the fertilizer opener, a fluted coulter, and finger row cleaning wheels for residue clearing.

Nitrogen was spring applied and an N-P-K dry fertilizer was applied with the planter. Soil tests were high to very high so a rate of P and K below crop removal was applied.

Results and Discussion

Table 1 contains the past 12-year yields for each tillage system and crop sequence on both

the Nira and Kalona soils. Yields prior to 2000 were summarized in previous annual reports.

During the past 12 years, the chisel-disk system yielded more than the no-till system by about 12 bushels/acre for continuous corn and by 2 to 5 bushels/acre for rotated corn. The alternative tillage system, that has more limited tillage than the chisel-disk system, averaged from 3 bushels/acre less to 3 bushels/acre more than the chisel-disk system.

The largest yield differences between the no-till and chisel-disk systems were usually seen in years with wet springs and perhaps less than ideal conditions at planting. These conditions can increase problems with sidewall or planter furrow compaction causing yield reductions in the no-till planted corn.

There was also a marked difference in corn yields between the continuous corn and the corn-soybean rotation. In the past twelve years, rotated corn on the Kalona soil averaged 5 to 15 bushels/acre higher yield than the continuous corn. On the Nira soil, there was a 25 to 33 bushels/acre difference. The higher yield differences on the Nira soil may be attributed in part to some sidehill seep wetness problems in the continuous corn in spite of drainage tile that has been installed. Although there were year-to-year variations, for most years these yield differences were present.

Soybean yields between tillage systems are similar. Twelve-year averages showed a 1.7 bushels/acre difference between the chisel-disk and the no-till systems on the Kalona soil and 1.2 bushels/acre difference on the Nira soil.

This fits with other observations that soybeans usually do not suffer the sidewall compaction problems of corn and that yields are similar between tillage systems. In the past 12 years,

the 10-in. row no-till soybeans have not shown a yield difference from the 30-in. row soybeans.

Table 1. Yield results for Kalona and Nira soils.

	Kalona Soil			Nira Soil		
	Corn on corn yield - bu/acre			Corn on corn yield - bu/acre		
	No-till	Alternative	Chisel-disk	No-till	Alternative	Chisel-disk
2000	154	153	152	120	123	124
2001	107	121	123	107	112	112
2002	106	127	128	117	114	127
2003	93	112	96	84	89	95
2004	161	174	168	170	184	194
2005	88	123	127	57	82	74
2006	191	196	193	189	196	195
2007	131	171	161	136	152	174
2008	170	173	175	187	216	202
2009	146	182	144	161	180	189
2010	178	138	199	114	104	85
2011	140	171	144	151	162	160
Average	138.8	153.5	150.9	132.8	142.9	144.4
	Corn on soybean yield - bu/acre			Corn on soybean yield - bu/acre		
	No-till	Alternative	Chisel-disk	No-till	Alternative	Chisel-disk
	No-till	Alternative	Chisel-disk	No-till	Alternative	Chisel-disk
2000	160	148	149	169	157	166
2001	124	127	123	135	138	137
2002	139	145	146	164	155	166
2003	153	164	172	180	186	175
2004	162	166	162	185	185	186
2005	151	161	174	118	126	145
2006	186	179	181	195	197	182
2007	126	151	140	178	193	204
2008	152	159	164	174	180	193
2009	158	160	155	205	204	202
2010	170	170	165	130	128	121
2011	159	150	147	149	156	168
Average	153.4	156.7	156.5	165.2	167.1	170.3
	Soybean yield - bu/acre			Soybean yield - bu/acre		
	No-till	Alternative	Chisel-disk	No-till	Alternative	Chisel-disk
	No-till	Alternative	Chisel-disk	No-till	Alternative	Chisel-disk
2000	40.4	35.3	42.4	42.3	41.1	42.1
2001	39.8	38.5	39.9	41.2	39.6	42.3
2002	49.3	48.7	49.9	51.6	51.5	53.7
2003	31.8	30.9	33.7	29.2	28.8	30.5
2004	51.9	52.8	51.8	49.8	51.4	51.9
2005	54.2	52.0	57.0	52.2	50.5	51.7
2006	50.8	49.9	54.7	61.8	61.6	63.5
2007	52.0	50.0	45.4	50.8	51.2	56.3
2008	40.4	36.3	40.6	44.0	46.3	49.2
2009	57.6	60.7	40.7	67.9	69.8	66.8
2010	53.1	48.3	48.4	60.8	55.1	62.7
2011	47.1	41.9	44.2	56.4	57.3	52.6
Average	47.4	45.4	45.7	50.7	50.4	51.9