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Conservation Tillage Study

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Abstract

The 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. These plots were begun in 1990.

Disciplines

Agricultural Science | Agriculture

Conservation Tillage Study

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Introduction

The 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. These plots were begun 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 in 10-in. rows and the corn was planted following one spring pass with a field cultivator over the soybean stubble.

No fall or spring tillage was done in the no-till system. For no-till planting, the planter was equipped with a knife and coulter for the fertilizer opener and 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 ten years of yields for each tillage system and crop sequence on both the Nira and Kalona soils. Yields prior to 1999 were summarized in previous annual reports.

During the past ten years, the chisel-disk system has outyielded the no-till system by 12 to 13 bushels/acre on the continuous corn and by 5 to 6 bushels/acre on the rotated corn. The alternative tillage system with more limited tillage than the chisel-disk system, averaged from 4 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 seen in years with wet springs and less than ideal conditions at planting. These conditions can increase problems with sidewall compaction or planter furrow compaction causing yield reductions in the no-till corn.

There was also a marked difference in corn yields between the continuous corn and the corn-soybean rotation. In the past ten years, rotated corn on the Kalona soil had a 5 to 15 bushels/acre higher yield than the continuous corn and on the Nira soil there was a 26 to 34 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. Although there was year-to-year variation, for most years these yield differences were present.

Soybean yields between tillage systems are very similar. Ten-year averages show only 0.7 bushels/acre difference between the chisel-disk and the no-till systems on the Kalona soil and 1.8 bushels/acre difference on the Nira soil. This fits with other observations that soybeans usually do not suffer the sidewall compaction problems that corn can experience. In the past ten years, the 10-in. row no-till soybeans have not shown any 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 - bushels/acre			Corn on corn yield - bushels/acre		
	No-till	Alternative	Chisel-disk	No-till	Alternative	Chisel-disk
1999	172	171	173	166	164	169
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
Average	137.3	152.3	149.6	133.3	143.2	146.8
	Corn on soybeans yield - bushels/acre			Corn on soybeans yield - bushels/acre		
	No-till	Alternative	Chisel-disk	No-till	Alternative	Chisel-disk
	No-till	Alternative	Chisel-disk	No-till	Alternative	Chisel-disk
1999	171	170	171	177	172	178
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
Average	152.4	157.0	158.2	167.6	168.9	173.1
	Soybeans yield - bushels/acre			Soybeans yield - bushels/acre		
	No-till	Alternative	Chisel-disk	No-till	Alternative	Chisel-disk
	No-till	Alternative	Chisel-disk	No-till	Alternative	Chisel-disk
1999	52.5	52.6	54.6	51.2	53.2	51.0
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
Average	46.3	44.7	47.0	47.4	47.5	49.2