2006

Long-Term Conservation Tillage Study

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Abstract
The project goal is 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. This study was begun in 1990 using no-till, ridge-till, and chisel-disk tillage systems. Results for 1990–1994 were previously reported.

Disciplines
Agricultural Science | Agriculture

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Introduction

The project goal is 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. This study was begun in 1990 using no-till, ridge-till, and chisel-disk tillage systems. Results for 1990–1994 were previously reported.

Materials and Methods

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

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

In 1995, the ridge-till system was converted to an "alternative" tillage system. In this system, the continuous corn ground is chiseled in the fall and then planted in the spring without further tillage. In the corn-soybean rotation, the soybeans are no-till drilled in 10-in. rows, and the corn is planted following one spring pass with a field cultivator over the soybean stubble.

Nitrogen is applied in the spring and an N-P-K dry fertilizer is applied with the planter. Soil tests are high to very high, so a rate of P and K below crop removal has been applied.

Results and Discussion

Table 1 contains the 11-year yields for each tillage system and crop sequence on both the Nira and Kalona soils. Yields are shown for each year along with the 11-year average.

Corn yields varied greatly from year to year, but the 11-year yield average for the alternative and chisel-disk systems averaged within 2–4 bushels/acre of each other over both soils and cropping sequences. In the corn following soybeans, the no-till system also averaged within 2-4 bushels/acre of other two systems. For corn-on-corn yields, the no-till system averaged 5–11 bushels/acre lower in yield than the other two tillage systems.

There was also a marked difference in corn yields between the continuous corn and the corn-soybean rotation. Over the eleven years, rotated corn on the Kalona soil had a 13–22 bushels/acre higher yield than the continuous corn, and on the Nira soil there was a 34–41 bushels/acre difference. While there was year-to-year variation, for most years these yield differences were present. Only in 1999 and 2004 were the corn-on-corn yields comparable to the rotated corn yields.

Soybean yields between tillage systems are very similar. Eleven-year averages show only 1.1 bushels/acre difference between the chisel-disk and the no-till systems on the Kalona soil and 1.0 bushel/acre difference on the Nira soil. This fits with other observations that soybeans usually do not suffer the sidewall compaction and early-growth problems that corn sometimes does. The 10-in. row no-till soybeans in the alternative tillage system have not shown any yield difference from the 30-in. row soybeans in the no-till or chisel-disk systems.

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
1995	113	119	115	131	136	139
1996	72	77	73	92	90	87
1997	113	111	108	121	123	121
1998	127	136	133	88	93	89
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	136	147	156
2005	88	123	127	57	82	74
Average	**119**	**130**	**127**	**111**	**116**	**118**
	Corn-on-soybeans yield (bu/acre)			Corn-on-soybeans yield–(bu/acre)		
	No-till	Alternative	Chisel -disk	No-Till	Alternative	Chisel -disk
1995	122	122	125	151	154	161
1996	101	99	96	142	133	134
1997	123	119	126	155	156	151
1998	146	153	151	128	124	129
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	148	148	149
2005	151	161	174	118	126	145
Average	**141**	**143**	**145**	**152**	**150**	**154**
	Soybean yield (bu/acre)			Soybean yield– (bu/acre)		
	No-till	Alternative	Chisel -disk	No-till	Alternative	Chisel -disk
1995	38.7	38.5	37.1	41.8	39.7	41.2
1996	37.7	37.6	37.0	43.8	44.4	46.0
1997	42.7	45.2	47.8	46.1	45.9	47.9
1998	45.2	45.2	44.4	45.1	43.2	46.2
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
Average	**44.0**	**43.4**	**45.1**	**44.9**	**44.5**	**45.9**