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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.

Disciplines

Agricultural Science | Agriculture

Conservation Tillage Study

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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.

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 spring disked and field cultivated.

No fall or spring tillage was done in the ridge and no-tillage systems. For planting on the ridges and in the no-tillage system, the planter was equipped with double-disc row cleaners. In 1994 a different planter was purchased that used a knife and coulter for the fertilizer opener and a fluted coulter and finger row cleaning wheels for residue clearing. This has done a better job of preparing a seedbed in the no-till system.

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

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

Results

Table 1 contains the eleven-year yields for each tillage system and crop sequence on both the Nira and Kalona soils. Yields are summarized for the periods 1990-1993 and 1994-2000. This is done because of a significant change in the planting equipment between 1993 and 1994.

Although the chisel-disk system had higher corn yields on both soils and cropping sequences during the 1990-1993 period, average yields are virtually the same across tillage systems for 1994-2000. Problems with sidewall or planter furrow compaction caused yield reductions in the no-till and ridge planted corn in the early years of this study. This problem has been minimal in the past seven years with the different planter system in the no-till system.

There was also a marked difference in corn yields between the continuous corn and the corn-soybean rotation. In the past seven years, rotated corn on the Kalona soil had an 11-14 bu/acre higher yield than the continuous corn, and on the Nira soil, there was a 35-40 bu/acre difference. Although there was year to year variation, for most years these yield differences were present.

Soybean yields between tillage systems are nearly identical. Ten-year averages show a 1.0 bu/acre difference between the chisel-disk and the no-till systems on the Kalona soil and a 0.1 bu/acre difference on the Nira soil. No change was noted in soybean yields across tillage systems between the 1990-1993 period versus 1994-2000. This fits with other observations that soybeans usually do not suffer the sidewall compaction problems that corn can. In the past six years, the 10-inch row no-till soybeans have not shown any yield difference from the 30-inch 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	Ridge/Alt.*	Chisel -Disk	No-till	Ridge/Alt.*	Chisel -Disk
1990	143	137	149	152	138	148
1991	23	55	40	47	34	46
1992	140	137	145	142	148	161
1993	98	103	108	119	122	125
1994	125	136	136	105	107	111
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
Average	116.4	121.4	121.1	116.6	116.2	120.0
90-93	101.0	108.0	110.5	115.0	110.5	120.0
94-00	125.1	129.0	127.1	117.6	119.4	120.0
	Corn on soybeans yield - bu/acre			Corn on soybeans yield - bu/acre		
	No-till	Ridge/Alt.*	Chisel -Disk	No-till	Ridge/Alt.*	Chisel -Disk
	No-till	Ridge/Alt.*	Chisel -Disk	No-till	Ridge/Alt.*	Chisel -Disk
1990	138	141	148	145	142	151
1991	129	125	146	119	116	132
1992	146	149	173	147	151	175
1993	99	101	108	132	122	135
1994	152	155	161	179	169	165
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
Average	135.2	134.7	141.3	149.5	145.1	152.5
90-93	128.0	129.0	143.8	135.8	132.8	148.3
94-00	139.3	138.0	139.9	157.3	152.1	154.9
	Soybeans yield - bu/acre			Soybeans yield - bu/acre		
	No-till	Ridge/Alt.*	Chisel -Disk	No-till	Ridge/Alt.*	Chisel -Disk
	No-till	Ridge/Alt.*	Chisel -Disk	No-till	Ridge/Alt.*	Chisel -Disk
1990	54.9	56.1	55.9	59.6	57.9	58.7
1991	49.5	46.4	48.7	47.2	41.7	42.3
1992	50.9	51.2	53.4	52.2	49.9	54.3
1993	47.9	47.8	48.2	51.5	50.9	52.8
1994	53.1	53.8	55.5	58.3	54.3	57.9
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
Average	46.7	46.3	47.7	49.0	47.5	49.1
90-93	50.8	50.4	51.6	52.6	50.1	52.0
94-00	44.3	44.0	45.5	46.9	46.0	47.5

* Ridge Till System, 1990-1994; Alternative Tillage System, 1995-2000.