

SOYBEAN YIELD RESPONSE TO CROP ROTATION AND CONSERVATION TILLAGE FOR THE BLACKLAND PRAIRIE

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ABSTRACT: This study was initiated to determine the effects of tillage/rotation treatments on corn and soybean yield. This study was conducted on two soil types, Houston clay (very fine, montmorillonitic, thermic, Typic Chromudelts) and Vaiden silty clay (very-fine, montmorillonitic, thermic, Vertic Hapludalfs). Cropping tillage evaluations were 1) No tillage soybeans, 2) conventional raised bed soybeans, 3) ridge-tilled soybeans and 4) turf-aerator soybeans. Rotations were 1) ridge till corn followed by ridge-tilled soybeans, 2) fall para-till corn followed by fall para-till bed soybeans and 3) no-till corn, disk followed by soybeans. Due to wet weather conditions in the fall, the fall para-till bed treatment was planted on the old rows in 2001. All of the ridge till systems were modified so that the high-clearance cultivator was not used in 2001. Environmental conditions were good in 2001 allowing some of the highest yields recorded for the trial. Due to wet weather conditions in the late fall, the fall para-till bed treatment was planted on the old rows in 2001. The ridge-till systems were modified so that the high-clearance cultivator was not used in 2001. Since this is the first year of this modification, no conclusions can be drawn from the data obtained in 2001. On the Vaiden clay soil, Fall para-till bed Corn Fb FPTB Soybean rotation yielded a high of 40.7 bu/ac but was not significantly different from any other system except RTCFbRTSb which was the lowest yielding treatment at 28.6 bu/ac. On the Houston clay, there was no significant difference between the four highest yielding systems, NT Corn Disk Fb Soybean at 48.1 bu/ac, Fall para-till bed Corn Fb FPTB Soybeans at 45.1 bu/ac, NT Soybeans at 42.5 bu/ac, and Ridge-till Corn Fb RT Soybeans at 42.5 bu/ac.

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KEY WORDS: Conservation tillage, soybeans, reduced tillage, no-till.

MATERIALS AND METHODS: This study was conducted during the 2001-growing season on the Prairie Research Unit. Two soil types, Houston Clay (very fine, montmorillonitic, thermic, Typic Chromuderts) and Vaiden Silty Clay (very fine montmorillonite, thermic, Vertic Hapludalfs) were used. The experimental design was a randomized complete block design with four replications. A fall application of 0-20-20, at 300 lb/ac, was spread before tillage treatments as per soil test recommendations. Tillage treatments were: 1) no-tillage (NT); 2) ridge-tillage (RT1) soybeans, planted no-till and cultivated once with a high-clearance cultivator equipped with ridgers; 3) turf aerator (TA) soybeans with turf aerator knives operated one time prior to planting at 10% angle from vertical and at a depth of 6 to 8 in depth; 4) conventional raised-bed tillage (CTB) soybeans chisel, disk, bedded, do-alled before planting, and cultivated once; 5) fall para-tilled bed (FPTB) soybeans. Tillage crop rotations were 1) RT corn Fb RT soybeans; 2) FPTB corn Fb FPTB soybeans; and 3) corn Fb soybeans. Due to wet weather conditions in the late fall of 2000, the fall para-till bed treatment was planted on the old rows in 2001. All of the ridge till systems were modified so that the high-clearance cultivator was not used in 2001. Pioneer 9495 was planted on May 2 2001. Gramoxone (paraquat) at .94 lb ai/ac was used for burn down and the pre-emergence herbicide, Dual (metachlor) @ 1.5-lb ai/ac was applied to ridge-till, turf aerator, and no-till soybean treatments. Conventional soybeans received a pre-emergence application of Dual. The center two rows of each plot were harvested for grain yield on October 4

2001. Soybean yields were adjusted to bu/ac at 13% moisture. Data was subjected to statistical analysis and means were separated by least significant difference (LSD) at the 0.05 probability level.

RESULTS AND DISCUSSION: Due to wet weather conditions in the late fall, the fall para-till bed treatment was planted on the old rows in 2001. The ridge-till systems were modified so that the high-clearance cultivator was not used in 2001. Since this is the first year of this modification, no conclusions can be drawn from the data obtained in 2001. On the Vaiden clay soil, Fall para-till bed Corn Fb FPTB Soybean rotation yielded a high of 40.7 bu/ac but was not significantly different from any other system except RTCFbRTSb which was the lowest yielding treatment at 28.6 bu/ac

On the Houston clay, there was no significant difference between the four highest yielding systems, NT Corn Disk Fb Soybean at 48.1 bu/ac, Fall para-till bed Corn Fb FPTB Soybeans at 45.1 bu/ac, NT Soybeans at 42.5 bu/ac, and Ridge-till Corn Fb RT Soybeans at 42.5 bu/ac.

Table 1. Soybean Yield on Houston clay soil

Crop Rotation/ Tillage System	1995	1996	1997	1998	1999	2000	2001
	-----bu/ac-----						
Conventional Tillage							
Continuous Soybeans	33.2	38.5	28.0	26.1	33.6	13.3	37.8 ^b
II. Stale Seedbed Systems							
A. Continuous Soybeans							
1. No-Tillage (NT) Soybeans	24.7	32.6	24.8	26.3	36.7	5.9	42.5 ^{ab}
2. Ridge Tillage (RT) Soybeans	27.2	33.5	34.1	32.4	37.1	8.2	38.3 ^b
3. Turf Aerator-Renovator (TA) Soybeans	27.9	32.5	26.2	22.8	37.3	9.5	38.1 ^b
B. Corn Soybean Rotation (2 Yr)							
4. Ridge till corn Fb RT Soybeans	28.3	36.1	31.1	29.5	37.9	8.3	41.1 ^{ab}
5. Fall Para-till Bed Corn Fb FPTB Soybeans	32.7	31.9	35.9	18.4	38.8	13.5	45.1 ^a
6. No- Till Corn Disk Fb NT Soybeans	*	41.6	35.1	22.3	37.3	13.2	48.1 ^a
Mean	29.2	35.2	30.8	25.4	36.9	10.4	41.6
LSD (0.05)	3.7	8.9	9.9	NS	5.5	3.0	8.1
CV%	17.9	9.8	20.5	48.6	13.1	18.2	13.1

Values with the same superscript are not significantly different (p< 0.05).

* Not available first year

Table 2. Soybean Yield on Vaiden Silty clay soil

Crop Rotation/ Tillage System	1995	1996	1997	1998	1999	2000	2001
	-----bu/ac-----						
Conventional Tillage							
Continuous Soybeans	30.5	42.1	25.0	31.5	21.4	2.6	38.8 ^a
II. Stale Seedbed Systems							
A. Continuous Soybeans							
1. No-Tillage (NT) Soybeans	34.3	30.9	19.2	33.5	16.1	1.7	36.0 ^{ab}
2. Ridge Tillage (RT) Soybeans	33.8	33.8	32.1	31.0	20.5	1.1	39.5 ^a
3. Turf Aerator-Renovator (TA) Soybeans	30.2	33.9	20.6	36.7	18.2	1.5	35.7 ^{ab}
B. Corn Soybean Rotation (2 Yr)							
4. Ridge-till Corn Fb RT Soybeans	39.4	35.3	30.3	38.0	20.5	2.4	28.6 ^b
5. Fall Para-till Bed Corn Fb FPTB	32.7	42.4	30.7	37.4	23.1	2.5	40.7 ^a

Soybeans							
6. No-Till Corn Disk; Fb NT Soybeans	*	43.0	32.9	33.5	22.8	2.4	36.5 ^{ab}
Mean	31.2	35.9	27.6	34.5	20.3	2.1	36.5
LSD (0.05)	6.6	7.7	7.6	5.5	3.7	1.2	8.9
CV%	13.9	14.5	18.1	10.7	12.0	38.8	16.4

Values with the same superscript are not significantly different ($p < 0.05$).

* Not available first year.