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Tillage and No-preplant Tillage Compared for Grain Sorghum and Soybean Production in North-central Kansas

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Two main functions of preplant tillage are to control early-season weed growth and to prepare a seedbed. Both functions, however, can be accomplished without tillage operations if herbicides are applied to control early-season weeds and a no-till planter is available to plant directly into crop residue.

We evaluated grain yields and weed control for three preplant-tillage systems: (1) disk as needed to control weeds and prepare a seedbed; (2) apply a herbicide in April to control weeds and grasses until planting time, disk just before planting; and (3) use a herbicide, with no-preplant tillage, to control weeds and grass before planting, then plant with a no-till planter. This study was established on the K.S.U. North-central Experiment Field near Belleville in 1975. (See Table 1.)

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The cropping sequences were: (1) continuous grain sorghum, (2) continuous soybeans, (3) grain sorghum after soybeans, and (4) soybeans after grain sorghum. In all plots, crops were planted with a no-till planter in rows 30 inches wide. Grain sorghum was seeded at 52,000 seeds/acre (seeds 4 inches apart in the row); soybeans at 105,000 seeds/acre (seeds spaced 2 inches apart). Grain sorghum was fertilized by broadcasting nitrogen fertilizer to apply 60 pounds of nitrogen/acre in early spring and by banding at planting with 10-20-0 at 100 pounds/acre. Furadan was banded at planting at 13 pounds/acre to control insects. Also, in grain sorghum plots Ramrod/Atrazine was broadcast at 6 pounds of product/acre at planting to provide weed and grass control.

Soybeans were not fertilized, but the seed was inoculated. When the seeds were planted, Lasso + Sencor was broadcast at 2 qt and at .75 lb of product/acre to control weeds and grass.

Table 1. *Preplant operations on tillage test plots for grain sorghum and soybeans, North-central Experiment Field, Belleville, 1975-81.*

	Operation and timing	
Preplant treatment	Mid April	Before planting
Mechanical only	Disk	Disk as needed
Mechanical + chemical	3 lb Bladex/a[1]	Disk
Chemical only	3 lb Bladex/a[1]	None

[1]80 W wettable powder

Table 2. *Average grain sorghum yields, broadleaf weed control, and grass control for tillage systems, Belleville, 1975-81.*

	Grain yield	Weed control	
Tillage treatment	(bu/a)*	Broadleaf (%)	Grass (%)
Mechanical only	64	72	91
Mechanical + chemical	66	85	93
Chemical only	65	87	75
LSD (.05)	N.S.	N.S.	13

*Grain yields corrected to 12.5% moisture.

Results for grain sorghum yields and weed control for 1975-81 are given in Table 2; those for soybeans in Table 3.

Table 3. *Average soybean yields, broadleaf weed control, and grass control for tillage systems, Belleville, 1975-81.*

Tillage treatment	Grain yield (bu/a)*	Weed control	
		Broadleaf (%)	Grass (%)
Mechanical only	24	69	85
Mechanical + chemical	24	78	87
Chemical only	25	75	82
LSD (.05)	N.S.	8	N.S.

*Grain yields corrected to 12.5% moisture.

Table 4 shows average crop yields and weed- and grass-control percentages for the cropping systems.

Table 4. *Average yields, broadleaf weed control, and grass control for cropping systems, Belleville, 1975-81.*

Cropping system	Grain yield (bu/a)*	Weed control	
		Broadleaf (%)	Grass (%)
Continuous grain sorghum	65	81	82
Sorghum after soybeans	65	82	91
LSD (.05)	N.S.	N.S.	9
Continuous soybeans	22	72	88
Soybeans after sorghum	26	77	80
LSD (.05)	N.S.	N.S.	6

*Grain yields corrected to 12.5% moisture.

Grain sorghum and soybean annual yields for each cropping system and preplant tillage system are listed in Tables 5 and 6, respectively. The wide variation in yields probably can be attributed to the rainfall patterns and total annual rainfall.

Table 5. *Annual grain sorghum yields for each cropping system and preplant tillage system, Belleville, 1975-81.*

Year	Sorghum after soybeans			Continuous sorghum			Average
	mech.	mech. +chem.	chem.	mech.	mech. +chem.	chem.	
	(bu/a)*						
1975	14	19	11	31	34	24	22
1976	50	50	42	47	49	58	49
1977	80	91	81	84	89	75	83
1978	58	72	67	64	64	71	66
1979	95	90	102	84	89	84	91
1980**	15	9	15	7	6	7	10
1981	139	128	140	128	132	138	134
Avg.	64	66	65	64	66	65	65

*Grain yield corrected to 12.5% moisture.
**Heavy chinch bug infestation caused crop failure.

Table 6. *Annual soybean yields for each cropping system and preplant tillage system, Belleville, 1975-81.*

Year	Soybeans after sorghum			Continuous soybeans			Average
	mech.	mech. +chem.	chem.	mech.	mech. +chem.	chem.	
	(bu/a)*						
1975	29	26	24	12	21	32	24
1976	8	5	7	24	8	12	11
1977	37	41	40	22	26	31	33
1978	15	15	13	15	16	18	15
1979	29	32	30	27	29	27	29
1980	18	21	20	17	15	16	18
1981	47	45	45	30	33	38	40
Avg.	26	26	26	21	21	25	24

*Grain yields corrected to 12.5% moisture.

Table 7 shows the annual rainfall during the growing season, divided into two parts: rainfall from April through June, when the moisture is primarily stored in the soil profile; and rainfall from July through September, when it replenishes soil moisture used by the crop.

Table 7. *Rainfall for the growing season (including spring and summer), Belleville, 1975-81.*

Year	Spring*	Summer**	Growing season (total)
		(inches)	
1975	13.24	5.57	18.81
1976	9.87	5.90	15.77
1977	13.38	15.80	29.18
1978	11.89	17.54	29.43
1979	10.69	10.53	21.22
1980	8.81	6.40	15.21
1981	9.56	14.69	24.25
Avg.	11.06	10.92	21.98

*April, May, and June
**July, August, and September

Below-average grain sorghum yields in 1975 and 1976 can be traced to below-average summer rainfall for those years. One cannot make such comparisons for 1980, when chinch bugs caused a crop failure. Near-average to above-average summer rainfall produced above-average grain yields in 1977, '78, '79, and '81.

Soybean yields were below average in 1976, '78, and '80. Rainfall was below average in 1976 and 1980 for both spring and summer. In 1978 rainfall was near average in the spring and 6.62 inches above average in the summer; however, that summer nearly 4 inches of rainfall came in one 24-hour period.

CONCLUSIONS:

Grain sorghum. Grain yields showed no significant differences that can be attributed to cropping or preplant-tillage systems. Yields did appear to be more affected by summer than by spring rains. Broadleaf weed control was not affected by cropping systems or by preplant-tillage systems (Tables 2 and 4). The "chemical only" preplant tillage system and the continuous grain sorghum cropping system provided inferior grass control.

Soybeans. Soybean yields were not affected by cropping or preplant-tillage systems, although continuous soybeans averaged 4 bu/acre less than did soybeans following grain sorghum (Table 4). Broadleaf weed control among the preplant tillage systems showed mechanical only to be inferior to the mechanical + chemical tillage system (Table 3). Grass control was superior for the continuous soybean cropping system.

NOTE: This study was designed to compare the effects of tillage and cropping systems on grain yields and on broadleaf and grassy weed control. No attempt was made to measure soil-erosion losses attributed to the three cropping systems.

One would think that early-spring rainfall would be better conserved by the no-preplant tillage system, but that was not reflected in our 7-year yield averages.

The economical benefit from fewer trips over the field versus the additional cost for an extra herbicide application for the no-preplant tillage system was not evaluated for this report.

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