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Controlling Weeds in Wheat Stubble in Extreme Western Kansas

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Average rainfall between wheat harvest and frost at Tribune, Kansas, is about 6.5 inches—30 percent of the total expected during the entire fallow period in a fallow-wheat system. Much of this late summer and fall moisture is wasted if weeds and volunteer wheat are allowed to grow undisturbed. Since moisture is usually the limiting factor in crop production, preserving additional water during fallow should increase crop yields. Or, the fallow period might be shortened. For example, fallow-wheat-sorghum (FWS) involves two crops in three years with two fallow periods of about 11 months each. Whereas, fallow-wheat or fallow-sorghum systems produce two crops in four years.

The study reported here compares several cropping systems, involving fallow, wheat, and sorghum (Table 1). The tests will run for several more years, so these results are only preliminary. Thus far we have harvested sorghum four years, 1972, 1973, 1974, and 1975, and wheat three years, 1973, 1974, and 1975. Sorghum yielded well in 1972, 1973, and 1975, but an early fall freeze in 1974 markedly reduced yields. Aver-

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age wheat yields were high all three years, 31 to 42 bu/a (Table 2).

When conventional tillage was used, wheat after sorghum (FWS) yielded the same as wheat after conventional fallow (FW), 33 bu/a. In the same FWS system, sorghum yielded 46 bu/a compared with 53 bu/a in the fallow-sorghum rotation (FS). But, two crops (wheat and sorghum) were produced in three years rather than two crops in four years. The conventional systems did not include complete weed control in the wheat stubble following harvest.

In the two experimental systems, FWS+ and FW+, blading plus a residual herbicide (an 80% atrazine product) controlled weeds in the wheat stubble. Equivalent late summer and fall weed control could have been accomplished with additional tillage in lieu of the herbicide. But the atrazine aided in weed control the next spring and, in the FWS+, in the sorghum crop,

Table 1. Cropping systems and cultural practices used in fallow, wheat, and sorghum studies at Tribune, Kansas.

System designation	Description
FW	Conventional fallow-wheat. Wheat stubble left until spring, then disked as needed until wheat is planted in fall.
FW+	Experimental fallow-wheat. Atrazine applied at 1.5 lb/a (product) to new wheat stubble, then bladed. Bladed as needed during fallow before planting wheat.
FWS	Conventional fallow-wheat-sorghum. Wheat stubble bladed once, usually in August. Disked as needed before planting sorghum. Igran herbicide applied to control weeds in sorghum. Sorghum cultivated. Sorghum stubble disked as needed during fallow before wheat is planted.
FWS+	Experimental fallow-wheat-sorghum. Atrazine applied at 2.5 lb/a (product) to new wheat stubble, then bladed. Disked once before planting sorghum. Residual atrazine was the weed control. Sorghum cultivated if necessary before wheat planting. No herbicide used between sorghum and wheat.
FS	Conventional fallow-sorghum. Sorghum stubble bladed as needed until frost, then listed to prevent winter wind erosion. Ridges disked twice before planting sorghum. Igran applied to control weeds. Sorghum cultivated.

although in some years spring tillage was needed to control grass weeds.

More moisture was stored in the soil in the FWS+ system than in the conventional FWS system, probably largely because the usual system did not control after-harvest weeds. The increased moisture contributed to increased yields. The FWS+ plots had 4.1 inches of soil moisture at planting time, compared with 2.9 for the conventional system, an increase of 41 percent. Likewise, sorghum yields increased from 46 bu/a to 53 bu/a, a 17 percent increase. Wheat yields in these systems averaged 38 bu/a in the FWS+ and 33 bu/a for FWS. However, the difference was from only 1975 yields. Wheat yields under the two systems did not differ in 1973 and 1974 (Table 2).

In the widely used fallow-wheat system, wheat stubble is often left untouched until the spring after harvest. Our work shows weed control in wheat stubble is as important in FW as in FWS. We used the same treatment described in the FWS+ system, except the atrazine

rate was reduced from 2.5 to 1.5 lb/a product. Average soil moisture at wheat planting increased 32 percent (from 4.4 to 5.8 inches), and average wheat yields increased 21 percent (33 to 40 bu/a).

Fall weed control was not advantageous every year; the benefit depended on amount and distribution of rainfall. Figure 1 gives the amount and distribution of precipitation for 1971-1975. Note the wide variation and that the average was less than long time figures. When moisture after harvest was low, weed growth was limited even without control measures. When fall rain was above average, 1972, and 1973, fall weed control led to increased crop yields (FW wheat yields in 1974 and 1975, and FWS sorghum yields in 1973 and 1974, Table 2). Fall weed control in 1971 and 1974 (when rainfall was low) increased neither moisture nor yields. However, fall weed control has never depressed yields.

Atrazine persists relatively long in the soil. Its rate of breakdown depends on many factors,

Table 2. Effects of cropping system on soil moisture and yields of wheat and grain sorghum at Tribune, KS.

Cropping system ¹	Fall weed control	Average soil moisture to 6 ft. at planting (in.)	Sorghum		Sorghum			Wheat			Average grain production ² lb/a/yr	
			1972	1973	1974	1975	1974	1975	Avg.			
FW	None	4.4	....	....	....	....	....	32	32	35	33	990
FW+	Blade plus residual herbicide	5.8	....	....	....	....	....	32	38	49*	40*	1200
FWS	Blade once	2.9	79	46	10	48	46	....	....	....	....	1519
	.....	4.6	....	....	....	....	....	29	36	35	33	
FWS+	Blade plus residual herbicide	4.1	72	68*	29*	48	54*	....	....	....	....	1768
	.....	5.2	....	....	....	....	....	29	35	48*	38*	
FS	.....	5.6	76	68*	14	54	53*	....	....	....	....	1484
L.S.D., 10%			NS	19	7.1	NS	7.6 ³	NS	NS	5.9	4.7 ³	.....

* Top statistical group each year.

1. See Table 1 for complete description of systems.

3. L.S.D. at 5% level for the averages.

2. Sorghum bu/a X 56 + wheat bu/a X 60 ÷ number of years in the sequence.

Small differences should not be overemphasized. Least significant differences (L.S.D.) are shown at the bottom of each table. Unless two values differ by at least the L.S.D. shown, little confidence can be placed in the superiority of one over the other.

including temperature, moisture, organic matter, and application rate. It is commonly used for weed control in corn, sorghum, and some fallow systems. However, it is not registered for use in wheat-fallow system in western Kansas, and its use is not recommended.

Our results show the importance of controlling fall weeds. Until atrazine or some other herbicide is registered and found effective, wheat stubble should be bladed to control weeds and volunteer wheat.

Yields from the various cropping systems are sometimes difficult to compare directly. We converted grain yields to pounds per acre per year (lb/a/yr, Table 2). Highest yield was from FWS+, 1768 lb/a/yr. That was 249 lb/a/yr or 16 percent more than conventional FWS at 1519 lb/a/yr. Both FWS and FWS+ yielded substantially more than FW (990 lb/a/yr) and FW+ (1200 lb/a/yr). Again the advantage of fall weed control is readily apparent when the FWS+ and FW+ are compared, respectively, with FWS and FW.

Ultimately net return, not total yield, will decide acceptance or rejection of a practice. When two crops, wheat and sorghum, are involved relative prices and price changes make accurate comparisons difficult. Possible additional costs for herbicides, tillage, seed, harvesting, and

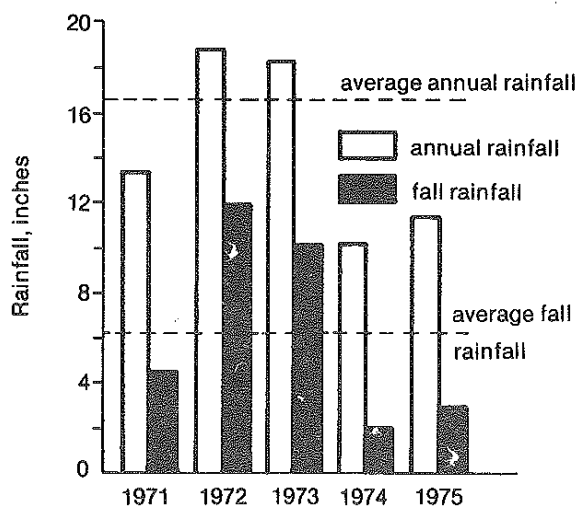


Fig. 1. Annual and fall (July through September) rain fall compared to long-time averages at Tribune, Kansas.



Fig. 2. Research plots at Tribune Branch Experiment Station showing weed-free wheat stubble after herbicide was applied, with grain sorghum in the background grown after wheat with the same herbicide treatment, 1973.

other items such as interest must also be considered. Gross returns can be easily calculated from yields given in Table 2. Use current or expected commodity prices. In any event and with virtually any realistic price structure, it seems that FWS+ (1768 lb grain/a/yr) will net substantially more per acre than will FW (990 lb/a/yr).

This is a progress report of continuing research at the Tribune Branch Experiment Station. We will continue to work and continue to bring results to farmers, producers, and other interested persons.

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