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Research on Wheat-Sorghum-Fallow in Western Kansas

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Yes, there is an alternative to wheat-fallow in this area. Research at the three western Kansas branch stations (Colby, Garden City and Tribune) report data supporting such a statement, though by no means are the results the same.

The wheat-sorghum-fallow system was developed for Kansas by the Fort Hays branch station (22 to 24" annual precipitation) for the central part of the state. The map of normal annual precipitation in Kansas for the period 1951-1980 shows that Colby and Garden City have between 18 and 20 inches, whereas Tribune has less than 16 inches. Work was started at the western branch stations in the early 1970's to study the application of the WSF system to this drier region. A brief summary of data is presented below and more complete data are available from each of the branch stations.

Results

Effects of Atrazine and Nitrogen. At Tribune, in 1971, a study of five different cropping systems was initiated. These systems were continuous wheat (WW), continuous sorghum (SS), wheat-fallow (WF), sorghum-fallow (SF) and wheat-sorghum-fallow (WSF). The WF and WSF were divided into two treat-

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Table 1. Yield summary, cropping systems study, Tribune, 1973-83.

Cropping System	Fallow Length: Months	Available Moisture: Inches**	Yearly Yield, Bu/A @ 12.5% Moisture											
			83	82	81	80	79	78	77	76	75	74	73	Av.**
GRAIN SORGHUM														
SS	8	4.1	22	31	67	61	16	64	44	0	46	17	42	37
WSF	11	4.0	46	39	86	54	0	59	38	0	48	10	46	39
WSF*	11	5.8	53	61	99	36	50	69	50	6	49	29	68	52
SF	20	6.1	69	101	96	61	65	87	58	22	54	14	68	63
WHEAT														
WW	3	1.5	32	6	20	12	11	14	16	0	13	17	21	15
WSF	11	3.3	49	19	31	21	35	35	17	13	37	36	29	29
WSF*	11	3.8	55	39	35	19	38	46	25	15	43	35	32	35
WF	14	4.1	59	29	32	14	35	29	28	16	34	32	32	31
WF*	14	5.7	58	36	37	24	46	49	30	22	46	38	34	38

* *Minimum tillage treatments using atrazine.*
** *11-year average.*

ments (1) minimum tillage by use of atrazine, a long-term, residual herbicide and (2) conventional tillage. After 11 years, some conclusions may be drawn.

The atrazine-treated plots in both the WSF and WF systems have stored more moisture and maintained higher yields throughout the test (Table 1). There was an average increase of 13 bushels/acre for grain sorghum and 6 bushels/acre for wheat in the WSF system and an average increase of 7 bushels/acre in the WF system for the plots treated with atrazine.

In 1973, the plots were split and nitrogen at 15 lb./acre/year was applied to half the plot area. During the last four years, 1980-83, nitrogen increased yields by 7 bushels/acre for sorghum and 3 bushels/acre for wheat in both WSF systems (data not shown). When yields were higher than average, nitrogen usually increased yields significantly, but over the years only the WSF system with atrazine showed a consistent increase.

Moisture Storage. There are some interesting data from Colby that indicate different storage rates at different seasons of the year in the WSF system (Table 2). On the average, there was little change in the available soil moisture from August 9 to November 12, but a great increase from November 12 to April 10. This can be interpreted as less moisture storage from late summer to early fall, but extremely heavy storage of winter moisture, probably snow, and moderate to heavy storage in early spring, or at least to sorghum-planting time. The data from Tribune for the same years, which did not have the November and April sampling dates, show less storage at planting time.

Table 2. Available stored moisture, combined averages, after wheat harvest to sorghum planting at Colby and Tribune, 1981-83.

Location and Year	Dates of Sampling*			
	8/9**	11/12**	4/10	6/24
COLBY	-Inches in 5 Foot Profile-			
1981	2.6	2.5	6.2	10.7
1982	7.7	5.1	9.5	10.6
1983	4.6	9.7	11.5	10.9
Average*	5.0	5.8	9.1	10.7
TRIBUNE				
1981	1.3	—	—	5.4
1982	−1.3	—	—	2.9
1983	0.4	—	—	8.8
Average*	0.1	—	—	5.9

**Average of 3 years;* ***previous year.*

Table 3. Percent precipitation stored by planting time (11 mo.) at Garden City and Tribune, 1979-82.

Year	Sorghum Planting		Wheat Planting	
	GC*	T*	GC	T
1979	33	43	27	25
1980	29	28	23	20
1981	37	40	33	34
1982	29	50	24	26
Average	32	40	27	26

**GC = Garden City, T = Tribune.*

Table 4. Yields of grain sorghum and wheat as affected by cropping system at Colby, Garden City and Tribune, 1981-83.

Cropping System	Yields, Bushels/Acre											
	1981			1982			1983			Average		
	C*	GC*	T*	C	GC	T	C	GC	T	C	GC	T
GRAIN SORGHUM												
WSF	74	70	99	62	76	61	54	35	53	63	60	71
SF	—	84	96	—	79	101	—	35	69	—	66	89
SS	—	44	67	—	71	31	—	29	22	—	48	40
WHEAT												
WSF	—	23	33	—	51	29	58	36	52	—	37	38
WF	—	30	35	—	55	33	—	52	59	—	46	42
WW	—	—	20	—	—	6	—	—	32	—	—	19

	1978			1979			1980			Average		
	C	GC	T	C	GC	T	C	GC	T	C	GC	T
WSF(GS)	38	—	64	53	—	25	42	57	45	44	—	45
WSF(Wheat)	37	—	41	27	—	37	37	46	23	34	—	34
WW	—	—	14	—	—	11	—	—	12	—	—	12

**C = Colby; GC = Garden City; T = Tribune.*

Moisture presented as percent precipitation stored, at Garden City and Tribune, is shown in Table 3. At both places, a greater percentage of moisture was stored at grain sorghum planting time in June than at wheat seeding time in September. There was a closer correlation of figures at wheat seeding time. The percent moisture stored at sorghum planting time was higher at Tribune, where perhaps more was in the form of snow.

ield. Yields of grain sorghum and wheat in the WSF system, compared to SF, WF, SS and WW when possible, are recorded in Table 4 for comparable years at Colby, Garden City and Tribune. The yields were correlated closely at all stations and matched up favorably with actual yield figures.

The 1978-80 average yields of grain sorghum and wheat for the WSF system were nearly the same at Colby and Tribune. The advantage of minimum or no tillage over conventional was different at the three stations for the WSF system. Colby showed the least response, probably due to the nearly full profiles of moisture at planting, regardless of treatment. Garden City showed intermediate response to no-till, depending on the year. Tribune showed the greatest response to minimum tillage, probably because of the greater proportional differences in stored moisture, although the actual amounts of moisture stored were less.

For the 1981-83 average, grain sorghum yields at

Garden City were only 6 bushels/acre less for WSF than for SF; at Tribune the drop was greater, 18 bushels/acre. Results of wheat yields were reversed: at Garden City the yield of wheat was 9 bushels/acre less for WSF than for WF, and the loss at Tribune was only 4 bushels/acre.

Chemicals. The chemicals used at the three stations varied, and the response to them also varied, in terms of weed control, crop damage, stored moisture, and cost. Long residuals, such as atrazine and Milogard; shorter residuals, such as Bladex, Igran, Dual, Banvel and 2-4-D; contact sprays, such as Roundup and Paraquat; and others were used separately or in combination. Specific weed problems, stubble, tillage practices, costs, etc. play major roles in the choice of a chemical to use for a specific task.

Varieties. Varieties or hybrids of wheat and sorghum vary in their performance in the WSF system. Data from Garden City (not shown) confirms this, but more work needs to be done before recommendations can be made.

Summary

The wheat-sorghum-fallow system is a viable alternative to wheat-fallow in western Kansas.

Two crops (one wheat, one grain sorghum) in 3 years produces more total grain that two crops (wheat) in 4 years. Research results at Colby, Garden City and Tribune Branch Experiment Stations show that, although there was a slight yield reduction compared to the WF and/or SF systems, the total grain production of WSF was increased substantially.

The 11-month periods of fallow in the WSF system for both grain sorghum and wheat were usually more efficient in storing moisture than the longer 14-month period for wheat and/or 20-month period for grain sorghum.

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