AES

Keeping Up With Research 67

March 1983

Efficient Storage of Soil Moisture With the Wheat-Sorghum-Fallow System

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The wheat-sorghum-fallow system allows two crops to be grown in three years, as opposed to one crop in two years in the wheat-fallow or sorghum-fallow systems. The fallow period between either wheat and sorghum or sorghum and wheat is only 11 months as opposed to 15 and 19 months for the wheat-fallow and sorghum-fallow systems, respectively. In western Kansas the dominant dryland cropping system is wheat-fallow. The wheat-sorghum-fallow system is practiced more often in the central part of the state. One reason for the lack of penetration of wheat-sorghum-fallow into western Kansas is low rainfall. Many farmers feel that there is not enough stored soil moisture to allow sorghum to be satisfactorily grown after only an 11-month fallow period.

A study was initiated in 1978 to examine the feasibility of the wheat-sorghum-fallow system in southwest Kansas. This report is concerned with the effectiveness of the wheat-fallow (WF), sorghum-fallow (SF), and wheat-sorghum-fallow (WSF) systems in storing soil moisture.

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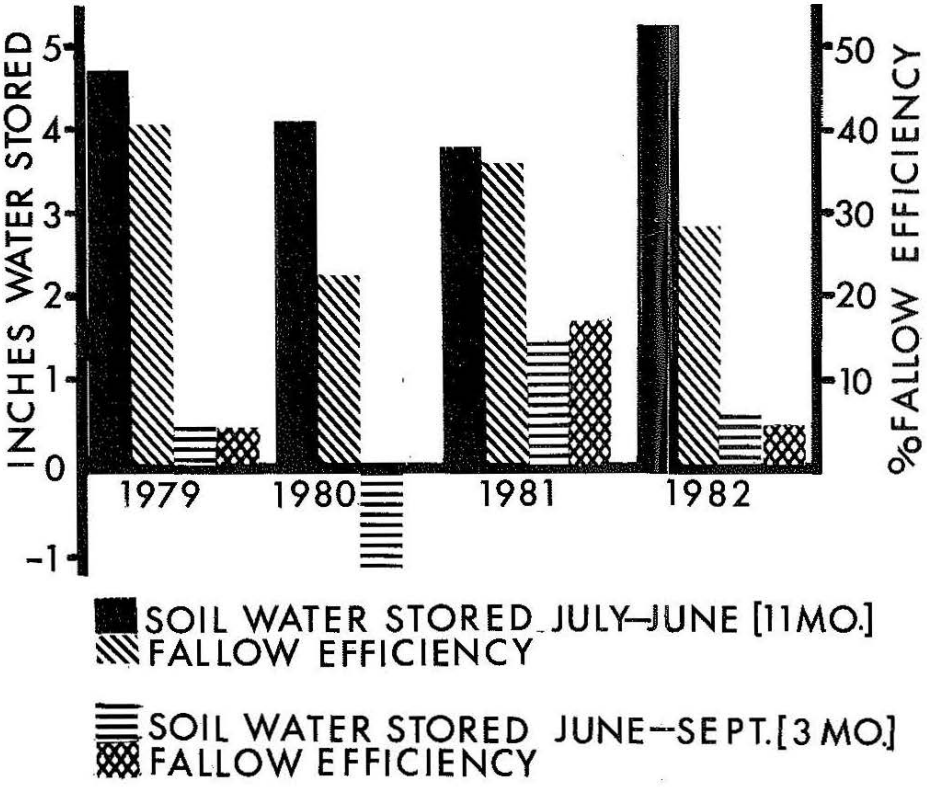
Figure 1. Effect of length of fallow on soil water storage and fallow efficiency (5 ft. profile).



Results

Soil samples were analyzed for moisture content following wheat harvest, at sorghum and wheat planting time in the WF and WSF systems, and at sorghum planting time in the SF system.

Figure 1 is a graphic representation of soil water storage at two times during fallow. The July to June period represents storage from wheat harvest until sorghum planting time, while the June to September period represents storage from sorghum planting time until wheat planting time, if the land was left fallow. Most storage occurred between July and June in each fallow period. In 2 of the 4 years additional storage from June to September was only about 1/2 inch. Because of the low accumulations, fallow efficiencies (the percentage of precipitation stored in the soil during fallow) were very low. A net loss of soil water, reducing

Table 1. Soil water stored by planting time as affected by cropping system.

	Inches of total water stored in 5 ft. profile by			
	Wheat planting (Sept.)		Sorghum planting (June)	
	Wheat-sorghum-fallow (11-mo. fallow)	Wheat-fallow (15-mo. fallow)	Wheat-sorghum-fallow (11-mo. fallow)	Sorghum-fallow (19-mo. fallow)
1979	14.80	15.06	14.60	14.35
1980	14.62	14.76	15.96	15.25
1981	12.84	14.50	12.97	14.64
1982	15.14	15.36	14.82	14.29
Avg.	14.35	14.92	14.59	14.63
LSD(.05) Year	1.06		1.05	
System	0.75		1.48	

the fallow efficiency to zero, occurred between June and September of 1980, due to very low precipitation and high evaporation. Only in 1981 was there a significant gain in moisture storage between June and September. This occurred because the summer and winter of 1980-81 were unusually dry, resulting in less water storage during the July to June period. In addition, the June to September period of 1981 was cooler and wetter than normal, allowing for significant storage during that time.

Table 1 lists the amounts of moisture stored by planting time in the WSF, WF, and SF systems. Moisture stored by wheat planting time differed between the WSF and WF systems only in 1981; moisture stored by sorghum planting time in the WSF and SF systems differed only in 1981 also. The amount of moisture stored by wheat planting time in the WSF system in 1981 (12.84 in.) was less than that stored in the WF system (14.50 in.) because of the low efficiency of sorghum stubble, as compared to wheat stubble, in reducing evaporation. The amount of wheat stubble remaining after harvest in 1980 was unusually large (about 5,000 lbs/A as opposed to the 3,000-4,000 lbs/A usually produced). This additional stubble apparently allowed the retention of more precipitation in 1981 than did the sorghum stubble. The amount of moisture stored by sorghum planting time in the WSF system in 1981 (12.97 in.) was less than that stored in the SF system (14.64 in.) because of the dry summer and winter of 1980-81, mentioned above. Much of the moisture stored in the longer fallow period of the SF system probably occurred following sorghum harvest in October 1979 but prior to the summer of 1980.

Summary

Following wheat harvest, most of the soil moisture was stored by sorghum planting time in June. In only 1 of 4 years was significant moisture stored during the period between June and wheat planting time in September. A significant loss of soil moisture occurred during this time in 1 year. More moisture was stored in the 19-month fallow period in the SF system, as opposed to the 11-month fallow period in the WSF system prior to sorghum in only 1 of 4 years, also. Likewise, there was more moisture stored in the 15-month fallow period of the WF system as opposed to that stored in the WSF system prior to wheat in 1 of 4 years.

The results of this study indicate that more moisture is stored in the longer fallow periods of WF and SF only when precipitation is very limited in the shorter fallow periods of WSF. Thus, the fallow periods of the WSF system are generally more efficient in storing moisture than those of the WF or SF systems.

Contribution 83-35-S, Garden City Branch Experiment Station.

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