

CONSERVATION TILLAGE

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Conservation tillage practices have had a major impact on wheat and sorghum yield in the Central Great Plains. The affect of improved use of straw mulches and total fallow period weed control on winter wheat yields obtained in wheat-fallow rotations at the Central Great Plains Research Station near Akron, Colorado has been significant. During the 1916-1960 period average 14-month fallow period precipitation was 16.5 inches and average wheat yield was 19.6 bushels per acre. From 1961 to 1975 precipitation was 15.3 inches and wheat yields were 32.2 bushels per acre.

The higher wheat yields in recent years are an integrated result of total fallow period weed control for higher soil water storage, conservation tillage utilizing crop stubble and clods, improved varieties, and improved seeding and harvesting equipment. The changes in wheat yields with time at Akron, CO are shown in the following table*:

Time Period	Fallow Tillage	Precip. In.	Wheat Yield Bu/A.	Water Use Eff. Bu/A/In.
1916-1930	Moldboard plow, harrow	17.3	15.9	0.46
1931-1945	Oneway disk, bare rodweeder	15.8	17.3	0.54
1946-1960	Disk, sweeps, rodweeder with chisels	16.4	25.7	0.78
1961-1975	Blades, sweeps, rodweeder with chisels (begin total fallow period weed control)	15.3	32.2	1.05

*Taken from Greb, Smika, Woodruff and Whitfield. 1974. Chapt. 4 In Summer Fallow in the Western United States. USDA-ARS. Conservation Research Report No. 17.

Research has shown the optimum fallow conditions should include:

1. Weed free soil during the entire fallow period.
2. Crop stubble in an upright position as long as possible during the fallow period but is a necessity during winter months to retain snow.
3. A mulch of 1500 to 2500 pounds of straw per acre on the soil surface at seeding time.

4. Firm clods where tillage is used and residue is not sufficient to provide adequate wind erosion protection.
5. Obtaining the above with the least amount of tillage.

Fallow systems common to the Great Plains.

1. Conventional tillage fallow - 4 to 6 tillage operations.
This generally involves 2 tillages after harvest with V-blade equipment followed the next spring and summer by blades, sweeps, chisels, disks, and rodweeder with chisels, etc. The tool used depends on the weed species to kill and the time of fallow period.
2. Reduced tillage fallow - 2 to 4 tillage operations.
With this system residual and/or contact herbicides are substituted for 2 to 4 tillage operations. Experimental results to date indicate that the best time to perform any tillage in this system is early in the fallow period, however, with herbicides available today this is difficult if not impossible.
3. No-till fallow - no tillage operations.
Herbicides are substituted for all tillage operations. This system has since 1961 presented 2 problems on occasion:
 - a) Too much stubble at planting for existing equipment to satisfactorily seed the crop.
 - b) Soil becomes too hard for planting equipment to penetrate for seeding operation - occurred on only extremely sandy soils to date.

Results from each of these systems are presented in the following table:

Fallow System	Soil Water Storage ^{1/}	Fallow Eff. ^{1/}	Soil NO ₃ at Planting ^{1/}	Grain Yield ^{2/}						Avg.
				In.	%	Lbs/A	1970	71	72	
Conventional No Fall	2.59	22	70	39	38	36	43	41	27	37
	3.14	26	104	43	44	40	49	47	21	41
Reduced Till.	4.17	35	97	49	43	43	51	52	34	45
No Till	5.12	43	119	—	—	—	—	53	35	—

^{1/} 1970-1976 average no experimental data in 1973.

^{2/} 1970-72 are an average of 5 farmer fields and 1 experiment field.

^{3/} Data from 1974-1976.