OKLAHOMA
AGRICULTURAL AND MECHANICAL COLLEGE
AGRICULTURAL EXPERIMENT STATION
DEPARTMENT OF AGRONOMY
STILLWATER, OKLAHOMA

CULTURAL METHODS
for
CORN AND GRAIN SORGHUMS
on
OKLAHOMA SOILS

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Bulletin No. 150. January, 1925.

CULTURAL METHODS FOR CORN AND GRAIN SORGHUMS ON OKLAHOMA SOILS

Tillage has some very important relationships with respect to crop production. It modifies the structure of the soil, thus facilitating aeration and drainage; it is a means of disposal of coarse materials such as farm manures, green manures, crop residues, and the like; it modifies bacterial activity thus influencing the availability of plant food; it loosens the ground for seeding; and it checks weed development. All of these factors are very important. It has been said that a good seed bed, well prepared, is a crop half produced. Alas, how true.

It is the purpose of this publication to consider the influence of tillage on weed development only.

The weed is one of the most destructive enemies of the farmers of this state. Moisture controls crop production in over two-thirds of this state every year, and very often is the limiting factor over the whole state. If it is not moisture, plant food comes in as a factor close second in the control of crop growth..

The weed is very destructive to both moisture and plant food. All plants require a certain amount of moisture for the production of a pound of dry matter; the weed is no exception. In fact, most weeds require as much, if not more, moisture than do the ordinary crops. The Nebraska Station* gives some data showing that sunflowers used more than three times as much water per plant as corn, while the water used per unit of dry matter was more than twice that for corn.

Data collected at the Oklahoma Experiment Station in 1924 show the influence of weeds in removing moisture from the soil; also, the effect of different methods of cultivation on the retaining of soil moisture.

*Nebr. Res. Bul. No. 6, Transpiration as a Factor in Crop Production.

Table I, Showing Effect of Weeds and Cultivation on Moisture

Treatment	Moisture Content ⅓ ft. June 20	Moisture Content ⅓ ft. July 2	Moisture Content ⅓ ft. July 30	Moisture Content Aug. 9, 1 ft. .....
Weeds allowed to grow	19.01%	19.99%	16.19%	8.75%
Weeds hoed off (scraped)	19.36%	21.26%	16.99%	13.35%
Deep after rains	22.78%	22.74%	16.52%	15.12%
Shallow three times	20.12%	20.53%	18.81%	13.49%
Shallow five times	19.68%	19.43%	19.45%	13.45%
Shallow after rains	19.42%	19.77%	19.22%	14.44%
Deep three times	19.97%	19.92%	19.11%	15.21%
Deep five times	.....	18.92%	18.07%	14.86%

Not a great deal of difference was observed in the first two determinations because the rainfall during June was 2.52 inches, fairly well distributed; also, weed growth had not advanced a great deal at that time. Later in the season, the influence of weeds was quite pronounced. The growing season of 1924 was much above the average so far as moisture was concerned. With average years, the effect of weeds on moisture would be even more pronounced than that noted in the table. An average moisture content of the plots on which kafir was allowed to grow from the years 1916 to 1922 inclusive, are recorded in the following table:

Table II, Showing Moisture Content of Plots for Different Periods

Treatment	May 29 June 15	June 26 July 5	July 11 July 20	July 25 Aug. 8
Weeds allowed to grow	19.38%	16.22%	14.45%	11.54%
Weeds scraped off with hoe	21.11%	18.62%	17.03%	13.72%
Cultivate deep after rains	19.95%	19.11%	18.21%	15.36%
Shallow three times	19.27%	18.92%	17.93%	15.32%
Shallow five times	19.13%	18.14%	17.87%	14.95%
Shallow after rains	19.49%	18.08%	17.78%	14.74%
Deep three times	19.31%	18.72%	17.40%	14.62%
Deep five times	19.04%	17.75%	18.46%	15.25%

As the season advances, rainfall decreases and weed growth is greater and the influence of the weed in removing soil moisture becomes more pronounced. It is during this period of greatest draft for moisture by the weeds that the crop also needs more moisture.

The moisture used by weeds would be more efficiently used if it were conserved for the growing of the general field crops. The same thing applies to the plant food removed. Data collected at the North Dakota Experiment Station* show that one ton of green pigeon grass removes enough fertility to raise approximately three bushels of wheat; one ton of barnyard grass enough to raise approximately four bushels of wheat; one ton of marsh elder enough to raise two bushels of wheat; one ton of lamb's quarter enough to raise five bushels of wheat; one ton of giant ragweed enough to raise five bushels of wheat; and one ton of rough pigweed enough to raise approximately four bushels of wheat. These figures mean enormous losses to farmers who allow weeds to remove fertility from the soil.

*Fertility and Weeds, Bulletin 112.

METHODS OF CONTROLLING WEEDS IN THE GROWING OF THE CORN AND GRAIN SORGHUM CROPS

EARLY PLOWING

If the ground is plowed early, it gives a chance for the weed seeds to sprout and with the further preparation of the seed bed later on the young weeds are practically all killed. The disk and harrow come in very handy; in fact, are almost essential for the final preparation of a good seed bed. Of

course, if the plowing is delayed until late spring, a large number of the weeds have begun to grow and are killed when plowed under, but it is impossible to prepare a good seed bed this late in the season for the coming crop, and a good seed bed is very essential. The influence of early plowing in preparing a good seed bed is illustrated by the following data collected by the Extension Division from club members in Oklahoma for the year 1922. The data covers 50 individual reports on peanuts, reports from 35 counties on cotton, and reports from 20 counties on corn.

Table III, Showing Influence of Early Seed Bed Preparation on Yield of Crops

Date of Plowing	Yield of Corn Per A., 1922, Bu.	Yield of Peanuts Per A., 1922, Bu.	Yield of Cotton Per A., 1922, Lb.
December, or earlier	50.00	39.00	624
January	44.60	31.00	558
February	38.00	25.00	564
March	24.50	24.00	553
April	28.33	24.00	.....
May	11.50	12.50	.....

It is also illustrated by the following experiment conducted by the Oklahoma Experiment Station.

Table IV, Showing Influence of Early Seed Bed Preparation on Yield of Wheat

	Five Year Average	
	Bu. Per Acre	Tons of Straw
Early—July 15	27.10	1.39
Medium—August 15	24.20	1.19
Late—September 15	22.00	1.15

The above date shows the advisability of early seed bed preparation of soils for the common crops grown in this state. The exception to this are "blow soils" and soils which have a tendency to wash badly. On "blow soils" every precaution should be taken to prevent blowing. This will of necessity alter the general cultural practices. Soils which wash badly should be terraced and kept in a sod crop as much as possible. The problem then of controlling weeds, for the most part, should be confined to those methods most efficient with respect to early seed bed preparation.

CULTIVATION

In order to test out the best method of cultivating, in 1917 the Oklahoma Experiment Station started an experiment on an ordinary upland soil common in this state. This experiment has been continued each year since that time. Table V gives the results so far secured.

In shallow cultivation, the depth of cultivating was from 0 to 3 inches, while in deep cultivation, the depth ranged from 4 to 6 inches. Where the weeds were scraped off with a hoe, the ground was not disturbed any more than could be helped.

The results show that the big item in cultivation is the control of weeds. When the weeds were allowed to grow, the average yield of grain was 13.02 bushels of kafir per acre, while with the weeds scraped off, the yield was 22.52 bushels—a difference of 9.5 bushels of grain per acre. The average of all cultivations was 21.57 bushels of grain per acre. This shows conclusively the status of the weed in limiting crop production. The average yield of all the plots receiving shallow cultivation was 22.93 bushels of grain per acre, while for the deep cultivations, it was 20.94 bushels. The greatest increase of cultivation over the plot where the weeds were scraped off with a hoe was where the crop was cultivated shallow after each rain. This increase amounted to 1.03 bushels of grain per acre. The increase for cultivating five times shallow during the growing season amounted to .62 bushels per acre. The yield for the plot cultivated three times shallow was practically the same as for the plot where the weeds were scraped off with a hoe. Shallow cultivation three times during the growing season was the most economical cultural treatment. The other shallow cultivations gave a little higher yield but not enough to pay for the extra labor. None of the deep cultivations gave as high a yield as the lowest yield on plots cultivated shallow. The general conclusion regarding cultivation on sandy to silt loam soils for these crops, is to cultivate shallow as many times as is necessary to keep the weeds under control. With heavier soils more tillage would probably be necessary to keep the soil open for the entering of moisture and for aeration. Harrowing the land just as the crop is coming through the soil, and after it is up, will help a great deal in the control of weeds, and will reduce the amount of later cultivation needed.

Table V, Showing Yields of Kafir for Various Treatments

Treatment	1917 Grain	1917 Forage	1918 Grain	1918 Forage	1919 Grain	1919 Forage	1920 Grain	1920 Forage	1921 Grain	1921 Forage
1. No cultivation or hoeing	592.5	2357.5	Non-Maturity Only Green Weights Recorded		8	952	330	1086	2811	4289
2. Weeds scraped off with hoe	862.5	3277.5			1055	1255	958	2045	2926	4274
3. Deep after rains	730	3020			1132	1868	661	1656	2118	3682
4. Shallow 3 times	902.5	3387.5			947	1643	727	1890	2888	3712
5. Shallow 5 times	875	3595			1155	1605	1042	2218	2810	3740
6. Shallow after rains	867.5	3632.5			1224	1426	925	2218	2849	4451
7. Deep 3 times	765	2935			1063	1807	958	2059	2233	3267
8. Deep 5 times	857.5	3142.5			1155	1625	958	2388	2349	3351
9. No cultivation or hoeing	290	2220			31	1199	99	759	2079	3171
10. Weeds scraped off with hoe	1015	3745			770	970	482	848	2310	4490
11. Deep after rains	837.5	3247.5			1194	1306	694	1580	2233	3367
12. Shallow 3 times	825	3295			862*	1138	661	1870	2426	3474
13. Shallow 5 times	1137.5	4287.5			670*	1430	1123	2481	2503	3147
14. Shallow after rains	806	3444			732*	1768	1229	2632	2772	4328
15. Deep 3 times	750	2980			231*	1019	793	1524	2002	3596
16. Deep 5 times	1065	3650			123*	667	859	1715	2002	2898
17. Deep-shallow	1281	4869			39*	1841	634	2412	2079	2871
18. Shallow-deep	856	3544			15*	1865	727	3606	2734	5066

Treatment	1922 Grain	1922 Forage	1923 Grain	1923 Forage	1924 Grain	1924 Forage	Aver. Yield Per A., 1917-24, Omitting 1918 Grain	Aver. Yield Per A., 1917-24, Omitting 1918 Forage	General Aver. of Plots and their duplicates Grain (Bus.)	General Aver. of Plots and their duplicates Forage (Lbs.)
1. No cultivation or hoeing	193	1357	No Grain Due to Dry Weather	0	1005	2595	12.60	1805	13.02	1907
2. Weeds scraped off with hoe	1848	4502		2400	1275	3325	22.76	3011	22.52	3244
3. Deep after rains	2695	5005		2800	1245	3555	21.89	3084	21.48	3197
4. Shallow 3 times	2002	5798		2500	1155	3145	21.99	3154	22.09	3332
5. Shallow 5 times	1771	4629		2350	1200	3100	22.58	3034	23.14	3377
6. Shallow after rains	1848	4352		2500	1050	2650	22.36	3033	23.55	3429
7. Deep 3 times	1733	3717		2600	975	2425	19.71	2687	20.06	3034
8. Deep 5 times	1925	4775		2700	1005	2495	21.04	2925	21.29	3192
9. No cultivation or hoeing	385	1265		0	1665	4635	13.44**	2008**		
10. Weeds scraped off with hoe	1771	3779		2600	1905	5395	22.27**	3476**		
11. Deep after rains	1733	3667		2750	1560	5240	21.06**	3309**		
12. Shallow 3 times	1964	4486		2900	1560	5040	22.18**	3509**		
13. Shallow 5 times	1848	4752		3000	1350	4650	23.69**	3719**		
14. Shallow after rains	2002	4898		3050	1500	4600	24.73**	3825**		
15. Deep 3 times	1887	4663		2700	1425	4815	20.40**	3380**		
16. Deep 5 times	1887	5163		2850	1425	4475	21.54**	3459**		
17. Deep-shallow	1579	4221		2700	1275	3025	20.38**	3349**	20.38***	3349***
18. Shallow-deep	1309	3891		3050	1275	2825	20.54**	3664**	20.54***	3664***

*Injured by stray livestock. **Omitting 1919 because of injury to some plots by stray livestock. ***Not duplicated.

SUMMARY

1. The weed is the most destructive enemy to dry farming.
2. It takes moisture from the soil which should be used by the crop. Furthermore, this moisture is removed from the soil at the time the field crop needs it mostly.
3. The weed removes a large amount of plant food from the soil.
4. Methods of control must recognize **early plowing** as the initial method in seed bed preparation.
5. Shallow cultivation gave better results than deep cultivation.
6. Scraping the weeds off with a hoe gave practically as good results as cultivation on sandy to silt loam soils. This, however, was not as economical as cultivation.
7. The primary principle of cultural methods in this state should be to control the weed. To do this, cultivate shallow as often as is necessary.
8. Shallow cultivation three times during the growing season was the most economical method in this experiment, though by cultivating shallow oftener somewhat larger yields were secured.

ACKNOWLEDGMENTS

The author wishes to acknowledge indebtedness to all who have worked on this experiment. Special acknowledgement is made to Dr. Wallace Macfarland, and Professor D. R. Johnson, who had charge of the experiment during the early part of the investigation.