Bulletin No. 150 - Fallow for Small Grains

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<table>
<thead>
<tr>
<th></th>
<th>Average Winter Wheat Yields for Nine Years, Sheridan Experiment Farm</th>
</tr>
</thead>
<tbody>
<tr>
<td>Grown in a rotation in which the preceding crop was winter wheat.</td>
<td>18.8 bushels per acre</td>
</tr>
<tr>
<td>Grown in a rotation in which the land was fallowed the preceding year.</td>
<td>35.0 bushels per acre</td>
</tr>
</tbody>
</table>

**FALLOW FOR SMALL GRAINS**

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Fallow for Small Grains*

R. S. TOWLE

This circular gives the results of experiments at the Sheridan Field Station† for the period from 1918 to 1926, inclusive. From these results a comparison may be made of the yields of winter wheat, spring wheat, oats, and barley on summer fallow and on land cropped the year before. The station is located on a non-irrigated tract of 160 acres about eight miles northeast of Sheridan. The land which is used for the experiments is on a northeast slope which is fairly uniform and is representative in general of the greater part of the dry-farmed land in this section of the state. The soil is a dark, heavy clay loam with a small quantity of gumbo. The altitude of the station is about 3,800 feet.

CLIMATE‡

The rainfall, as recorded at the station shows wide fluctuations both in amount and also in its distribution during the season, a condition which is characteristic generally of the Great Plains. The average annual rainfall from 1917 to 1925, inclusive, was 15.11 inches, with a range from 8.56 inches in 1919 to 25.18 inches in 1923. The seasonal rainfall (April 1 to August 31) ranged from 4.14 inches in 1919 to 13.32 inches in 1922 with an average of 8.69 inches for the ten-year period from 1917 to 1926, inclusive.

The records of evaporation are a fair index of climatic factors, other than rainfall, that influence crop production. Evaporation is determined by micrometer measurements of the change in water level in a tank 24 inches deep and 6 feet in diameter, sunk to a depth of 20 inches in the ground. Evaporation tends to vary inversely with the rainfall, and at Sheridan it has ranged from 1.51 times the rainfall during the same period in 1923, to 8.2 times the rainfall in 1919.

*Division of State Farms Bulletin No. 9.
†This station is conducted cooperatively by the Office of Dry-Land Agriculture of the United States Department of Agriculture and the Division of State Experiment Farms, Agricultural College, University of Wyoming.
State Farms—Cheyenne, Laramie County; Eden, Sweetwater County; Gillette, Campbell County; Grover, Lincoln County; Lander, Fremont County; Lyman, Uinta County; Sheridan, Sheridan County; Torrington, Goshen County; Worland, Washakie County. (Cheyenne and Sheridan Farms cooperating with U. S. D. A.)
‡Climatic records were taken in cooperation with the Office of Biophysical Investigations of the United States Department of Agriculture.
The mean temperature from April 1 to September 30 averaged 59.3°F for the ten-year period. Temperatures of 100°F occur but seldom during any season, and in many years not at all. The wind velocity is relatively low compared with other sections in the Great Plains. Winds strong enough to cause destructive soil shifting are rare.

PLAN OF EXPERIMENTS

For comparing the yields on fallow and on land cropped the year before, the yields from 86 tenth-acre plats have been considered. There are 23 rotations varying in length from two to five years considered in these pages, and four series of plats on each of which a single crop is grown continuously.

In each of the continuously cropped series, two plats are alternately cropped and fallowed, one being in crop in the even years and the other in the odd years, and two other plats are seeded each year. With the spring grains, one of these is plowed eight inches deep in the fall and the other is plowed shallow in the spring. With winter wheat one is plowed as soon as possible after harvest and the other shortly before seeding. In this bulletin the average yields of the two plats that are plowed and continuously cropped are used for comparisons with the yields on the plats that are fallowed every other year. In some of the rotations, all the small grains, except barley, are grown on fallow and in others they follow other crops. In many cases where one crop follows another, it is in a rotation in which there is a fallow year.

All plats of a given crop were seeded at the same time to the variety considered best adapted to the locality. Plowing for fallow was generally completed before any great amount of weed growth had taken place, usually about the middle of June. After plowing, just sufficient cultivation was given with ordinary tillage implements to keep the land reasonably free from weeds. During the last three years a duckfoot cultivator has been used for this purpose. Less cultivation has been found necessary with this implement than with a disk. The duckfoot kills weeds more readily than the disk, and it leaves the surface in better condition to take up the rainfall and to resist soil blowing.
RESULTS WITH WINTER WHEAT

The yields of winter wheat on fallow show a considerable increase when compared with the yields on land cropped the year before. There are instances where land cropped the year before made a higher yield than land that was fallowed, but in general the yields on fallow were considerably the higher.

The average yield of winter wheat on the plats alternately fallowed was 29.4 bushels to the acre for the nine-year period from 1918 to 1926, inclusive, and 16.7 bushels on the plats cropped continuously. In rotations containing other crops the average yield on fallow was 35.0 bushels to the acre, whereas the yield following another crop of winter wheat was 18.8 bushels. On oats ground the yield was 23.9 bushels, and on disked corn ground 25.6 bushels. This was an increase for fallow of 86 per cent compared with land in winter wheat the year before, stubbled in; 46 per cent compared with oats ground, and 37 per cent compared with corn ground. In one year, 1920, the yield following oats was slightly higher than on fallow in a rotation, but in 1921 when yields by all other tillage methods were poor, there was a fair yield on fallow. In 1919 when the crop generally was a total failure, there was some crop on fallow.

RESULTS WITH SPRING WHEAT

With spring wheat, increases in yield due to fallow have been generally smaller than with winter wheat. The average yields for the nine-year period were 22.8 bushels to the acre on alternate fallow and 13.9 bushels on the plats continuously cropped.
TABLE I.
AVERAGE AND ANNUAL YIELDS OF WINTER WHEAT ON FALLOW AND FOLLOWING SMALL GRAINS AND CORN AT THE
SHERIDAN FIELD STATION FOR THE NINE YEARS FROM 1918 TO 1926, INCLUSIVE.

<table>
<thead>
<tr>
<th>Preceding Crop</th>
<th>Treatment</th>
<th>Yields Per Acre (bushels)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>1918</td>
</tr>
<tr>
<td>Fallow</td>
<td>Alternate fallow</td>
<td>44.2</td>
</tr>
<tr>
<td>Winter Wheat</td>
<td>Continuous plowed</td>
<td>34.2</td>
</tr>
<tr>
<td>Fallow</td>
<td>In rotation</td>
<td>42.9</td>
</tr>
<tr>
<td>Winter Wheat</td>
<td>do plowed</td>
<td>32.6</td>
</tr>
<tr>
<td>do</td>
<td>do disked</td>
<td>29.5</td>
</tr>
<tr>
<td>Oats</td>
<td>do do</td>
<td>36.3</td>
</tr>
<tr>
<td>Corn</td>
<td>do do</td>
<td>36.0</td>
</tr>
</tbody>
</table>

TABLE II.
ANNUAL AND AVERAGE YIELDS OF SPRING WHEAT ON FALLOW AND FOLLOWING SMALL GRAINS AND CORN AT THE
SHERIDAN FIELD STATION FOR THE NINE YEARS FROM 1918 TO 1926, INCLUSIVE.

<table>
<thead>
<tr>
<th>Preceding Crop</th>
<th>Treatment</th>
<th>Yields Per Acre (bushels)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>1918</td>
</tr>
<tr>
<td>Fallow</td>
<td>Alternate fallow</td>
<td>29.2</td>
</tr>
<tr>
<td>Spring wheat</td>
<td>Continuous, plowed</td>
<td>22.1</td>
</tr>
<tr>
<td>Fallow</td>
<td>In rotation</td>
<td>30.3</td>
</tr>
<tr>
<td>Oats</td>
<td>In rotation, plowed</td>
<td>22.8</td>
</tr>
<tr>
<td>Corn</td>
<td>do do</td>
<td>27.4</td>
</tr>
<tr>
<td>Corn</td>
<td>do disked</td>
<td>23.4</td>
</tr>
</tbody>
</table>
In rotations with other crops the yield on fallow was 24.2 bushels as compared with 15.9 bushels on oats ground, an increase of 8.3 bushels for fallow. The yield on fallow was only 5.6 bushels more than on corn ground. With spring wheat as with winter wheat, fallow produced fair crops in some years when yields were low on land cropped the previous year. In the extremely dry year of 1919, however, the crop on fallow was poor.

RESULTS WITH OATS

Increases in the yields on fallow over the yields on land cropped the year before were smaller with oats than with either winter wheat or spring wheat. Alternate fallow produced an average yield of 46.6 bushels for the nine-year period, and the plats continuously cropped produced a yield of 33.3 bushels. In rotations with other crops, the average yield on fallow was 45.7 bushels. This is only six bushels more than the average yield where oats followed corn. Where oats followed a small grain crop the average yield was 36.1 bushels, only 9.6 bushels less than the average on fallow in rotations.
### TABLE III.

<table>
<thead>
<tr>
<th>Treatment</th>
<th>1918</th>
<th>1919</th>
<th>1920</th>
<th>1921</th>
<th>1922</th>
<th>1923</th>
<th>1924</th>
<th>1925</th>
<th>1926</th>
<th>Average</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fallow</td>
<td>61.2</td>
<td>55.3</td>
<td>50.9</td>
<td>50.4</td>
<td>54.9</td>
<td>51.9</td>
<td>65.6</td>
<td>58.8</td>
<td>53.1</td>
<td>56.9</td>
</tr>
<tr>
<td>Oats</td>
<td>3.3</td>
<td>2.2</td>
<td>0</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>1</td>
<td>3</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Small grain</td>
<td>55.8</td>
<td>55.8</td>
<td>55.8</td>
<td>55.8</td>
<td>55.8</td>
<td>55.8</td>
<td>55.8</td>
<td>55.8</td>
<td>55.8</td>
<td>55.8</td>
</tr>
<tr>
<td>Corn</td>
<td>55.8</td>
<td>55.8</td>
<td>55.8</td>
<td>55.8</td>
<td>55.8</td>
<td>55.8</td>
<td>55.8</td>
<td>55.8</td>
<td>55.8</td>
<td>55.8</td>
</tr>
</tbody>
</table>

### TABLE IV.

<table>
<thead>
<tr>
<th>Treatment</th>
<th>1918</th>
<th>1919</th>
<th>1920</th>
<th>1921</th>
<th>1922</th>
<th>1923</th>
<th>1924</th>
<th>1925</th>
<th>1926</th>
<th>Average</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fallow</td>
<td>47.9</td>
<td>42.9</td>
<td>42.4</td>
<td>42.1</td>
<td>41.8</td>
<td>42.8</td>
<td>42.2</td>
<td>42.2</td>
<td>42.2</td>
<td>42.2</td>
</tr>
<tr>
<td>Barley</td>
<td>47.9</td>
<td>42.9</td>
<td>42.4</td>
<td>42.1</td>
<td>41.8</td>
<td>42.8</td>
<td>42.2</td>
<td>42.2</td>
<td>42.2</td>
<td>42.2</td>
</tr>
<tr>
<td>Oats</td>
<td>47.9</td>
<td>42.9</td>
<td>42.4</td>
<td>42.1</td>
<td>41.8</td>
<td>42.8</td>
<td>42.2</td>
<td>42.2</td>
<td>42.2</td>
<td>42.2</td>
</tr>
<tr>
<td>Corn</td>
<td>47.9</td>
<td>42.9</td>
<td>42.4</td>
<td>42.1</td>
<td>41.8</td>
<td>42.8</td>
<td>42.2</td>
<td>42.2</td>
<td>42.2</td>
<td>42.2</td>
</tr>
</tbody>
</table>
RESULTS WITH BARLEY

With barley the only direct comparison possible is between alternate fallow and continuous cropping. The average yields by these two methods for the nine-year period were 23.7 bushels to the acre for the continuously cropped plats and 39.2 bushels on fallow, an increase of 15.5 bushels to the acre, or 65 per cent for fallow. On disked corn ground in rotation with other crops, the yield of barley for the same period was 36.0 bushels to the acre, only 3.2 bushels less than on the alternate fallow. Following a crop of oats the average yield of barley was 32 bushels to the acre.

FALLOWING WITH THE DUCKFOOT CULTIVATOR COMPARED WITH PLOWING

In 1925 and 1926 spring wheat was grown on two fallow plats not included in the regular cropping system. One plat consisted of the ordinary plowed fallow, and the other was not plowed but only cultivated with the duckfoot cultivator. Both plats were given the same tillage after the time of plowing. For the plat not plowed, it was found necessary to give a cultivation somewhat earlier than the ordinary plowing date and again at the time of plowing the other plat. This made one extra tillage operation over that required for the plowing, or two cultivations with the duckfoot to take the place of the plowing. The same amount of power was required for a 16-inch plow as for a 7-foot duckfoot cultivator. But little difference resulted in the yields by the two methods of fallow in those two years, the yields for each method being as follows:

<table>
<thead>
<tr>
<th>Year</th>
<th>Fallow-plowed</th>
<th>Fallow-cultivated only</th>
</tr>
</thead>
<tbody>
<tr>
<td>1925</td>
<td>29.7</td>
<td>29.3</td>
</tr>
<tr>
<td>1926</td>
<td>17.2</td>
<td>20.8</td>
</tr>
</tbody>
</table>
SUMMARY

The averages of nine years show that winter wheat produced nearly twice as much on fallow as it did following another crop of winter wheat and 46 per cent more than when it was seeded on oats stubble. Compared with winter wheat seeded on disked corn ground, the yield on fallow was 37 per cent greater. There were fair yields on fallow in years when the crop following small grain or corn was poor or even practically a failure.

Higher yields of spring wheat and oats were produced on fallow than on land cropped the year before, but the margin of fallow over other tillage methods was smaller than with winter wheat. As with winter wheat, the crop was more certain on fallow than on land in crop the previous year. For barley the average yield for the nine-year period on corn ground was nearly as large as on fallow.

In comparing the yields on fallow with those on land which produced a crop the year before, the fact should be considered that fallow land is idle part of the time. In the case of winter wheat, it would appear that the increase in yield due to fallow is sufficient to pay for the fallow, except possibly where the crop may be grown on corn ground. With spring grain, especially oats and barley, it does not appear that the increase in yield on fallow is sufficient to pay directly for the use of the extra land and labor.

However, there have been seasons when crops on land which produced the year before have been practically failures and those on fallow have produced fair yields. It is probable that droughty seasons will occur in the future as frequently as in the past. Consequently it would seem to be good practice to grow at least a part of the acreage of small grain on fallow. Such a cropping system not only insures a crop in dry years but it is also an aid in the control of weeds, the value of which cannot be easily estimated.