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OATS

Rotation vs. Continuous Culture

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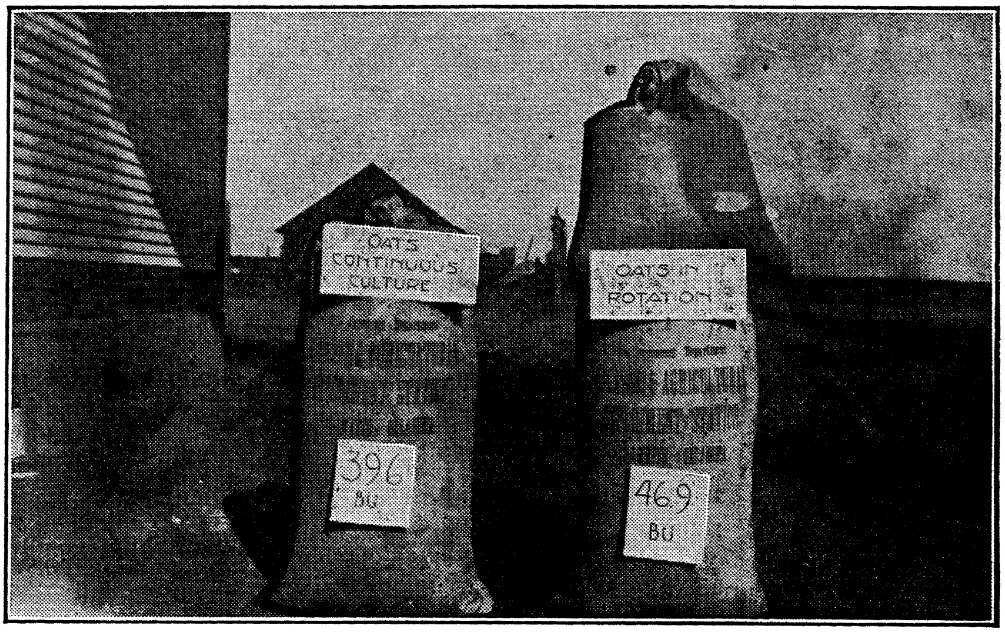

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SUMMARY

1. A continuous cropping system with the oats crop is not advisable.

2. Straw may be used in connection with continuous cropping with profit.

3. The use of manure is profitable whether used in connection with continuous cropping or a rotation.

4. Manure has produced greater yields than crop residues whether used with continuous cropping or a rotation.

5. A crop rotation has been more effective in maintaining the yield of oats than has manure when used in the continuous cropping system.

6. The crop rotation has given as an average for the last five years of 7.31 bushels per acre more oats than has the continuous culture.

7. The best system studied was manure used in connection with a crop rotation. This system gave a yield of 8.7 bushels per acre more oats as an average for five years than did the continuous cropping system.

8. Considering the approximate 1,500,000 acres of oats grown per year in the state, and basing the calculations on the figures shown above a rotation would mean over $4,000,000 to the farmers of the state each year over continuous cropping after extra cost of threshing and hauling the increase in yield have been deducted. Another $1,000,000 could be added yearly by using manure in connection with the rotation.

Oats---Rotation vs. Continuous Culture

BY H. F. MURPHY

The object of this bulletin is to bring before the farmer the results that he may likely expect in growing a small grain under different soil managements and treatments.

According to a survey made of the state through the county agents in the various sections of the state a very small percentage of the farmers practice much of any crop rotation. This does not necessarily mean that the same crop is grown on a piece of land year in and year out but it is safe to suppose that in a large number of cases this is true. Possibly the west half of the state is more affected by growing a single crop on the same land a larger number of years than any other section; wheat being the predominating crop in that section, although it is also a practice in other parts of the state to grow corn continuously on the bottom land, and in the south to grow cotton more or less continuously on the same soil.

From the same survey made through the same source it was brought to light that a very small percentage of the manure produced on the farms in the state was returned to the soil. This is an exceedingly bad practice. The most economical fertilizer the farmer can use is the manure produced on his farm. It will repay him more for the time and money outlayed than any fertilizer he can buy, although it is not a balanced fertilizer in itself.

It is a common thing for crop residues to be wasted. Many a straw stack has gone up in smoke so as to provide a little larger amount of ground to be planted to a given crop, when by a little effort during the slacker parts of the year the same results could be obtained and a higher yield for the other acreage brought about at the same time.

All the above ideas are considered by the rational farmer in his yearly, monthly, weekly, and still more definite, his daily thoughts and actions in producing the most from the soil with the most economical expenditure of money.

In the past these facts have not been so pronounced but with an increasing population and a soil that is already depleted of some of its necessary elements for supporting plant growth, the answer and actions that are brought about by these ideas will help determine the agriculture of the future.

AN OKLAHOMA EXPERIMENT

In order to ascertain to what extent the above problems affected Oklahoma, the Experiment Station started a series of experiments about five years ago, using oats grown continuously and oats grown in a rotation consisting of oats, cowpeas, darso,

and cotton. The first year that data were secured was 1917. No fertilizer had ever been applied to any of the plots so far as is known before this experiment was started.

SOIL AND SUBSOIL

The soil is classified as belonging to the Kirkland series and ranges from a loam to a silt loam. The distinguishing features of this soil is that it is underlaid with a more or less hardpan subsoil which is very hard when dry and very plastic when wet. Both the soil and subsoil are low in organic matter as is typical of a large percentage of Oklahoma uplands.

The land is divided into one-tenth acre plots. Seven-foot alleys running the length of each plot separate the several plots from each other. These alleys are sufficiently wide to eliminate any possibility of mixing the soil of one plot with another when the soil is plowed and prepared for the crops. The plots are rectangular in shape being 17½ feet wide by 248 9-10 feet long.

MANURAL APPLICATIONS

To the plots receiving manure, the manure is applied once every four years equivalent to that which would have been produced if the crops raised on the particular plots had been fed to livestock. This makes the application different for different plots but it is in proportion to the yields produced.

The crop residues for the residue plots are returned each year. These residues consist of the straw, forage, or vines, grown on the particular plots.

RESULTS

The results of this experiment clearly show that continuous culture is not advisable for the oats crop. The five year average of the highest yielding check plot in the continuous culture is not as high as the average of the lowest check plot where the rotation was used, as can be observed in the following table.

TABLE 2—CONTINUOUS OATS CULTURE

Yields in Pounds Per Acre Per Year

Plot and Treatment	1917		1918		1919		1920		1921		5-Yr. Average	
	Grain	Straw	Grain	Straw	Grain	Straw	Grain	Straw	Grain	Straw	Grain	Straw
19 Check	1560	1720	1725	1575	1540	2180	770	1280	1090	1010	1337	1553
22 Check	1620	1530	1610	1400	1735	2405	800	1200	970	730	1347	1453
25 Check	1240	1310	1490	1970	1710	2470	800	1000	1100	1000	1268	1550
28 Check	1160	1090	1735	1720	1455	1985	460	640	760	990	1114	1285
20 Manure	1790	1960	1807	1563	1845	2895	780	1240	1090	710	1462.4	1669.6
23 Residues	1650	1700	1772	1560	1830	2570	680	1120	1010	890	1388.4	1568

OATS IN A ROTATION

Yields in Pounds Per Acre Per Year

	1917		1918		1919		1920		1921		5-Yr. Average	
	Grain	Straw	Grain	Straw	Grain	Straw	Grain	Straw	Grain	Straw	Grain	Straw
19 Check	800	1200	1222.5	1687.5	1777.5	3182.5	1770	2030	1180	1270	1350	1873.9
22 Check	1000	1080	2010	2020	1850	2290	1500	2700	1395	1165	1551	1851
25 Check	1210	1370	1680	1620	1765	2445	1750	2450	1650	1450	1611	1867
28 Check	1310	1210	1040	1240	1470	2110	2100	2200	1535	1365	1491	1625
2 Manure	1080	920	2017.5	1992.5	1790	3010	1240	1460	1600	1300	1545	1736.5
8 Residue	890	810	1405	1355	1920	3020	1780	2570	1350	1450	1469	1841

The average of the check plots for the continuous culture of oats shown in Table 2 is 1266.5 pounds or 39.58 bushels of grain and 1460.2 pounds of straw per acre, while the average of the check plot where the rotation is followed is 1500.7 pounds or 46.89 bushels of grain and 1804.2 pounds of straw. This is a difference of 7.31 bushels of grain and 344 pounds of straw for an average of five years in favor of the rotation. This means a great loss to the grain farmer who practices continuous culture of oats.

In making a comparison of the effects of manure it is readily observed that manure whether used in a rotation or in continuous culture gives a good return. The average for manure in continuous culture is 1462.4 pounds or 45.70 bushels of grain and 1669.6 pounds of straw per acre. When this is compared with the effects of rotation alone it becomes evident that the rotation alone has been more effective in maintaining the yields of oats than has manure when used in the continuous culture.

TABLE 3

Treatment	Yields Average, 5 Years Bu. Grain	Lbs. Straw
Manure and Continuous Culture	45.70	1669.6
Rotation alone	46.89	1804.2

In making a comparison of the effects of manure the following table is sufficient to show that manure used in connection with a rotation gives the greatest yields.

TABLE 4

Treatment	Yields Average, 5 Years Bu. Grain	Lbs. Straw
Manure and Continuous Culture	45.70	1669.6
Manure and Rotation	48.28	1736.5
Check Plots, Continuous Culture (Average)	39.58	1460.2

Table 4 also shows a comparison of the poorest yields which were obtained by continuous culture alone and the best yields which were obtained by using manure in connection with a crop rotation. The table shows a difference of 8.7 bushels of grain and 276.3 pounds of straw in favor of the rotation and manure.

Crop residues are especially helpful in maintaining the yield of oats when grown continuously on the same land. Residues have not shown up so well where used in a rotation so far, but may show to advantage later on when the experiment has been conducted longer. Table 5 shows a summary of the different methods used in connection with continuous culture.

TABLE 5

Treatment	Yields of Grain Per Acre 5-Year Average
Check, Continuous Culture	39.58 bushels
Residues, Continuous Culture	43.38 bushels
Manure, Continuous Culture	45.70 bushels

It is interesting to compare the results obtained for the various methods used in the continuous culture (Table 5) with those obtained with the rotation (Table 6.)

TABLE 6

Treatment	Yields of Grain Per Acre 5-Year Average
Check Plot, Rotation	46.89 bushels
Residues and Rotation	45.90 bushels
Manure and Rotation	48.28 bushels

Any of the methods when used in connection with a rotation is better than the best method (manure) followed in the continuous cropping system.

Another point that should be noted is the yields of the crops at the beginning of

the experiment as compared with the 1921 yields. Table 7 will help bring out this comparison.

TABLE 7

Treatment	1917	1921
Continuous Oats (Yield Per Acre)		
Check Plots (Average)	43.59 bushels	30.62 bushels
Manure	55.94 bushels	34.06 bushels
Residues	51.56 bushels	31.56 bushels
Oats in a Rotation		
Check Plots (Average)	33.75 bushels	44.99 bushels
Manure	33.75 bushels	50.00 bushels
Residues	27.81 bushels	42.18 bushels

This table shows that the rotation check plots averaged 9.84 bushels per acre lower in yield at the beginning than did the continuous check plots. At the end of 1921 or five years cropping, they were yielding 14.37 bushels per acre more gain than the continuous check plots were at the same time. Theoretically if the plots had had the same average at the beginning (1917) and had behaved in the same ratio in which they have, the yields of oats on the rotation check plots in 1921 would have been 24.21 bushels per acre above the yields obtained on the continuous check plots. In practice, however, we are aware that the difference would not have been so great because with a poorer soil to start with the decline in yields would not have been in the same ratio.

The money value for the oat crops is shown in Table 8. The price per bushel used in the calculations is fifty-three cents which is the average farm price paid for oats in Oklahoma for the ten years 1911-1920. Columns 5 and 6 of Table 8 show the value after the cost of the extra threshing and hauling to market due to increased yields are deducted. Eight and one-half cents per bushel were allowed for the threshing and five cents per bushel were allowed for hauling. Other minor expenses were not considered.

TABLE 8

Continuous Oats

	Total yield, 5 years, 1917-1921, bushels	Total value, 5 years, 1917-1921, (dollars)	Total value above continuous check plot, 5 years, (dollars)	Yearly value above continuous check plot, (dollars)	Value after cost of extra threshing and hauling to market is deducted	
					Total value above continuous check plot, 5 years	Yearly value above continuous check plot per acre
Checks (Average)	197.88	$104.88				
Manure	228.49	121.10	$16.22	$3.26	$12.09	$2.42
Residues	216.92	114.97	10.09	2.02	7.52	1.50
Oats in Rotation						
Checks (Average)	234.47	124.27	$19.37	$3.87	$14.43	$2.88
Manure	241.44	127.96	23.08	4.61	17.20	3.44
Residues	229.51	121.64	16.76	3.35	12.49	2.50

COMPARATIVE OAT YIELDS, FIVE-YEAR AVERAGE

1, Continuous—No treatment; 2, Continuous—Manure; 3, Continuous—Residues; 4, Rotation—No treatment; 5, Rotation—Manure; 6, Rotation—Residues.