

## XXVI. CONTINUOUS CULTURE OF OATS VERSUS ROTATION

H. S. Murphy

From the Oklahoma Agricultural Experiment Station, Stillwater.

In 1916 the Oklahoma Experiment Station started an experiment, the object of which was to ascertain what the effect is of the continuous growing of oats on land, and how this compares with oats grown in a rotation. The rotation used consisted of oats, cowpeas, darso and cotton grown on a common Oklahoma upland, namely Kirkland loam to silt loam.

**Manurial Applications.** For the manure plots, manure was applied once every four years equivalent to that which would have been produced if the crops raised had been fed to livestock. The crop residues for the residue plots were returned each year. These residues consisted of 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 1  
Continuous Oats Culture  
YIELD PER ACRE PER YEAR

Plot and Treatment	1917		1918		1919		1920		1921		5-Year Av.	
	G.	S.	G.	S.	G.	S.	G.	S.	G.	S.	G.	S.
19. C	1560	1720	1725	1575	1540	2180	770	1280	1090	1010	1337	1553
22. C	1620	1530	1610	1400	1735	2405	800	1200	970	730	1347	1453
25. C	1240	1310	1490	1970	1710	2470	800	1000	1100	1000	1268	1550
28. C	1160	1090	1735	1720	1455	1985	460	640	760	990	1114	1285
20. M	1790	1960	1807	1563	1845	2895	780	1240	1090	710	1462.4	1669.6
23. R	1650	1700	1772	1560	1830	3570	680	1120	1010	890	1388.4	1568

### Oats in Rotation

19. C	800	1200	1222.5	1687.5	1777.5	3182.5	1770	2030	1180	1270	1350	1873.9
22. C	1090	1080	2010	2020	1850	2290	1500	2700	1395	1165	1551	1851
25. C	1210	1210	1040	1620	1765	2445	1750	2450	1650	1450	1611	1867
28. C	1310	1210	1040	1240	1470	2110	2100	2200	1535	1365	1491	1625
2. M	1080	920	2017.5	1992.5	1790	3010	1240	1460	1600	1300	1545	1736.5
8. R	890	810	1405	1355	1920	3020	1780	2570	1350	1450	1469	1841

G—Grain; S—Straw; C—Check; M—Manure; R—Residues.

The average of the check plots for the continuous culture of oats shown in Table 1 is 1266.5 pounds or 39.58 bushels of grain and 1460.2 pounds of straw per acre, while the average of the check plots 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 rotation. This means a great loss to the grain farmer who practices continuous culture of oats.

TABLE 2

Treatment .....	Average 5 years	
	Grain (bushels)	Straw (pounds)
Manure and Continuous Culture.....	45.70	1669.6
Rotation alone .....	46.89	1804.2

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	
	Grain (bushels)	Straw (pounds)
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 3 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 yields 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 4 shows a summary of the different methods used in connection with continuous culture.

TABLE 4.

Treatment .....	Yields of Grain per acre	
	Average 5 years	
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 4) with those obtained with the rotation (Table 5).

TABLE 5.

Treatment .....	Yields of Grain per acre	
	Average 5 years	
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 6 will help bring out this comparison.

TABLE 6.

	1917	1921
Check Plots (Average) -----	43.59 Bushels	30.62 Bushels
Manure -----	55.94 Bushels	34.06 Bushels
Residues -----	51.56 Bushels	31.56 Bushels
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 grain 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 7. 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 7 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 was allowed for the threshing and five cents per bushel was allowed for hauling. Other minor expenses were not considered.

Table 7 Continuous Oats

Checks	Total yield 5 years 1917-1921 in bushels.	Total value 5 years 1917-1921 in dollars	Total value above continuous check plot 5 years in dollars	Yearly value above continuous check plot in dollars	Value after cost of extra threshing and hauling is deducted	
					Total value above continuous check plots, for 5 years	Yearly value above continuous check plot per acre
(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
<b>Oats in Rotation</b>						
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

**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 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 has been deducted. Another \$1,000,000 could be added yearly by using manure in connection with the rotation.