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THE CLERMONT COUNTY EXPERIMENT FARM

SECOND ANNUAL REPORT, FOR THE YEAR 1913

In the first report on this farm, made in Bulletin 241, is outlined a general plan of management, which was submitted to and approved by the County Agricultural Society, and which is republished here for convenience of reference, this being the first publication of this Station relating solely to Clermont County.

PROPOSED PLAN OF MANAGEMENT

Lying at the gates of a great city as does Clermont county, it would seem that the production of such articles of food as are least adapted to long transportation should occupy a prominent place in its agriculture. Only a small part of the total area of the county, however, is adapted to gardening and truck farming, and the Experiment Farm has been located on a soil representing the larger area, hence its work will be limited by the character of its soil.

The statistics of crop production for this county show that the leading crops have given the following average yields per acre, by ten-year periods, for the 60 years since 1850, when the collection of such statistics was begun:

Period	Yield per acre		
	Corn bus.	Wheat bus.	Oats bus.
1850-9	33.3	11.8	19.3
1860-9	28.8	8.8	18.8
1870-9	30.0	10.2	18.3
1880-9	26.6	8.9	17.5
1890-9	25.5	9.9	20.1
1900-9	24.8	11.1	

These statistics show that there has been a steady decrease in the yield of corn, and that the yields of all the crops are far too low for profit, thus indicating that the problems relating to the increase of soil fertility must be given first rank in the work of the county experiment farm.

The appearance of the land selected for the Experiment Farm, and also that of much of the land in other parts of the county, indicates that underdrainage is absolutely essential to its profitable cultivation, and the first work, therefore, will be to thoroughly drain such portions of the farm as may be selected

for field experiment. It would seem well, however, to leave a small tract underdrained, and on this to locate an experiment planned to illustrate the effect of drainage.

The statistics of crop production indicate that systematic rotation of crops is not always practiced in the county, as the area devoted each year to corn is nearly as great as the combined areas given to wheat and oats, and is several times greater than that reported as in clover. The fact that crop rotation is absolutely essential to the attainment of the greatest economy in production has been repeatedly demonstrated, but it may be well to give a small area to continuous cropping as an object lesson on this point. What would seem to be of more importance is a trial of a few simple rotations, planned as an inquiry into the best system of rotation for the conditions of this county. Two rotations in common use in southern Ohio are a 3-year rotation of corn, wheat and clover, and a 5-year, or longer, rotation of corn, oats, wheat clover and timothy, the timothy being allowed to stand until it no longer yields a profitable cutting. This practice has undoubtedly been a potent factor in reducing the crop yields in Clermont county to their present low average, and to this practice is probably due the reputation that timothy has attained of being a hard crop on the land; coming at the end of a long period of cropping with other plants of the same general character, it has found the soil depleted and has naturally left it more so.

A few years ago the production of timothy was of sufficient importance to justify making it a leading object of investigation in Clermont county, because of the demand for such hay for the feeding of city horses; but the present outlook is that the automobile and truck will soon replace the horse on city streets.

With clover, however, the case is wholly different, as the demand for milk and meat must inevitably increase with the growth of the city, and because of its great usefulness both in the production of these food necessities and in the maintenance of soil fertility, the clover crop should receive the most earnest attention of agricultural investigators throughout Ohio.

In Clermont county such attention is the more important because of the increasing difficulty experienced in growing clover in this section, and for this reason, if for no other, a careful study should be made of other plants belonging to the same general family as clover, with a view to their substitution for that crop.

Such a plant is the Soy or Soja bean, a Japanese plant which is being grown very successfully at the Central Station and on the district experiment farms. This plant is found to be well adapted to the climate of Ohio, and it is proposed to make a careful study of it on the county experiment farms already established in Paulding and Miami counties. Our present belief is that the soybean may be substituted for the oat crop over the southern half of Ohio with enormous advantage to the agriculture of that region. One of the great advantages of such a substitution has been discovered at the Central Station, in the fact that wheat following soybeans yields several bushels to the acre more than when it follows oats.

Alfalfa is another leguminous crop which should be carefully studied on rhe Clermont County Experiment Farm.

Clermont county's average oat crop, of less than 20 bushels per acre, is losing money every year for the man who grows it. True the same may be said of the 11 bushel wheat crop and the 25-bushel corn crop; but Clermont county lies in the very heart of the corn belt, and there can be no question as to the possibility of the restoration of that crop to profitable production; while wheat is a crop of such vast importance to the human race that no effort should be spared

to discover the conditions under which it may be profitably grown. Wheat is now yielding fairly remunerative crops under some of the treatments on the district experiment farms in Meigs and Montgomery counties, crops which certainly justify the expectation that a way will be found to produce wheat profitably in Clermont county. With oats, however, the case is different. Oats is distinctly a north latitude crop, attaining its greatest perfection beyond the northern limits of corn production, and it is highly probable that the energies of the Clermont county farmer can be much more profitably expended on some other crop.

ORCHARD WORK

The conditions of the Clermont County Experiment Farm, while not the best tor fruit production, are sufficiently good to justify the giving of considerable attention to that industry, and it is proposed to start experiments in orcharding and the culture of some of the small fruits. Experiments in progress in other sections of southern Ohio leave no room to doubt that it is possible to make the apple orchard a very profitable feature of Clermont county's husbandry.

DAIRYING

Clermont county is well situated for the production of milk, and the entire energies of a large experiment farm might well be devoted to this industry; but with the limited sum out of which must be provided drainage, buildings, teams, implements and other equipment, it will not be well to undertake any work along this line at present. But the system of management under which the problems of fertility maintenance may be most affectively studied will be just that best suited to dairying, and therefore the work should be so planned that milk production may be undertaken when conditions permit.

As stated in Eulletin 241, the selection of this farm was not made until September, 1911. The farm lies on the main road between Hillsboro and Cincinnati, a road which had been improved by graveling at an early day. At one time it had been a productive farm, as indicated by the brick dwelling and large barn, but for fifty years its main crop had been timothy hay, grown for the Cincinnati market. Practically no livestock had been kept.

When offered to the county as an experiment farm the roof of the barn had partly fallen in and the dwelling and outbuildings had had no repairs for many years. No draining had ever been done, and the land was occupied with a scattering growth of such weeds as can endure a water logged soil.

The seasons of 1912 and 1913 have of necessity been chiefly spent in building, planting orchards and draining. The barn has been completely remodeled, the framework of the old barn being enlarged and covered with new roof, new siding and new floors; ten acres have been planted in two orchards, one of apples, containing 320 trees for cultural and fertilizer tests and 70 trees of 35 varieties for variety comparisons, and one of peaches, containing 145 trees of

29 varieties; 2,645 rods—or more than 8 miles—of tile drain have been laid, and a beginning has been made in an experiment in the use of fertilizers and manures on crops grown in a 4-year rotation of corn, soybeans, wheat and clover. The plan of this experiment is shown in Table I, and the results for 1912 and 1913 are given in Tables II to VII.

TABLE I: Plan of fertilizing in corn-soybeans-wheat-clover rotation, Clermont County Experiment Farm. Pounds per acre.

Plot No.	On corn				On soybeans			On wheat			Plot No.
	Acid phosphate	Muriate of potash	Nitrate of soda	Powdered limestone	Acid phosphate	Muriate of potash	Nitrate of soda	Acid phosphate	Muriate of potash	Nitrate of soda	
1	...	..	..	.....	...	..	..	...	..	..	1
2	200	..	..	.....	100	..	..	200	..	..	2
3	200	50	..	.....	100	20	..	200	20	..	3
4	...	..	..	.....	...	..	..	...	..	..	4
5	200	50	50	.....	100	20	30	200	20	80	5
6	200	50	50	2,000	100	20	30	200	20	80	6
7	...	..	..	.....	...	..	..	...	..	..	7
8	Phosphated manure, 8 tons			.....	...	..	..	200	50	50	8
9	Phosphated manure, 8 tons			2,000	...	..	..	200	50	50	9
10	...	..	..	.....	...	..	..	...	..	..	10

TABLE II. Fertilizers and manure on CORN at Clermont County Experimemt Farm. Rotation I. Corn, soybeans, wheat and clover.

Plot No.	Treatment per acre	1912		1913		2-year average	
		Grain Bus.	Stover Lbs.	Grain Bus.	Stover Lbs.	Grain Bus.	Stover Lbs.
	Yield per acre						
1	None	9.28	530	31.86	1,570	20.57	1,050
2	Acid phosphate, 200 lbs	14.57	710	27.14	1,580	20.85	1,145
3	Acid phos., 200 lbs.; mur. of potash, 50 lbs	18.00	870	29.00	1,730	23.50	1,300
4	None	12.43	560	26.57	1,620	19.50	1,090
5	Acid phosphate, 200 lbs. Muriate of potash, 50 lbs. Nitrate of soda, 50 lbs.	23.43	970	35.86	1,910	29.64	1,440
6	Acid phosphate, 200 lbs; mur. of potash, 50 lbs.; nitrate of soda, 50 lbs.; powdered limestone, 2 tons	23.71	960	37.71	1,870	30.71	1,415
7	None	13.28	560	21.86	1,350	17.57	955
8	Manure, 8 tons	25.00	1,050	34.14	1,840	29.57	1,445
9	Manure, 8 tons, phosphated	29.71	1,180	35.71	1,820	32.71	1,500
10	None	17.86	840	10.43	860	14.14	850
	Average unfertilized yield	13.21	622	22.68	1,350	17.94	986
	Increase per acre*						
2	Acid phosphate, 200 lbs	4.24	170	−2.96	−7	.64	81
3	Acid phos., 200 lbs.; mur. of potash, 50 lbs.	6.62	320	.67	127	3.64	223
5	Acid phosphate, 200 lbs. Muriate of potash, 50 lbs. Nitrate of soda, 50 lbs.	10.72	410	10.86	380	10.79	395
6	Acid phos., 200 lbs.; mur. of potash, 50 lbs.; nitrate of soda, 50 lbs.; powdered limestone, 2 tons	10.71	400	14.28	430	12.49	415
8	Manure, 8 tons	10.19	397	16.09	653	13.14	525
9	Manure, 8 tons, phosphated	13.38	433	21.47	797	17.42	615

*In calculating increase it is assumed that if Plots 1 and 4, unfertilized, yield 30 and 33 bushels, the unaided yields of Plots 2 and 3 will probably be 31 and 32 bushels.

TABLE III: Fertilizers, manure and lime on SOYBEANS at Clermont County Experiment Farm. Rotation I: Corn, soybeans, wheat and clover, 1913.

Plot No.	Treatment per acre	Yield per acre		Increase per acre	
		Grain Bus.	Straw Lbs.	Grain Bus.	Straw Lbs.
1	None	4.17	1,350	....	...
2	Acid phosphate, 100 lbs	5.00	1,600	.72	223
3	Acid phosphate, 100 lbs.; muriate potash, 20 lbs	5.67	1,460	1.28	57
4	None	4.50	1,430	....	...
5	Acid phos., 100 lbs.; mur. potash, 20 lbs.; nit. soda, 30 lbs.	5.17	1,590	.75	187
6	Acid phos., 100 lbs.; mur. potash, 20 lbs.; nit. soda, 30 lbs.	5.50	1,770	1.25	393
7	None	4.17	1,350	....	...
8	(Untreated manure on corn)	5.33	1,680	1.22	293
9	(Phosphated manure on corn)	5.67	1,860	1.61	437
10	None	4.00	1,460	....	...
	Average unfertilized yield	4.21	1,400	....	...

TABLE IV: Fertilizers, manure and lime on WHEAT at Clermont County Experiment Farm. Rotation I: Corn, soybeans, wheat and clover, 1913.

Plot No.	Treatment per acre	Yield per acre		Increase per acre	
		Grain Bus.	Straw Lbs.	Grain Bus.	Straw Lbs.
1	None	6.17	610	....	...
2	Acid phosphate, 200 lbs	12.33	1,220	6.11	613
3	Acid phosphate, 200 lbs.; muriate of potash, 20 lbs	13.17	1,260	6.89	657
4	None	6.33	600	....	...
5	Acid phos., 200 lbs.; mur. potash, 20 lbs.; nitrate soda, 80 lbs.	16.83	1,820	9.72	1,163
6	Acid phos., 200 lbs.; mur. potash, 20 lbs.; nitrate soda, 80 lbs.	16.00	1,670	8.11	957
7	None	8.67	770	....	...
8	Acid phos., 200 lbs.; mur. potash, 50 lbs.; nitrate soda, 50 lbs.	12.33	1,270	4.33	543
9	Acid phos., 200 lbs.; mur. potash, 50 lbs.; nitrate soda, 50 lbs.	11.17	1,180	3.83	497
10	None	6.67	640	....	...
	Average unfertilized yield	6.96	665	....	...

TABLE V: Total cost of fertilizers, value of increase and net gain per acre for 3 crops of rotation.

Plot No.	Treatment	Total amount applied	Cost of fertilizers	Value of increase*	Net gain
		Lbs.			
2	Acid phosphate	500	$3.80	$7.29	$3.49
3	Phosphate and potash	590	5.87	9.96	4.09
5	Complete fertilizer	750	10.27	15.25	4.98
6	Complete fertilizer + Powdered limestone	750 + 2,000	13.27	15.53	2.26
8	Untreated manure	8 tons	5.52	12.32	7.80
9	Phosphated manure + Powdered limestone	8 tons + 2,000	8.52	14.52	6.00

*Rating corn at 40 cents per bushel, soybeans at $1.50, wheat at 80 cents, corn stover and bean straw at $3.00 per ton, and wheat straw at $2.00.

Table V shows the total cost of fertilizers per acre for one rotation, the value of increase, and the net gain on the three crops thus far harvested. This table shows that the treatment has produced an immediate and marked increase in yield, and that the complete fertilizer, containing nitrogen as well as phosphorus and potassium, has produced not only the largest total increase but also the largest net gain, notwithstanding the greatly increased cost of the fertilizer.

In computing the cost of manure it is rated at 50 cents per ton, an amount more than sufficient to cover the greater cost of applying manure than fertilizers. The actual cost of manure will of course vary on different farms.

When the clover crop of 1914 is harvested it will probably add considerably to the net gain shown in Table V.

In the older experiments with fertilizers, which have been in progress for 20 years at Wooster, 19 years at Strongsville and 10 years each at Germantown and Carpenter, the full effect of fertilizers and manure has never been realized in the first application, hence it is reasonable to expect that as the work progresses on the Clermont county experiment farm a larger net gain will be found than that shown in Table V. This point is illustrated by Table VI, which gives the results of the 5-year rotation at Wooster, grouped in four 5-year periods. As each treatment is repeated on 5 different tracts of land the figures for each 5-year period represent the average of 5 different crops of each kind, or 25 crops in all.

TABLE VI. THE 5-YEAR ROTATION AT WOOSTER. Total fertilizing materials and their cost, and total and net value of increase produced for 5-year periods and for 20 years, all calculated for one rotation of 5 years.

Plot No.	Fertilizing materials in pounds per acre for each rotation	Cost of fertilizers for each rotation	Average value of total increase per acre for each rotation					Net gain or loss (—) from fertilizers for each rotation					Plot No.
			First 5-yrs.	Second 5-yrs.	Third 5-yrs.	Fourth 5-yrs.	20-yr. av. total	First 5-yrs.	Second 5-yrs.	Third 5-yrs.	Eourth 5-yrs.	20 yr. av. net	
2	Acid phosphate, 320	$ 2.60	$ 8.50	$17.37	$24.32	$16.96	$16.52	$ 5.90	$14.77	$21.72	$14.36	$13.92	2
3	Muriate potash, 260	6.50	5.19	4.67	9.17	3.81	5.73	—1.31	—1.83	2.67	—2.69	—.77	3
5	Nitrate soda, 440; dried blood, 50	14.40	4.70	10.47	9.30	7.74	8.37	—9.70	—4.00	—5.37	—6.66	—6.03	5
6	Acid phosphate, 320; nitrate soda, 440; dried blood, 50	17.00	19.09	35.27	39.75	32.44	31.34	2.09	18.27	22.75	15.44	14.34	6
5	Acid phosphate, 320; muriate potash, 260	9.10	14.40	24.37	33.51	27.73	24.69	5.30	15.27	24.41	18.63	15.59	8
9	Muriate potash, 260; nitrate soda, 440; dried blood, 50	20.80	5.85	11.35	13.23	14.04	11.07	—15.05	—9.55	—6.67	—6.86	—9.83	9
11	Acid phos., 320; mur. potash, 260; nit. soda, 440; dried blood, 50	23.50	26.39	42.43	49.96	39.42	39.28	2.90	18.93	26.46	15.92	15.78	11
12	" " 320; " " 260; " " 680; " " 50	30.70	26.16	45.53	48.24	41.05	39.98	—4.54	14.83	17.54	10.35	9.28	12
14	" " 240, " " 180; " " 280; " " 50	16.05	21.37	32.91	37.33	28.32	30.14	5.32	15.86	21.28	12.27	14.09	14
15	" " 160; " " 100; " " 120; " " 50	8.60	13.89	22.86	27.13	20.08	21.66	5.29	14.26	18.53	11.48	13.06	15
17	" " 480; " " 260; " " 220; " " 25	17.60	15.74	36.61	46.28	41.30	35.23	—1.86	19.01	28.68	23.70	17.63	17
18	Yard manure, 16 tons	?	19.82	34.24	55.94	54.45	40.40	?	?	?	?	?	18
20	Yard manure, 8 tons	?	13.02	21.28	35.36	30.09	24.54	?	?	?	?	?	20
21	Same elements as 17, but nitrogen in oilmeal	17.60	20.43	36.25	42.24	36.37	33.50	2.83	18.65	24.64	18.77	15.90	21
23	" " " 17, " " " dried blood	17.60	19.09	34.37	39.28	35.14	31.75	1.49	16.77	21.68	17.54	14.15	23
24	" " " 17, " " " sulphate ammonia	17.60	20.70	32.77	38.71	35.20	31.91	3.10	14.77	21.11	17.60	14.31	24
26	" " " 11, " phosphorus in bonemeal	23.50	20.89	36.17	42.55	29.68	32.37	—2.61	12.67	19.05	6.18	8.87	26
27	" " " 17, " nitrogen in nitrate of lime*	17.60	19.86	39.88	42.08	31.33	33.42	—3.64	16.38	18.58	7.83	9.92	27
29	" " " 11, " phosphorus in basic slag	23.50	21.91	39.32	39.04	32.84	33.42	—1.59	15.82	15.54	9.34	9.92	29
30	" " " 17, " nitrogen in tankage**	17.60	13.74	30.51	41.62	36.87	30.40	....	12.90	24.02	19.27	12.80	30

The nearest practicable approach to a common denominator for the various kinds of produce grown in this rotation is their market value, and in Table VI the results of the tests are arranged on this basis for four 5-year periods and for the entire 20 years, corn being rated at 40 cents per bushel, oats at 30 cents, wheat at 80 cents, hay $8.00 per ton, stover at $3.00 and straw at $2.00; valuations much below present prices for the grains, but not far from the average values during the period of the test.

The fertilizing materials are valued at a fraction over $16.00 per ton for acid phosphate, 2½ cents per pound for muriate of potash and 3 cents per pound for nitrate of soda; and it is assumed that the cost per pound of the fertilizing elements will be practically the same in the other carriers used on Plots 21 to 30, inclusive.

The table shows that the effectiveness of the fertilizers and manure increased during the first three periods, the greatest relative increase being shown by the manure. Taking the second part of the table, giving the net gain after deducting the cost of the fertilizers, it will be seen that during the first period eight of the fertilizer applications failed to produce sufficient increase to cover their cost; during the second period three, during dhe third period two, during the fourth period three. Every complete fertilizer has been used with a profit since the first period, but when either nitrate of soda or muriate of potash has been used unaccompanied by some carrier of phosphorus there has been a loss in each period (except from muriate of potash in the third period) and in the average of the 20 years.

Nevertheless, both nitrogen and potassium are essential to the highest net profit, as shown by comparing Plot 2, receiving phosphorus only, with Plot 6 receiving nitrogen, Plot 8 receiving potassium, and Plot 11 receiving both these elements in addition to phosphorus.

The results of the comparison of different carriers of nitrogen and phosphorus have been discussed in Circular No. 93.

*Since 1910; previously, same quantities of elements as on Plot 11, with nitrogen in nitrate of soda and phosphorus in dissolved boneblack.

**Since first period. Smaller application during first period.

VARIETY TESTING

By THE DEPARTMENT OF AGRONOMY

CORN

But ten plots were available for testing different varieties of corn. Four plots were planted with the Clarage as a check or "yard stick."

The results of this test are as follows:

TABLE VII: Corn in variety test, Clermont County Experiment Farm, 1913.

Planted May 8; harvested September 9.

Variety	Comparative yield per acre		Hamilton county yields Bus.
	Bushels of corn	Pounds of stover	
Leaming	29.83	1,150	48.99
Darke County Mammoth	31.74	1,150	53.18
White Cap	29.69	1,150	51.42
Cook's No. 75	28.02	1,230	57.61
Reid (Orcutt)	29.30	1,510	52.14
Leaming (Scott)	28.11	1,290	51.85
Average 4 Clarage check plots	28.71	1,152	52.23

These yields of corn give a pretty good indication of the low state of fertility of the county experiment farm. There is certainly plenty of room for improvement.

The Darke County Mammoth leads, with the Leaming second.

The yields of the same varieties in a similar test at the Hamilton county farm are given for comparison.

OATS

Seven varieties of oats are included in this test, as follows:

TABLE VIII: Oats in variety test at Clermont County Experiment Farm, 1912

Variety	Comparative yield per acre		Bushels per acre at:	
	Bus. of grain	Pounds of straw	Hamilton county 1913	Wooster 6-yr. average
Ohio 7009 (Sixty Day)	....	...	16.92	66.52
Ohio 6203 (Siberian)	9.40	810	11.34	69.55
Swedish Select	4.61	720	8.02	56.70
Big Four	16.48	680	17.93	65.50
Silver Mine	15.13	690	21.51	65.42
Ohio 6222 (Improved American)	10.96	770	11.93	66.18
Av. 4 Wideawake Checks	12.11	750	16.09	55.74

Note. Varieties planted April 18, harvested July 21.

The Big Four and the Silver Mine varieties lead in yield in both Clermont and Hamilton counties, but the yields are very low in both. This is due in part to the very poor oats season, the State over, and, in part, to the fact that Clermont and Hamilton are south of Ohio's oats belt. We may expect more from soybeans in southern Ohio than from oats.