ROTHAMSTED RESEARCH

Report for 1937

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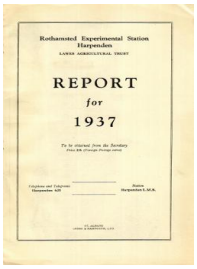

Laborabory and Farm Report for 1937

Rothamsted Research

Rothamsted Research (1938) *Laborabory and Farm Report for 1937 ;* Report For 1937, pp 108 - 113
- DOI: https://doi.org/10.23637/ERADOC-1-69

WOBURN EXPERIMENTAL FARM REPORT FOR 1936-7

BY DR. H. H. MANN

Season

The season of **1936-37** was a very wet one, especially in the early spring, and in the autumn. This made the sowing of spring crops difficult, though the relatively dry period in the summer itself made both the hay time and harvest fairly successful. This dry period, however, caused the sowing of kale and other similar fodder crops to be unsatisfactory, especially when they could not be planted before June. The meteorological records from October **1936** to the end of **1937** were as follows :

METEOROLOGICAL RECORDS FOR 1936-37

Month	*Rainfall*		Bright Sunshine	*Temperature (Mean)*			
	Total Fall	No. of Rainy Days		Maximum	Minimum	1 ft. in Ground	Grass Minimum
1936	Ins.		Hours	°F.	°F.	°F.	°F.
Oct. ..	1.80	17	110.3	55.5	40.4	49.1	36.0
Nov. ..	2.14	17	44.3	47.0	34.7	43.3	32.6
Dec. ..	1.38	16	51.5	46.1	34.9	40.5	31.2
1937							
Jan. ..	3.16	24	50.8	45.6	35.2	40.7	32.0
Feb. ..	4.16	22	64.7	47.3	36.8	40.7	30.4
Mar. ..	3.27	21	104.3	44.0	31.3	39.2	28.3
April..	2.54	15	96.4	54.3	40.4	47.9	38.0
May ..	3.94	16	166.7	61.5	45.5	55.5	43.4
June ..	1.49	10	178.9	66.0	47.8	63.2	44.8
July ..	1.21	9	128.4	68.9	53.3	64.4	50.0
Aug. ..	2.36	5	199.5	72.5	52.8	66.5	48.5
Sept...	1.46	16	150.2	64.1	46.4	58.3	42.1
Oct. ..	2.75	12	73.7	57.5	42.1	51.3	37.5
Nov. ..	1.84	11	59.4	46.6	34.0	43.0	30.7
Dec. ..	2.44	23	28.7	41.1	31.8	38.6	29.1
Total or mean for 1937 ..	30.62	184	1301.7	55.8	41.4	50.8	37.9

CONTINUOUS WHEAT AND BARLEY EXPERIMENTS

The present interest of these experiments, which have been carried on ever since **1877**, resides chiefly in the study of the effect of fallowing, without further manure, on the crops of wheat or barley. Two fallows have been taken in recent years, namely in **1926** and **1927**, and again in **1934** and **1935**. The crop in **1937** was thus the second after a two year fallow, and thus assists in determining how far the previous manuring for fifty years has affected the power of recovery of the soil through fallowing.

(*a*) *Continuous Wheat.* " Red Standard " wheat was sown in October, and a good plant was obtained and developed normally. The only difficulty in growing it was the excessive growth of wild vetchling (*Vicia hirsuta*) on certain plots, notably on plots **6**, **9** and

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11b. The infestation by this weed was little improved by the two years' fallow previously referred to.

TABLE I.

Continuous Growing of Wheat, 1937—after 2 years' (1934—1935) fallowing and previous fallowing, 1927 and 1928.

	Stackyard Field	*Produce per acre*			
Plot	Manures Applied Annually. (Before the Fallow.) For amounts see Report 1927-1928 No manures since 1926	Dressed corn per acre bushels	Total corn per acre lb.	Weight per bushel lb.	Straw, chaff, etc., per acre lb.
1	Unmanured	17.9	1,007	56.0	1,862
2a	Sulphate of ammonia	2.3	137	58.9	266
2aa	As 2a, with lime, Jan., 1905, repeated 1909, 1910, 1911	7.4	443	60.0	1,040
2b	As 2a, with lime, December, 1897	12.9	770	59.5	1,347
2bb	As 2 b, with lime, repeated Jan. 1905	12.8	758	59.0	1,330
3a	Nitrate of soda	14.0	837	59.5	1,472
3b	Nitrate of soda	11.5	687	59.5	1,133
4	Mineral manures (superphosphate and sulphate of potash)	18.6	1,053	56.5	1,922
5a	Mineral manures and sulphate of ammonia	8.5	508	60.0	1,045
5b	As 5a, with lime, Jan., 1905	13.5	795	59.0	1,614
6	Mineral manures and nitrate of soda	12.0	721	60.2	1,386
7	Unmanured	16.0	899	56.2	1,546
8a	Mineral manures and, in alternate years, sulphate of ammonia	1.2	72	58.9	218
8aa	As 8a, with lime, Jan., 1905, repeated Jan., 1918	5.4	306	60.0	685
8b	Mineral manures and sulphate of ammonia (omitted in alternate years)	1.8	105	58.9	218
8bb	As 8b, with lime, Jan., 1905, repeated Jan., 1918	lost	lost	lost	lost
9a	Mineral manures and, in alternate years, nitrate of soda	8.7	528	60.5	1,351
9b	Mineral manures and nitrate of soda (omitted in alternate years)	8.3	496	59.2	2,080
10a	Superphosphate and nitrate of soda	12.4	729	58.5	1,219
10b	Rape dust	13.3	772	58.0	1,398
11a	Sulphate of potash and nitrate of soda	13.6	827	60.5	1,910
11b	Farmyard manure	11.6	681	58.5	1,807

The chief interest of these figures lies in the relation of previous manuring to the capacity for recovery of fertility by means of fallowing. This is shown in the following figures for certain selected plots.

Yield of dressed corn per acre

Plot	1877–86 (with manures)	1917–26 (with manures)	1929 After two years' fallow (no manures since 1926)	1936	1937 After two years' fallow
	bushels	bushels	bushels	bushels	bushels
1	16.8	3.6	11.1	10.7	17.9
2a	25.4	0.3	0.3	no crop	2.3
2b	——	4.3	1.1	13.7	12.9
3b	24.1	7.1	9.5	13.4	11.5
4	17.7	4.4	17.8	15.8	18.6
5a	31.5	5.1	10.9	15.3	8.5
5b	——	7.4	13.3	14.8	13.5
6	32.4	8.6	12.8	11.4	12.0
7	17.4	4.0	8.5	13.0	16.0
11b	26.7	9.5	21.3	14.3	11.6

The recovery of the yield after the fallows is very striking, as well as the maintenance of the recovered yield for at least two years, in spite of the absence of any manuring since 1926. This applies to all plots except that which had farmyard manure for the first fifty years, and to the plots which have become acid through the use of sulphate of ammonia.

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(*b*) *Continuous Barley*. The crop in **1937** was substantially a failure. The land in this case has become unworkable in a wet period, and as the early spring of **1937** was wet, it was impossible to get a good seed bed. Plumage Archer barley was sown on March **31**st, on a very bad tilth. The crop never flourished and the yield was barely worth recording. The following table gives the actual yields :

TABLE II

Continuous Growing of Barley, 1937—*after 2 years'* (1934-1935) *fallowing and previous fallowing*, 1927 *and* 1928

Stackyard Field — *Produce per Acre*

Plot	Manures Applied Annually (Before the Fallow) For amounts see Report 1927-1928 No manures since 1926	Dressed corn per acre bushels	Total corn per acre lb.	Weight per bushel lb.	Straw, chaff, etc., per acre lb.
1	Unmanured	1.4	69	43.0	328
2a	Sulphate of ammonia	—	—	—	—
2aa	As 2a, with lime, Mar., 1905, repeated 1909, 1910, 1912 and 1923	4.3	184	41.0	596
2b	As 2a, with lime, Dec., 1897, repeated 1912	1.2	56	44.8	195
2bb	As 2a, with lime, Dec., 1897, repeated Mar., 1905	2.3	104	44.8	308
3a	Nitrate of soda	2.5	112	44.8	376
3aa	As 3a, with lime, Jan. 1921	2.8	124	44.8	376
3b	Nitrate of soda	2.6	116	44.8	388
3bb	As 3b, with lime, Jan., 1921	2.2	100	44.8	244
4a	Mineral manures (superphosphate and sulphate of potash)	1.4	64	44.8	250
4b	As 4a, with lime, 1915	0.8	38	44.8	186
5a	Mineral manures and sulphate of ammonia	—	—	—	—
5aa	As 5a, with lime, Mar., 1905, repeated 1916	2.4	108	44.8	180
5b	As 5a, with lime, Dec., 1897, repeated 1912	1.2	54	44.8	170
6	Mineral manures and nitrate of soda	3.3	140	43.0	381
7	Unmanured	2.6	119	45.0	301
8a	Mineral manures and, in alternate years, sulphate of ammonia	—	—	—	—
8aa	As 8a, with lime, Dec., 1897, repeated 1912	2.6	116	44.8	312
8b	Mineral manures and sulphate of ammonia (omitted in alternate years)	—	—	—	—
8bb	As 8b, with lime, Dec., 1897, repeated 1912	2.5	112	44.8	328
9a	Mineral manures and, in alternate years, nitrate of soda	3.9	182	47.0	464
9b	Mineral manures and nitrate of soda (omitted in alternate years)	4.6	208	45.0	478
10a	Superphosphate and nitrate of soda	2.6	112	43.0	356
10b	Rape dust	1.7	78	[44.8	282
11a	Sulphate of potash and nitrate of soda	4.0	192	48.0	492
11b	Farmyard manure	5.8	284	48.5	706

ROTATION EXPERIMENT

The rotation experiment on the relative value of farmyard manure made from a rich feeding stuff like oil cake and from less nitrogenous material like corn (which was the work for which the farm was originally opened) came to an end in **1937** after continuing for sixty-one years. The last crop, taken on Series C in Stackyard Field, was wheat, grown after alsike clover in **1936**. Red Standard wheat was sown on October **29**th, **1936**, and grew well, giving the following yields, per acre :

Plot	*Head Corn*		*Tail Corn*	*Straw, Chaff, etc.*
	Yield	Weight per Bushel.		
	bushels	lb.	lb.	cwt.
1. After cake-feeding	17.4	60.4	1	19.3
2. After corn-feeding	17.4	60.6	1	20.1

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The final year, therefore, gave results which agree with those obtained throughout the experiment, indicating that the farmyard manure prepared from the richer materials does not carry its superiority as a manure beyond the first crop after it is applied.

GREEN MANURING EXPERIMENTS

The year under report was also the last year of one of the oldest experiments at Woburn, on the value of green manuring with tares or mustard as a preparation for wheat. This, which is in Lansome Field, has gone on ever since **1893**, and has shown that two crops of green manures, applied every second year, even when supplemented by dressings of superphosphate and potash, are not sufficient to maintain the fertility of the land for wheat. The last crop of wheat in **1937** shows this as clearly as in any previous year. The variety of wheat was Red Standard, and it was sown on October **27**th, **1936**.

Yield of wheat per acre

Plots	Nitrogen in green manures	*Head Corn*		*Tail corn*	*Straw, chaff, etc.*
		Yield	Weight per bushel		
	lb.	bushels	lb.	lb.	lb.
1. Mustard, old series ..	26.3	7.1	60.5	4	1190
2. Tares, old series ..	37.8	9.4	57.4	2	1343
3. Mustard, new series ..	31.6	10.4	58.9	2	1851
4. Tares, new series ..	34.7	10.5	58.6	2	1455
5. Control ..	——	10.8	58.0	2	1918

New Green Manuring Experiment

In view of the unsatisfactory results obtained with green manuring with either tares or mustard as a preparation for wheat, a new experiment was designed in **1936** whereby these green manures, as well as clover and ryegrass, were used as a preparation for kale, two crops being taken in the previous winter and spring, and the kale being sown in or about June. At the same time, the use of farmyard manure (at the rate of ten tons per acre) and of straw (at the rate of **30** cwt. per acre) in conjunction with the green manures, was tested. Details of the results of the first two years of this experiment (**1936** and **1937**) will be found in the statistical section of this report. In this experiment, any residual value of the green manures and other additions may have on a succeeding crop of barley are also tested.

LUCERNE INOCULATION EXPERIMENT

In **1932** a series of plots was laid down to test the effect of inoculation of the seed on the yield and character of lucerne, and so **1932** is the sixth year of the growth of this crop. It may be stated at once that the results have shown no increase of yield

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due to the inoculation, though the nitrogen content of the fodder from the inoculated plots was greater in the earlier years. But the plots have continued to yield very heavy crops, and that of **1937** is one of the largest that have been obtained. The actual yields per acre in each of the six years, including **1937**, on both the inoculated and the un-inoculated plots are shown in the following table. Three crops were obtained during the season, as usual.

Yield of lucerne hay per acre

	1932	1933	1934	1935	1936	1937	Total
	tons	tons	tons	tons	tons	tons	tons
Un-inoculated plots ..	0.70	3.28	4.07	6.55	4.37	5.02	23.99
Inoculated plots.. ..	0.68	3.12	3.96	6.48	4.29	4.98	23.51
Mean of all plots ..	0.69	3.20	4.01	6.52	4.33	5.00	23.75

This crop has been maintained by very thorough harrowing of the area after the final cutting has been taken each year, repeated several times during the succeeding winter, and, in the last three years, a dressing of farmyard manure (**10** tons per acre) applied as a top dressing in January of each year. There is no sign, except at one end of the block, of the lucerne dying out after the end of six years.

OTHER EXPERIMENTS

An account of the following experiments will be found in the statistical section of this report.

1. *Six Course Rotation Experiment.* This has been carried out ever since **1930**, using no outside organic manures, but applying varying quantities of nitrogen (in the form of sulphate of ammonia), potash (in the form of muriate of potash), and phosphoric acid (in the form of superphosphate) for each crop. **1937** is the eighth crop in this series.

2. *The Manuring of Sugar Beet.* This is a study of the effect of farmyard manure applied in the previous autumn, and of common salt, superphosphate, and muriate of potash, applied either in the previous autumn, in the early spring, or at the time of sowing, on the sugar beet crop on the light sandy soil at Woburn.

3. *The Manuring of Market Garden Crops with Concentrated Organic and Other Nitrogenous Manures.* The crop used in **1937** was kale, and the manures investigated were soot, dried poultry manure, rape dust, compared with sulphate of ammonia.

POT CULTURE EXPERIMENTS

The main programme in the pot culture house was a continuation of work on problems which have arisen in connection with the field experiments. The experiments on "clover sickness" in different kinds of clover, begun in **1931**, have now definitely established that the clover failure which is so common on the light soils of Woburn is something apart from eelworm attack, and also from damage by fungi, to which it is usually attributed, though these co-exist frequently with it. Heating of the soil to **135-140°F** prevents for a time the advent of clover sickness, and also cures it, if present. In **1936**, the still more important discovery was made that a liberal

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application of farmyard manure was successful in preventing clover sickness from appearing in the crop, while artificial manures had not a similar effect. The results will be published in the coming year.

The study of questions relating to acid soils, such as those produced by the continued use of sulphate of ammonia on a lime-deficient soil, have taken a good deal of time. Some of the important results are that (*a*) excellent crops of barley can be grown on these soils without any addition of lime, provided they receive a good dressing of farmyard manure, (*b*) the addition of calcium salts of any kind cannot replace the use of caustic lime or carbonate of lime in bringing back the fertility of acid soils, (*c*) even large dressings of phosphates do not bring back the fertility of these soils, though this has been stated by many workers on the subject.

Work has continued on the effect of manuring with various forms of organic material, chiefly those which might be used as green manures in comparison with farmyard manure and with sulphate of ammonia. These results do not lend themselves to a summary, but they will be published in the near future.

FARM REPORT

From the point of view of yield, the season of 1936-37 was, on the whole, a good one. All crops grew well, and spring grain crops did very well indeed. The rain came very awkwardly for things like sugar beet or potatoes, and, to an even greater extent, for kale and similar vegetables. But, in spite of this, good crops of all except kale were obtained over the greater part of the farm.

In Stackyard Field, the area known as Series D was fallowed in preparation for another experiment, and the year was suitable for this purpose. As a result, a very foul piece of land has become ready for further experimental cultivation. Similar measures will be taken with Series C in 1937-38.

As far as livestock is concerned, sheep did very well during the year, and the shepherd (W. McCallum) obtained the shepherd's prize for the county for the highest percentage of lambs to ewes (171 per cent.) in the lambing season of 1936-37. The year closed with a breeding flock of 61 ewes, all being cross bred, with one Hampshire ram.

As far as pigs are concerned, the herd was somewhat reduced in the year and the period closed with 186 animals. Awards were made to the farm at the Bedfordshire County Show for a bacon pig (first prize) and for sows (second and third prizes). Awards were also obtained at the fat stock shows at Bedford and Bletchley in December 1936.

https://doi.org/10.23637/ERADOC-1-69