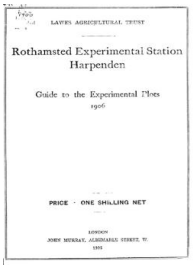
Rothamsted Experimental Station - Guide to the Experimental Plots 1906



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Hoosfield

Rothamsted Research

Rothamsted Research (1906) *Hoosfield ;* Rothamsted Experimental Station - Guide To The Experimental Plots 1906, pp 31 - 40 **- DOI: https://doi.org/10.23637/ERADOC-1-140**

short of that on Plot 7, where minerals are used every year with the same amount of ammonium-salts, thus showing that the previous mineral manuring is carried forward and has an effect in seasons beyond the year of its application.

HOOS FIELD—BARLEY

The experiments on the continuous growth of barley were begun in the Hoos field in 1852. The arrangement of the plots and the manures applied to each plot have practically been unchanged since, so that the plots to-day show the effects of more than fifty years' continuous growth of barley under the same treatment year after year. There are four longitudinal strips receiving different combinations of the mineral manures; these are all crossed by four breadths receiving different nitrogenous manures. The mineral manuring on the strips is as follows:—(1) None; (2) Phosphoric acid only, no potash or alkali salts; (3) Potash, magnesia, and soda, no phosphoric acid; and (4) Complete mineral manure, supplying both phosphoric acid and the alkaline salts. Each of these is combined with the four cross-dressings of nitrogenous manures—Series O, no nitrogen; Series A, ammonium-salts; Series N, nitrate of soda; and Series C, rape cake. There are other plots, one of which has received farmyard manure for the first twenty years, but has since been unmanured.

TABLE XV.—*Experiments on Barley, Hoos Field. Manuring of the Plots per acre per annum*, 1852 *and since.*

Plot.	Abbreviated Description of Manures.	Nitrogenous Manures.				Mineral Manures.			
		Farmyard Manure.	Rape Cake.	Ammonium-salts.	Nitrate of Soda.	Super-phosphate.	Sulphate of Potash.	Sulphate of Soda.	Sulphate of Magnesia.
		Tons.	Lb.	Lb.	Lb.	Cwt.	Lb.	Lb.	Lb.
1 O	No Minerals, and no Nitrogen	...	...	...	...	...	...	...	...
2 O	Superphosphate only, do.	...	...	...	...	3·5	...	...	...
3 O	Alkali Salts only, do.	...	...	...	...	...	200	100	100
4 O	Complete Minerals, do.	...	...	...	...	3·5	200	100	100
1 A	Ammonium-salts alone	...	...	200	...	...	...	...	...
2 A	Superphosphate and Ammonium-salts	...	...	200	...	3·5	...	...	...
3 A	Alkali Salts and do.	...	...	200	...	...	200	100	100
4 A	Complete Minerals and do.	...	...	200	...	3·5	200	100	100
1 N	Nitrate of Soda alone	...	...	...	275	...	...	...	...
2 N	Superphosphate and Nitrate of Soda	...	...	...	275	3·5	...	...	...
3 N	Alkali Salts and do.	...	...	...	275	...	200	100	100
4 N	Complete Minerals and do.	...	...	...	275	3·5	200	100	100
1 C	Rape Cake alone	...	1000	...	...	...	...	...	...
2 C	Superphosphate and Rape Cake	...	1000	...	...	3·5	...	...	...
3 C	Alkali Salts and do.	...	1000	...	...	...	200	100	100
4 C	Complete Minerals and do.	...	1000	...	...	3·5	200	100	100
7-1	Unmanured (after dung 20 yrs., 1852-71)	...	...	...	...	...	...	...	...
7-2	Farmyard Manure	14	...	...	...	...	...	...	...

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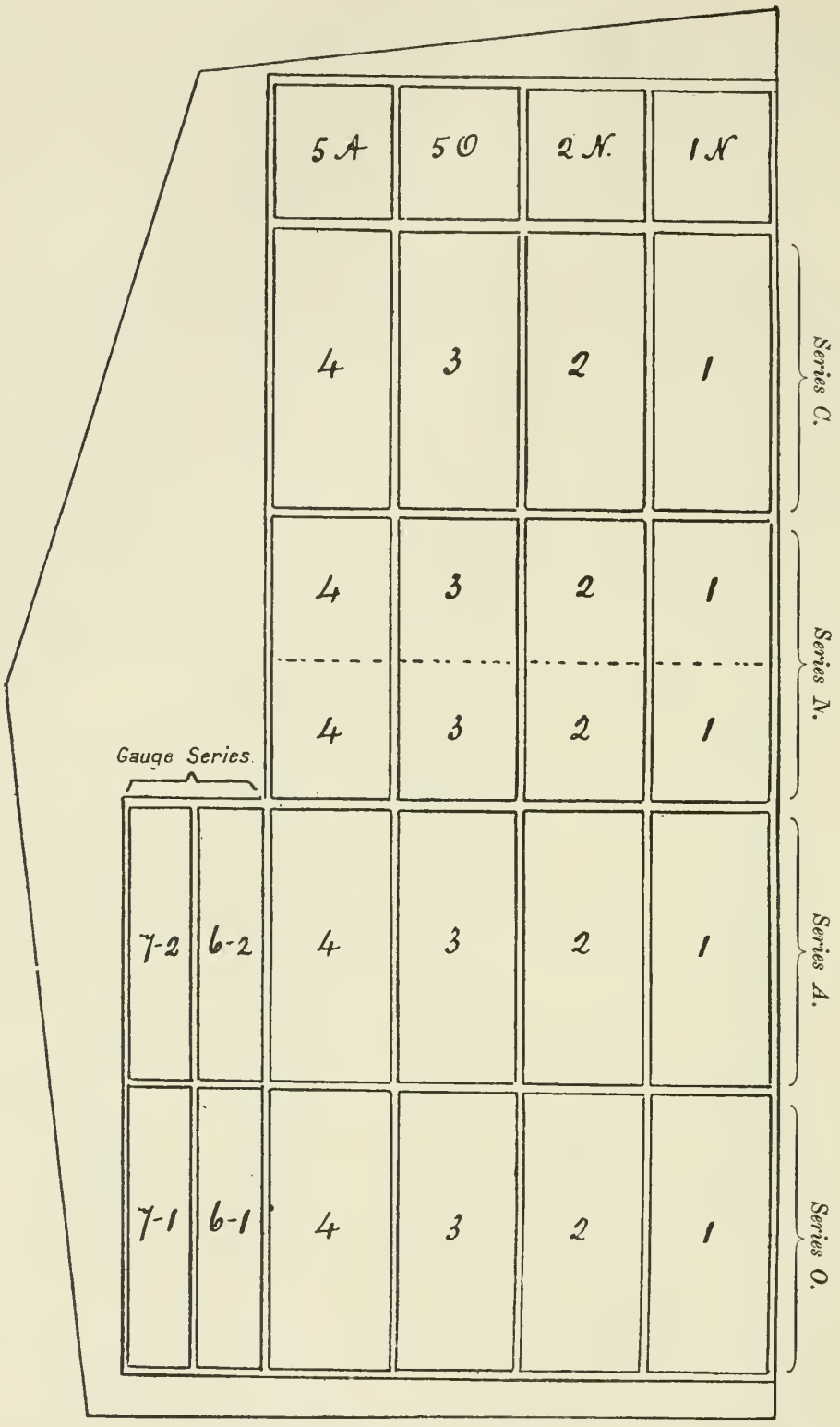
E.—*Plan of the Plots in Hoos Field, on which Barley has been Grown since* 1852.



Total area of ploughed land about $5\frac{1}{2}$ acres.

Area of Plots.
- 1, 2, 3, and 4, of Series O, Series A, and Series C, each $\frac{2}{11}$ acre.
- 1, 2, 3, and 4, of Series N, each $\frac{2}{11}$ acre.
- 1 N, 2 N, 5 O, and 5 A, each $\frac{1}{11}$ acre.
- 6-1 and 6-2, each about $\frac{1}{7}$ acre.
- 7-1 and 7-2, each about $\frac{1}{9}$ acre.

The double lines indicate division paths between plot and plot.

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TABLE XVI.—*Experiments on Barley, Hoos Field. Produce of Grain and Straw per acre. Averages over* 51 *years* (1852-1902), *and over* 10 (1893-1902). *Also Produce in* 1905.

Plot.	Abbreviated Description of Manures.	Dressed Grain.			Straw.		
		Average, 51 years (1852-1902).	Average, 10 years (1893-1902).	Season 1905.	Average, 51 years (1852-1902).	Average, 10 years (1893-1902).	Season 1905.
		Bush.	Bush.	Bush.	Cwt.	Cwt.	Cwt.
1 O	No Minerals, and no Nitrogen . .	15·3	10·1	6·5	8·8	6·4	5·3
2 O	Superphosphate only, do. . .	20·1	13·6	11·9	10·2	7·8	6·7
3 O	Alkali Salts only, do. . .	16·1	8·9	7·7	8·9	5·9	7·0
4 O	Complete Minerals do. . .	20·4	12·4	16·8	10·8	8·0	11·9
1 A	Ammonium-salts alone . . .	26·5	16·2	12·3	14·9	10·5	11·9
2 A	Superphosphate and Ammonium-salts .	39·9	26·8	22·1	22·5	16·5	19·0
3 A	Alkali Salts and do. .	29·4	20·8	14·9	17·0	12·9	14·0
4 A	Complete Minerals and do. .	42·1	35·1	35·5	24·9	20·5	22·2
1 N	Nitrate of Soda alone	30·4	20·5	17·3	18·1	14·4	14·3
2 N	Superphosphate and Nitrate of Soda .	44·0	35·9	32·9	26·2	23·0	25·8
3 N	Alkali Salts and do. .	31·5	23·4	17·3	19·7	15·3	14·8
4 N	Complete Minerals and do. .	43·5	34·9	32·2	27·4	22·6	24·7
1 C	Rape Cake alone	39·2	31·0	29·0	22·4	18·4	17·1
2 C	Superphosphate and Rape Cake . .	41·5	33·2	28·5	23·9	19·6	17·7
3 C	Alkali Salts and do. . .	37·7	29·6	29·3	22·4	18·1	20·8
4 C	Complete Minerals and do. . .	41·0	32·5	34·2	24·5	20·1	23·1
7-1	Unmanured (after dung 20 yrs., 1852-71)	27·0*	19·9	14·1	15·4*	12·8	8·6
7-2	Farmyard Manure	47·6	42·6	39·4	29·1	28·8	27·9

* Average 31 years (1872-1902).

Effect of Nitrogenous Manures

The effect of nitrogenous manures upon the barley crop is best seen by comparing the yields of the various Plots 4, all of which receive the same mineral manures; the diagram, Fig. 11, shows this comparison in a graphic form.

Effect of Mineral Manures

The diagram, Fig 12, shows in a graphic form the effects of the various mineral manures, the nitrogen supply being the same in all cases.

The great importance of phosphoric acid to the barley crop is seen on comparing Plots 3 and 4, which only differ from one another in the omission of phosphoric acid on Plot 3. In the field the most striking effect is seen in the hastened maturity brought about by the phosphoric acid. By comparing Plot 2 with Plot 4 we can see the effect of omitting potash from the manure. Where nitrate of soda is used as the source of nitrogen the soda liberates sufficient potash from the soil to supply the needs of the crop, but with ammonium-salts the omission of potash has latterly begun to tell upon the yield, though it did not do so in the earlier years of the experiment.

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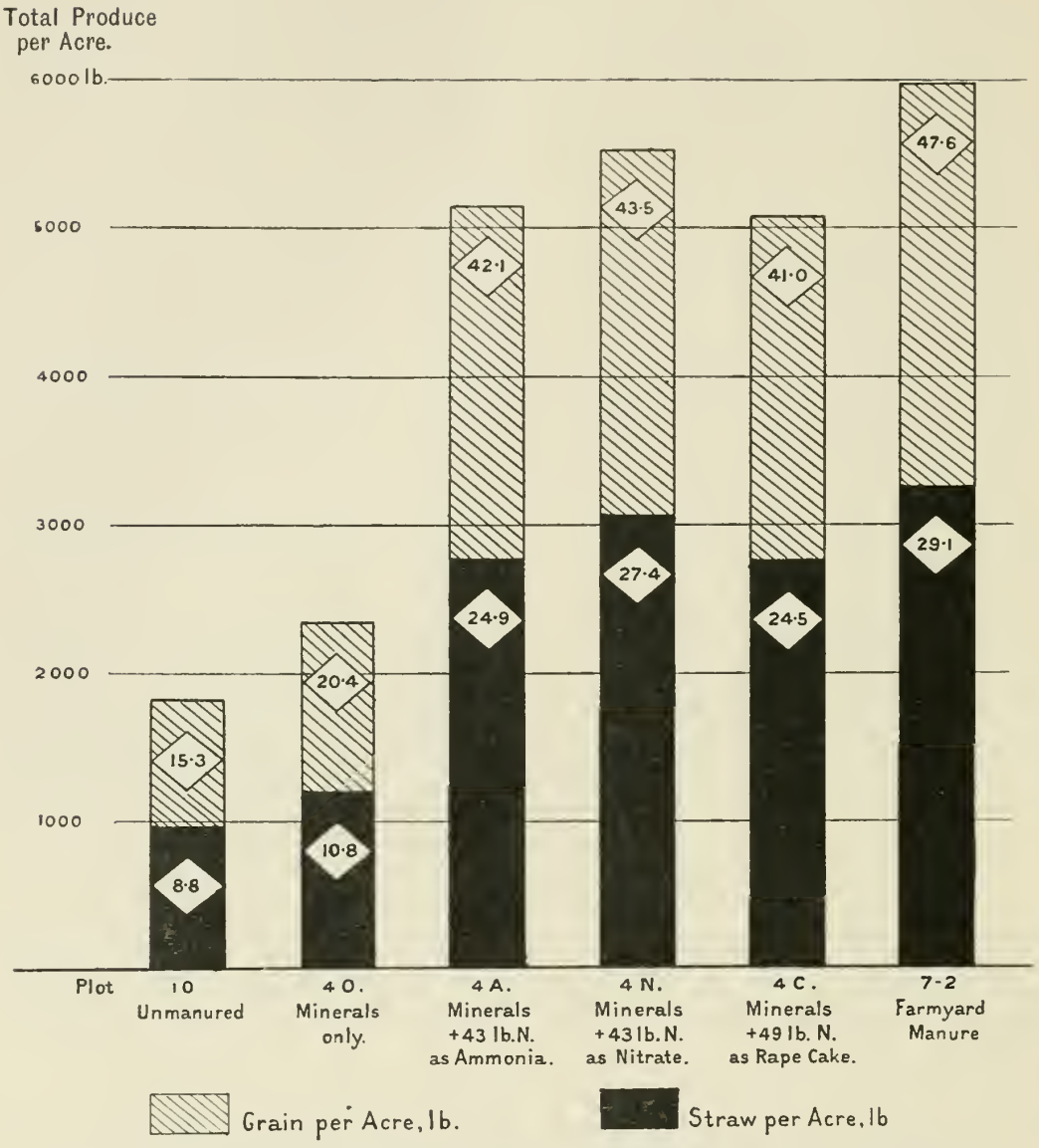

FIG. 11.—Yield in Barley (Grain and Straw) with different sources of Nitrogen. Averages for 51 years (1852-1902).

The figures in the labels indicate bushels of Grain and cwt. of Straw.

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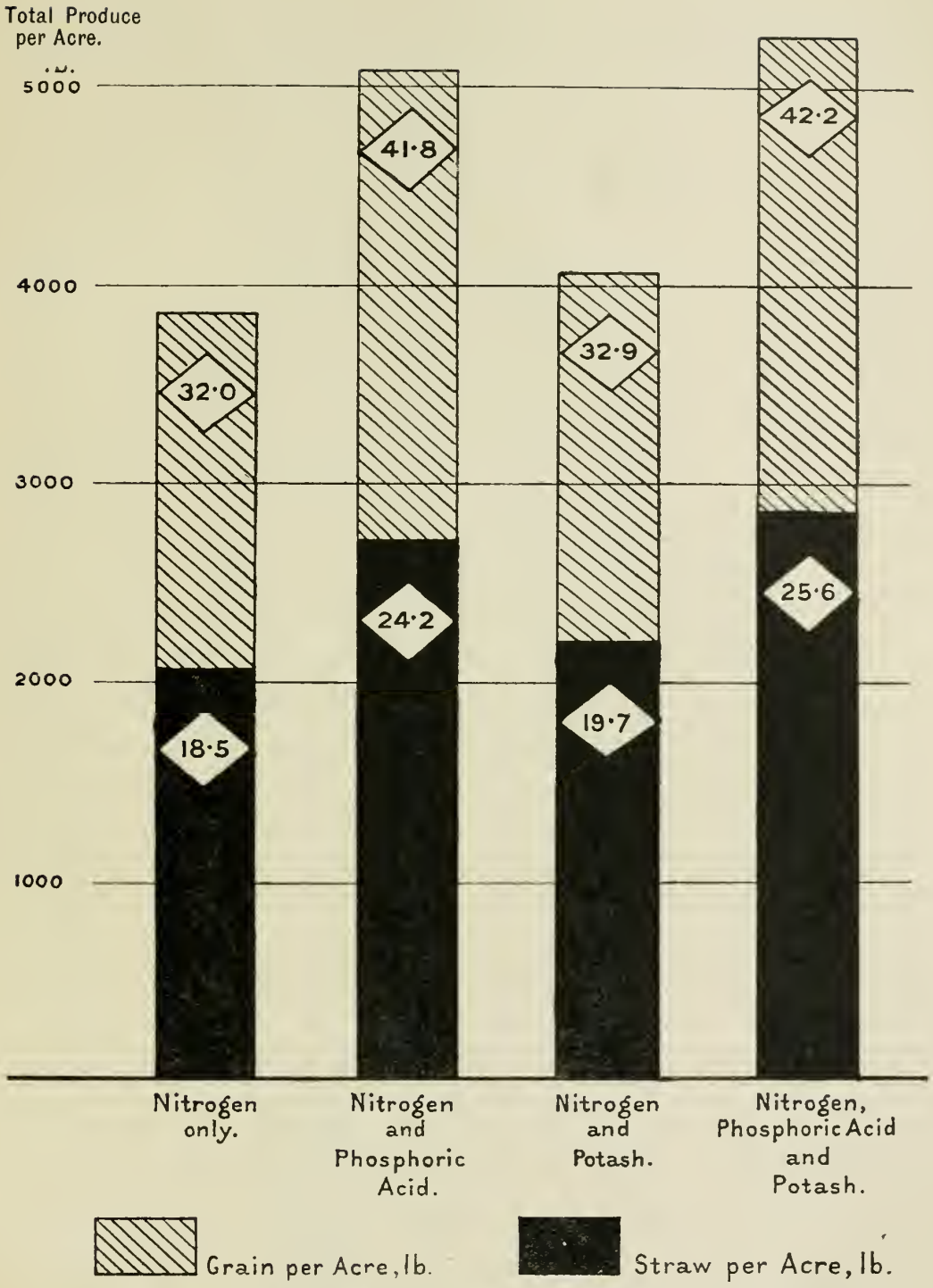

FIG. 12.—Effect of Mineral Manures on the yield of Barley (Grain and Straw). Mean of Series A. N. and C. 51 years (1852-1902).

The figures in the labels indicate bushels of Grain and cwt. of Straw.

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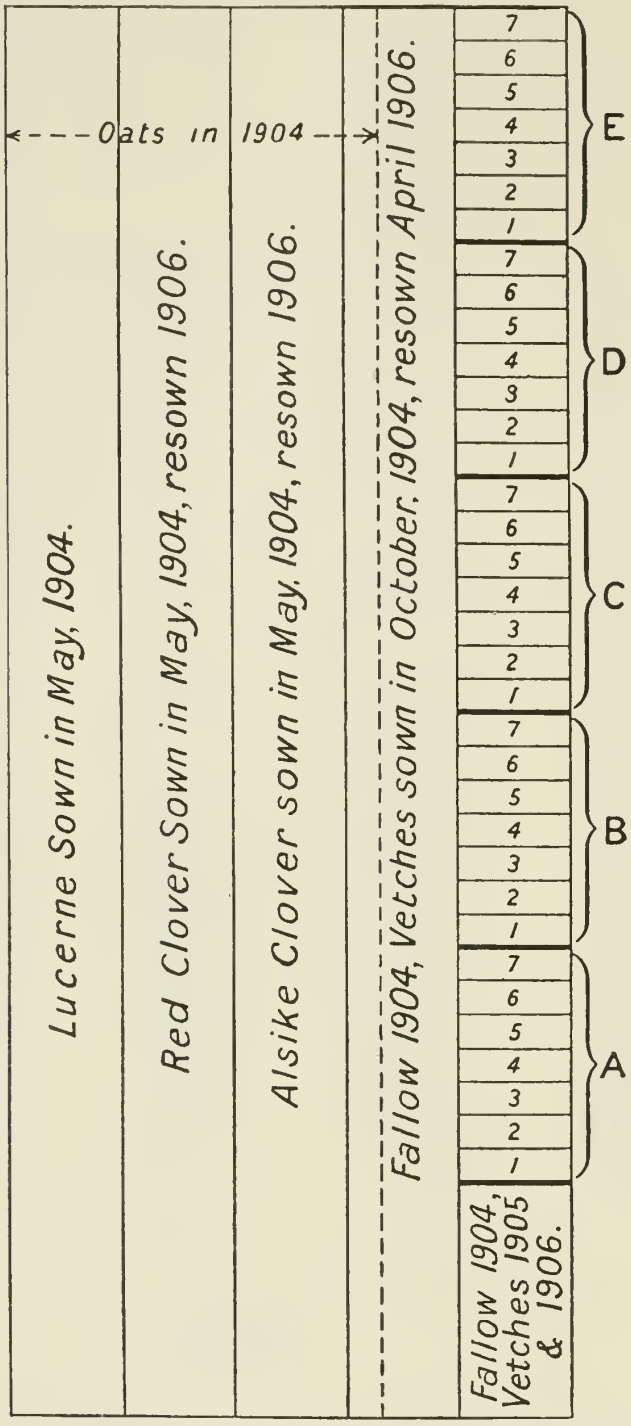
F.—*Hoos Field Leguminous Plots. Season* 1906.



[Total area under experiment about 3 acres.]

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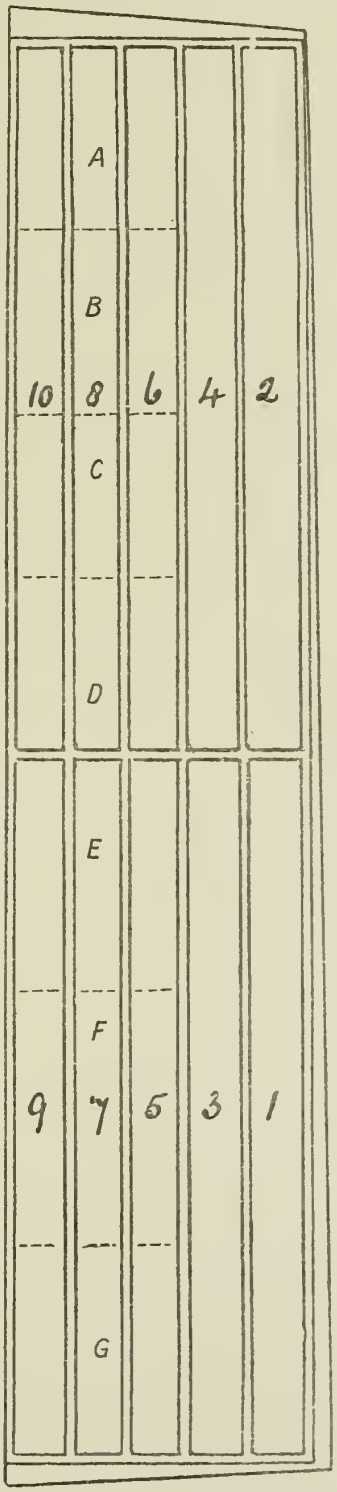
G.—*Plan of the Plots in Hoos Field, on which Potatoes were grown without Manure, and with various Manures.*

26 years, 1876-1901.

In 1902 and 1903 Barley, and in 1904 Oats, were sown, without manure, to determine the duration of the residues of the previous manuring. In 1905 Barley was again sown on Plots 1-4 without manure. Plots 5-10 sown with Leguminous seeds.



Total area of ploughed land about $2\frac{1}{16}$ acres. Area of each plot $\frac{1}{16}$ acre.
The double lines indicate division paths between plot and plot.

C 2

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HOOS FIELD LEGUMINOUS PLOTS

1848-9 ONWARDS

The small plots (see Plan on page 36) represent portions of the original plots on which attempts have been made to grow leguminous plants continuously since 1848. Various combinations of mineral manures have been used up till 1898, but after the first few years very small crops have been grown, and the clovers in particular generally fail. After fallowing in 1903 to clean the plots, they were resown as before in 1904.

The remainder of the area was formerly occupied by similar small plots of the same leguminous plants. These were ploughed up in 1898, and five crops of wheat were taken without manure in order to test the amount of nitrogen accumulated by the leguminous crop and left in the soil.

In 1904 black tartarian oats were sown, and in the oats, lucerne, red clover, and alsike clover were sown on three strips; a fourth strip, fallowed in 1904, was sown with vetches in October of that year, as shown in the Plan on page 36. The new plots run across the old ones at right angles. The following table shows the crop obtained in 1905, after which the clover and vetch plots were broken up and resown in a barley crop in 1906.

TABLE XVII.—*Produce per acre, as Hay. Season* 1905.

	First Crop.	Second Crop.	Total.
	Cwt.	Cwt.	Cwt.
Lucerne . . .	21·5	16·6	38·1
Red Clover . .	25·7	21·5	47·2
Alsike Clover . .	36·9	...	36·9
Vetches . . .	45·8	...	45·8

HOOS FIELD—POTATO PLOTS

RESIDUE OF MANURES

On ten plots potatoes were grown with various manures for 26 years (1876-1901), with the results set out in Table XVIII. In 1902 the manuring was discontinued and barley sown; this was again followed by barley in 1903, and by oats in 1904. The yield produced by the residues of the manures applied to the potatoes is shown in Table XVIII.

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HOOS FIELD

TABLE XVIII.—*Produce of Barley per acre in* 1902 *and* 1903, *without Manure, on the Plots which had grown Potatoes, variously Manured, in the* 26 *years*, 1876-1901, *inclusive. In* 1904 *Black Tartarian Oats were sown, again without Manure.*

Plot.	Potatoes, 1876-1901. Manures per acre per annum. (In the 5 years, 1897 to 1901, 400 lb. Basic Slag was used throughout instead of Superphosphate.)	Potatoes, 1876-1901. Average Produce of Total Tubers per acre.	Barley, Unmanured. 1902. Dressed Grain.	Barley, Unmanured. 1902. Total Straw.	Barley, Unmanured. 1903. Dressed Grain.	Barley, Unmanured. 1903. Total Straw.	Oats, Unmanured. 1904. Dressed Grain.	Oats, Unmanured. 1904. Total Straw.
		Tons.	Bush.	Lb.	Bush.	Lb.	Bush.	Lb.
1	Unmanured, 1876 and since	1·4	33·2	1799	9·6	544	23·1	1346
2	Unmanured, 1882 and since. Previously Farmyard Manure, 14 tons	2·8	35·4	1872	15·2	1020	21·5	1176
3	Farmyard Manure, 14 tons, 1883 and since. Previously Superhosphate also	4·8	71·0	5216	46·9	3474	55·5	3060
4	Farmyard Manure, 14 tons, 1883 and since, 1882 and previously Superphos., and in 1881 and previously Nitrate Soda = 86 lb. Nitrogen also	5·1	72·4	5115	44·9	3486	61·5	3258
5	Ammonium-salts = 86 lb. Nitrogen	1·7	59·1	3774	19·2	1018	24·1	1170
6	Nitrate Soda = 86 lb. Nitrogen	2·1	62·9	4275	18·6	911	22·7	1263
7	Ammonium-salts = 86 lb. Nitrogen, and Mixed Mineral Manure *	5·3	64·4	4286	28·9	1634	30·9	1693
8	Nitrate Soda = 86 lb. Nitrogen, and Mixed Mineral Manure	5·4	67·0	4629	26·2	1748	32·6	1635
9	Superphosphate only	2·7	35·1	1811	13·3	890	22·7	1104
10	Mixed Mineral Manure only	2·9	24·8	1610	12·8	887	20·6	1151

* "Mixed Mineral Manure," Superphosphate, and Sulphates of Potash, Soda and Magnesia.

On Plots 1, 2, 3, and 4 barley was again sown (without manure) in 1905, and gave the following results:—

TABLE XIX.—*Produce per acre in* 1905.

Plot.	Dressed Grain.		Straw.	Total Produce.
	Yield.	Weight per Bushel.		
	Bush.	Lb.	Cwt.	Lb.
1	4·6	52·0	3·0	613
2	7·1	52·3	3·4	799
3	28·3	55·7	14·8	3317
4	30·3	55·9	17·2	3693

HOOS FIELD

INOCULATION OF LEGUMINOUS PLANTS

Since the land on which potatoes had been formerly grown (see Plan on page 37) is known to have carried no leguminous crop for the last fifty years, it was decided to use those plots which no longer showed much residue of the manures previously applied, *i.e.*, Plots 5-10, for testing the comparative effects of different media for inoculating leguminous plants with their appropriate bacteria. Plots 6, 8, and 10 were divided transversely into four plots; on A, soil inoculated with Hiltner's preparation from Munich; on B, soil inoculated with Moore's preparation from the United States; on C, soil from a field which had carried red clover in 1904, were sown on 7th April; D being left uninoculated. Red clover seed was sown on 15th May over the whole area.

Plots 5, 7, and 9 were similarly divided into three plots and sown with cow peas (*Vigna catjang*), a leguminous plant quite new to this land. On E, the seed was inoculated with Moore's medium just before sowing; on F, soil obtained from an old cow pea field in the United States was spread; and G was not inoculated. The cow peas were sown on 16th May, but failed to give a satisfactory plant, and were ploughed up. The plots were sown with red clover in 1906, as part of a further trial of the continuous growth of clover.

HOOS FIELD—WHEAT AFTER FALLOW

The two half-acre plots in Hoos field are never manured, but every year one carries a wheat crop and the other is given a bare summer fallow, the treatment alternating, so that every year one plot is carrying a wheat crop following a bare fallow. By comparing the results obtained with the yield of the unmanured plot growing wheat continuously, the benefit of the bare fallow can be estimated.

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