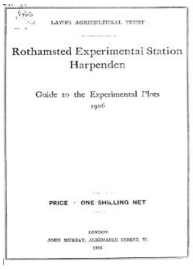
Rothamsted Experimental Station - Guide to the Experimental Plots 1906



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Agdell Field - Crop Grown in Rotation

Rothamsted Research

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THE ROTHAMSTED SOIL

The Rothamsted soil was described by Lawes in 1847, as follows:— "The soil upon which my experiments were tried consists of rather a heavy loam resting upon chalk, capable of producing good wheat when well manured; not sufficiently heavy for beans, but too heavy for good turnips or barley. The average produce of wheat in the neighbourhood is said to be less than 22 bushels per acre, wheat being grown once in five years. The rent varies from 20s. to 26s. per acre, tithe free."

It is fairly uniform in the different fields, and consists essentially of a heavy loam containing little coarse sand or grit, but a considerable amount of fine sand and silt, and a large body of clay. In consequence, the soil has to be worked with care, becoming very sticky and drying to impracticable clods if moved when wet. It "runs together" if heavy rain falls after a tilth has been established, and then dries with a hard, unkindly surface, these difficulties being much exaggerated on the plots which have been farmed for a long time without any supply of organic matter in the manures.

The most notable feature in the Rothamsted soil is the amount of calcium carbonate in the surface layer; analyses of the earliest samples available (1856) show more than 5 per cent. in the surface soil of Broadbalk field. The subsoil below the depth of 9 inches contains little or no calcium carbonate, and this fact, together with the varying proportion in the surface soil, indicate that the original soil was almost devoid of calcium carbonate, and that the quantity now found in the surface soil has all been applied artificially.

AGDELL FIELD

Crops grown in Rotation

The Agdell field, which was put under experiment in the year 1848, differs from the other Rothamsted fields in that it is farmed on a four-course rotation of Swedes, barley, clover (or beans) or fallow, and wheat, instead of growing one crop continuously. It is divided into three main plots, one of which (O) has received no manure, the second (M) mineral manures only, and the third (C) a complete manure, containing the same minerals, but also nitrogen in the form of rape cake and ammonium-salts. The manures are applied to the Swedes only, the other three crops of each course being grown without manure. Each of the three plots is further subdivided:— Half the plots carry clover or beans as the third crop of the course, and half the plots are bare fallow. This shows the effect of introducing the leguminous crop into the rotation, as compared with the bare fallow.

On this field the long-continued cropping without manure on O affects the successive crops in the rotation very differently. The Swede crop is least capable of growing in the impoverished soil, and is reduced to less than a ton per acre; the clover and barley crops are also small, but the deep-rooted wheat crop is comparatively little affected, and yielded as much as 19·6 bushels per acre in 1903, the fifty-sixth year without any

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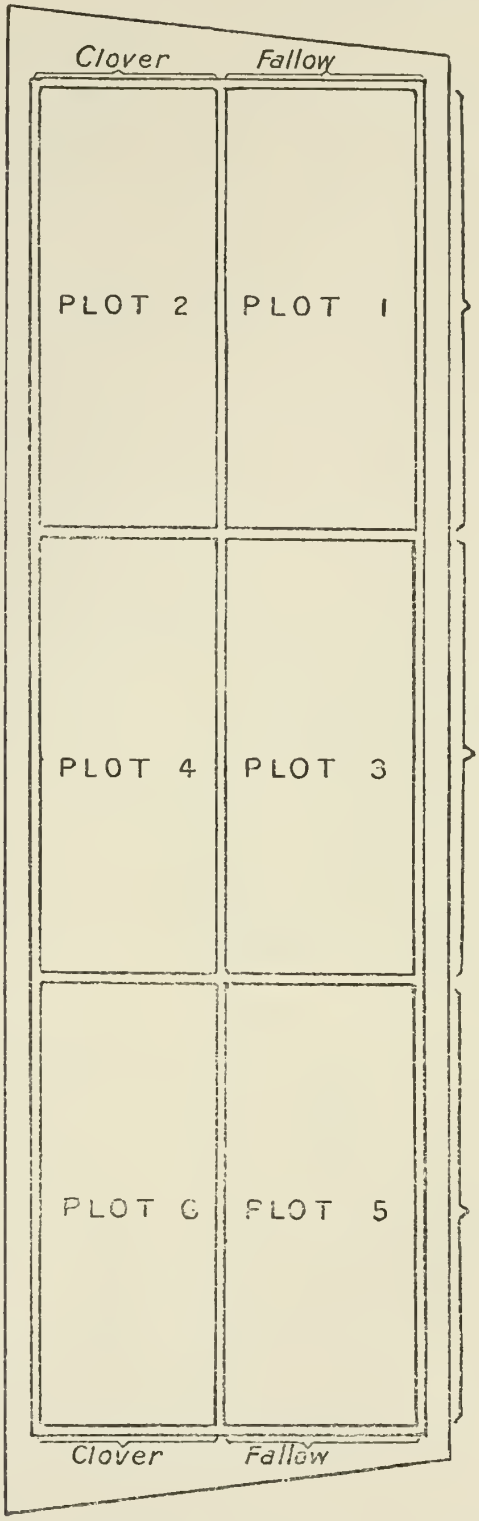
A.—*Plan of the Plots in Agdell Field on which Experiments have been made on Four-Course Rotation.*

1848 and onwards.



C. *Complete Manure for Root Crop.*
As "M" and
200 lb. Ammonium-salts, and
2000 lb. Rape Cake
per acre.

M. *Minerals only for Root Crops.*
500 lb. Superphosphate,
500 lb. Sulphate of Potash.
100 lb. Sulphate of Soda,
200 lb. Sulphate of Magnesia,
per acre.

O.
Unmanured.

Total area of ploughed land, about 3 acres. Area of each of the 6 divisions, $\frac{2}{5}$ acre.

The 2 lower divisions, Unmanured continuously (Plots 5 and 6).
The 2 middle divisions, Mineral Manure, for the Roots, each Course (Plots 3 and 4).
The 2 upper divisions, Mineral and Nitrogenous Manure, for the Roots, each Course (Plots 1 and 2).
The 3 left-hand divisions, Clover (or Beans), 3rd year each Course.
The 3 right-hand divisions, Fallow, 3rd year each Course.
The double lines indicate division paths between plot and plot.

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manure. With minerals, but without nitrogen, the Swedes continue to give a fair crop; the barley and wheat are but little better than on the unmanured plot, while the clover grows almost as freely as on the completely manured plot.

TABLE I.—*Effect of Manure on Crops grown in rotation, Agdell Field. Average produce per acre over the five last Courses*, 1884-1903.

	O.	M.	C.
	Unmanured.	Mineral Manures.	Complete Manure.
Roots (Swedes) . . . . Cwt.	15·9	208·2	399·9
Barley Grain . . . . Bush.	15·8	20·0	27·7
Barley Straw . . . . Cwt.	11·3	12·7	18·5
Clover Hay * . . . . Cwt.	9·4	35·5	37·8
Bean Corn † . . . . Bush.	15·9	28·3	19·6
Bean Straw † . . . . Cwt.	8·8	17·0	11·5
Wheat Grain . . . . Bush.	26·2	36·1	37·1
Wheat Straw . . . . Cwt.	20·8	31·1	33·0

* Average of 3 courses. † Average of 2 courses.

TABLE II.—*Crops grown in rotation, Agdell Field. Produce per acre over the last complete Course* (14*th*), 1900-1903.

Year.	Crop.	O. Unmanured.		M. Mineral Manure.		C. Complete Mineral and Nitrogenous Manures.	
		5. Fallow.	6. Beans or Clover.	3. Fallow.	4. Beans or Clover.	1. Fallow.	2. Beans or Clover.
1900	Roots (Swedes) . Cwt.	44·8	15·8	201·6	272·1	480·6	480·0
1901	Barley Grain . . Bush.	16·3	22·1	15·9	22·3	25·1	29·4
	Barley Straw . . Cwt.	9·1	13·8	9·3	12·9	15·8	17·5
1902	Clover Hay . . Cwt.	...	0·1	...	3·7	...	6·1
1903	Wheat Grain . . Bush.	20·3	18·9	21·9	28·9	23·6	27·9
	Wheat Straw . Cwt.	17·9	16·2	24·9	32·4	28·4	32·2

When the plots 2 and 4 grow a good crop of clover, the residues of the crop have a very beneficial effect upon the succeeding crops of the rotation, as compared with the crops of plots 1 and 3, which are bare fallowed; the wheat is increased by something like 15 per cent., the roots (although manured) are slightly better, and the barley, following the roots, still shows the value of the preceding clover crop. No such residue seems to be left behind by the bean crop, whenever that is taken in the rotation instead of clover. On the unmanured plot 6, only, the clover shows no effect on succeeding crops, because there its growth is too small to leave behind any residue of nitrogen.

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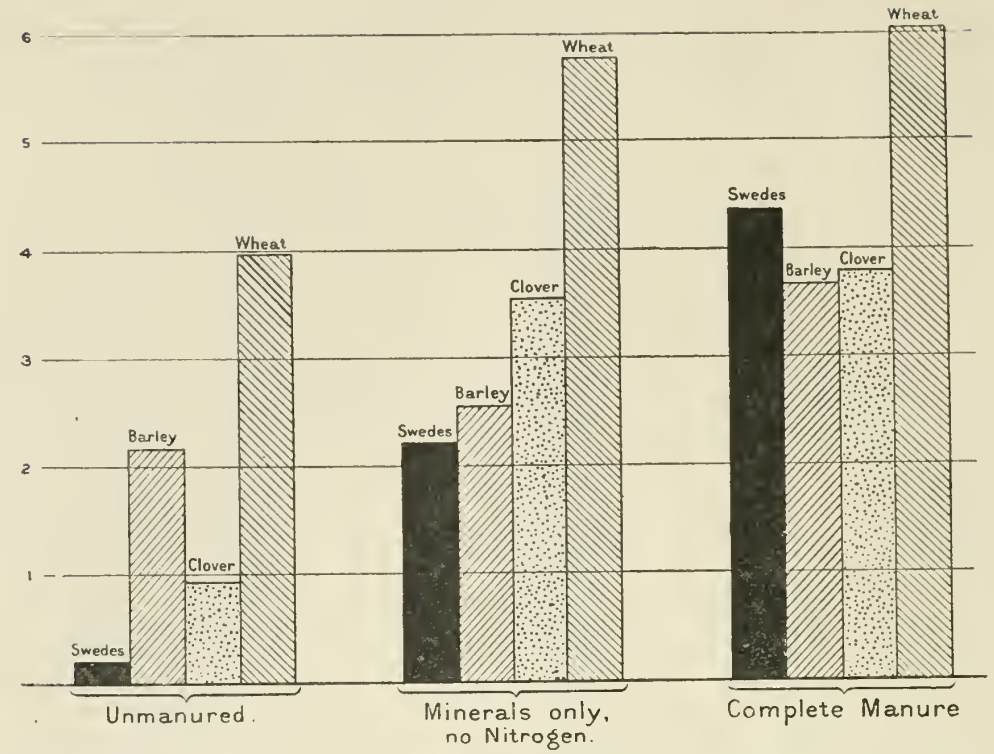

FIG. 1.—Effect of Manure upon Crops grown in Rotation. Total Produce. Averages of Five Courses (1884-1903). Swedes in 100 cwt.; Barley and Wheat in 1000 lb.; and Clover in 10 cwt.

TABLE III.—*Crops grown in rotation, Agdell Field. Effect of the largest Clover or Bean Crop on the following Wheat Crop. Total produce per acre.*

	Clover, 1894.	Wheat, 1895.			Beans, 1862.	Wheat, 1863.		
		After Fallow.	After Clover.	Difference due to Clover.		After Fallow.	After Beans.	Difference due to Beans.
	Cwt.	Lb.	Lb.	Per cent.	Lb.	Lb.	Lb.	Per cent.
O. Unmanured	16·5	3131	3193	+ 2·0	3603	7222	5281	- 26·9
M. Mineral Manure	59·7	4220	5180	+ 22·7	4033	7910	6090	- 23·0
C. Complete Manure	76·7	4547	5209	+ 14·6	5755	8792	7674	- 12·7

TABLE IV.—*Crops grown in rotation, Agdell Field. Effect of Clover or Beans on the following Wheat Crops. Total produce per acre.*

	Clover Crops.*	Wheat.†			Bean Crops.‡	Wheat.§		
		After Fallow.	After Clover.	Difference due to Clover.		After Fallow.	After Beans.	Difference due to Beans.
	Cwt.	Lb.	Lb.	Per cent.	Lb.	Lb.	Lb.	Per cent.
O. Unmanured	15·2	4173	3475	- 16·7	1888	4907	4373	- 10·9
M. Mineral Manure	44·4	5245	5613	+ 7·0	2615	5528	5447	- 1·5
C. Complete Manure	52·9	5479	6130	+ 11·9	3177	6092	5929	- 2·7

* 5 years (1874, 1882, 1886, 1894, and 1902).
† 5 years (1875, 1883, 1887, 1895, and 1903).
‡ 8 years (1854, 1858, 1862, 1866, 1870, 1878, 1890, and 1898).
§ 8 years (1855, 1859, 1863, 1867, 1871, 1879, 1891, and 1899).

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