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Guide to the Experimental Plots - 1913

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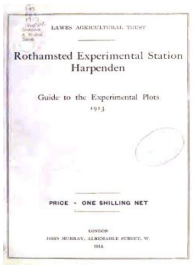
LAWES AGRICULTURAL TRUST

Rothamsted Experimental Station
Harpenden

Guide to the Experimental Plots
1913

PRICE - ONE SHILLING NET

LONDON
JOHN MURRAY, ALBEMARLE STREET, W.
1914

Barn Field - Mangolds

Rothamsted Research

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The diagram, Fig. 2, shows in a graphic form the benefit the whole rotation receives from the growth of clover, even when the root crop receives nitrogenous manures.

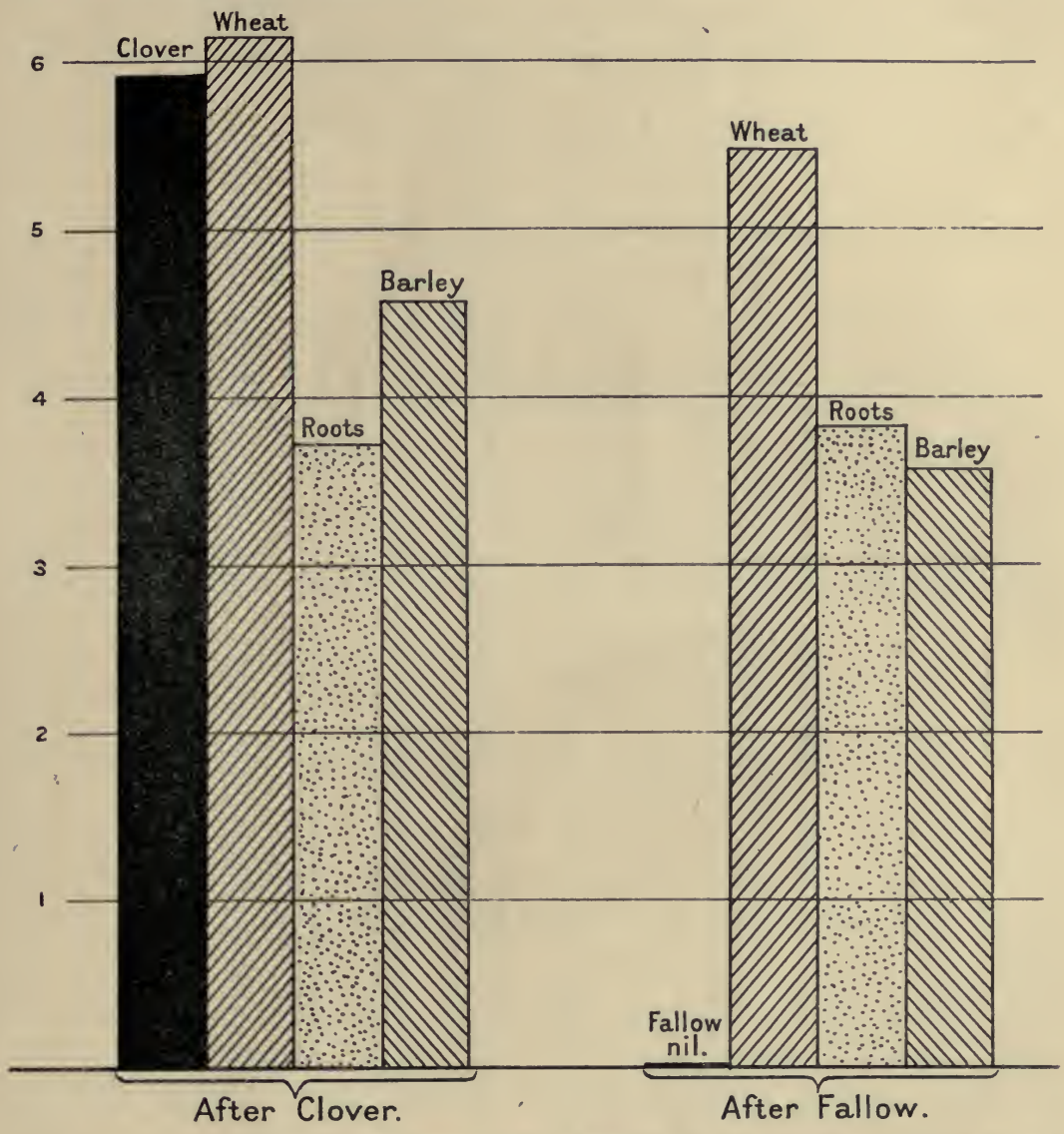

FIG. 2.—Comparative Effect of Clover or Bare Fallow on the succeeding Crops in the Rotation. Total Produce—In 1000 lb. for Clover, Wheat, and Barley, and in 100 cwt. for Roots.

BARN FIELD

Mangolds.

The experiments upon mangolds began in 1876, but the land had been receiving similar manures for other root crops since 1856.

The field is divided longitudinally into eight strips running the whole length of the field; each of these strips receives one manure throughout its length; farmyard manure alone on Strip 1, and in combination with superphosphate and sulphate of potash on Strip 2, nothing on Strip 8, superphosphate alone on Strip 5, superphosphate and sulphate of potash

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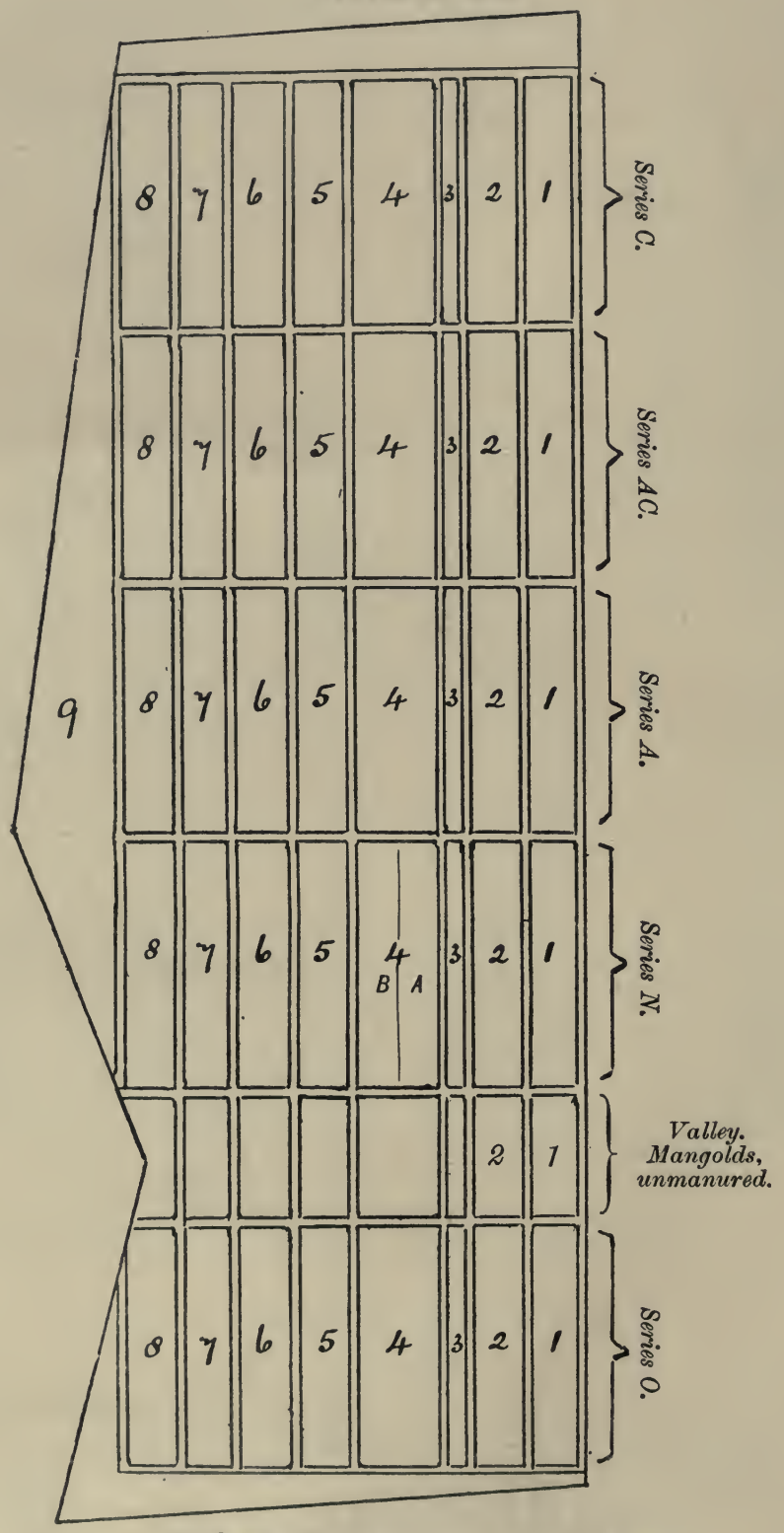
B.—*Plan of the Plots in Barn Field on which Experiments have been made with Root Crops.*

1843 and onwards.



Total area of ploughed land, about 8 acres.

Area of Plots { 1, 2, 5, 6, 7, and 8, of each Series, rather over $\frac{1}{7}$ acre.
3, of each Series, about $\frac{1}{27}$ acre.
4, of each Series, about $\frac{1}{6}$ acre.
9, rather over $\frac{4}{10}$ acre.

The double lines indicate division paths between plot and plot.

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on Strip 6, and complete minerals, including sulphate of magnesia and common salt, on Strip 4. The strips are then subdivided into plots by cross-dressings of nitrogenous manures; nothing on the O series, nitrate of soda on Series N, ammonium-salts on Series A, rape cake on Series C, and a combination of ammonium-salts and rape cake on Series AC.

TABLE V.—*Experiments on Mangolds, Barn Field, beginning* 1876. *Quantities of Manures per acre per annum.*

Strip.	Strip Manures.					Nitrogenous Manures running across all the Strips.					
						Series O.	N.	A.	AC.		C.
	Farmyard Manure.	Superphosphate.	Sulphate of Potash.	Sulphate of Magnesia.	Chloride of Soda. (Salt.)	None.	Nitrate of Soda.	Ammonium-salts.*	Rape Cake.	Ammonium-salts.*	Rape Cake.
	Tons.	Cwt.	Lb.	Lb.	Lb.	Lb.	Lb.	Lb.	Lb.	Lb.	Lb.
1	14	...	...	...	...	...	550	400	2000	400	2000
2	14	3·5	500†	...	...	...	550	400	2000	400	2000
4	...	3·5	500	200	200	...	550	400	2000	400	2000
5	...	3·5	...	...	...	...	550	400	2000	400	2000
6	...	3·5	500	...	...	...	550	400	2000	400	2000
7‡	...	3·5	...	200	200	...	550	400	2000	400	2000
8	...	...	...	...	...	...	550	400	2000	400	2000

* Equal parts Sulphate and Muriate Ammonia of commerce.
† The addition of Potash to Plot 2 began in 1895. ‡ Commenced in 1903 only.

TABLE VI.—*Barn Field Mangolds. Produce of Roots and Leaves per acre. Season* 1912.

Strip.	Strip Manures.	Cross-Dressings.				
		O.	N.	A.	AC.	C.
		None.	Nitrate of Soda.	Ammonium-salts.	Rape Cake and Ammonium-salts.	Rape Cake.
		Tons.	Tons	Tons.	Tons.	Tons.
1	Dung only	R. 16·91	29·38	24·51	25·76	23·75
		L. 4·20	6·79	7·47	9·00	7·43
2	Dung, Super., Potash	R. 18·51	29·92	27·85	31·80	28·39
		L. 4·37	7·87	8·42	10·35	7·67
4	Complete Minerals	R. 2·62	15·25 *15·05	10·78	27·99	21·53
		L. 1·05	4·33 *5·23	2·96	9·20	4·83
5	Superphosphate only	R. 2·10	9·46	3·14	8·63	9·10
		L. 1·04	3·48	2·54	5·17	3·78
6	Super. and Potash	R. 2·13	12·22	10·30	24·36	19·20
		L. 0·86	3·28	2·98	8·50	3·68
7	Super., Sulph. Mag., and Chloride Sodium	R. 2·04	13·03	11·12	24·00	21·27
		L. 0·97	3·73	3·14	8·46	4·90
8	None	R. 1·14	4·10	1·48	8·82	9·07
		L. 0·88	2·70	1·52	5·20	3·93

R. = roots. L. = leaves.
* Received an equivalent amount of Phosphoric Acid, Nitrogen, and Potash, but without any Soda Salts.

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The value of farmyard manure in growing mangolds is evident, especially when they are grown continuously on the same land. In favourable seasons it is possible to obtain good crops by the aid of manures containing no organic matter, as seen in 1912; but in ordinary years the bad texture of the soil which results, and its tendency to lose water on account of the lack of humus, affect both the germination of the seed and the growth of the plant in its early stages.

TABLE VII.—*Barn Field Mangolds. Average produce of Roots per acre over* 34 *years* (1876 *to* 1912).*

Strip.	Strip Manures.	Cross-Dressings.				
		O.	N.	A.	AC.	C.
		None.	Nitrate of Soda.	Ammonium-salts.	Rape Cake and Ammonium-salts.	Rape Cake.
		Tons.	Tons.	Tons.	Tons.	Tons.
1	Dung only . . .	18·15	26·24	22·48	24·84	24·69
2	Dung, Super., Potash †	18·87	26·63	24·37	27·24	26·40
4	Complete Minerals .	5·05	17·71	14·75	26·73	22·11
5	Superphosphate only .	4·92	15·05	7·04	9·68	10·78
6	Super. and Potash .	4·32	15·42	14·08	23·42	19·28
8	None	3·69	9·94	5·61	9·29	9·71

* 1885, 1901, and 1908 omitted. † The addition of Potash to Plot 2 only began in 1895.

Effect of Nitrogen.

To ascertain the effects of nitrogen, it is best to examine Strip 4, which receives a complete mineral manure with different compounds of nitrogen. Series A, which receive ammonium-salts, should also be compared with Series N, receiving nitrate of soda. The general superiority of nitrate of soda as a nitrogenous manure for mangolds is most strikingly seen on Plots 5, where potash is omitted.

The diagram, Fig. 3, shows on the left hand the average results obtained with the varying amounts and compounds of nitrogen on the Plots 4 in question, where there is an abundant supply of mineral manure. The right-hand half of the diagram shows the effect of the same nitrogenous manures when used in conjunction with dung instead of complete minerals.

The injurious effects of the very large amounts of nitrogen added to some of the plots is very manifest wherever there is more nitrogen than the plant can properly deal with. The leaves have a dark green appearance, are much curled and crinkled, and show an increased tendency to variegation, the chlorophyll collecting into dark green or almost black blotches on the lighter background of the leaf. The leaf-stalks are often much more coloured, and become a bright orange-yellow.

On these plots the leaves do not ripen off and obtain the general yellow flaccid appearance presented on the more healthy plots when the crop is ready to lift; instead, the outer leaves begin to die and shrivel up quite early in October; in some places they show numbers of dead spots and burnt-looking patches round the edges of the leaf.

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Thus, towards the end of October, the plots receiving the excess of nitrogen present a very unhealthy appearance; a large proportion of the plants seem scorched and withered as regards the outer leaves, and only show a cluster of small dark green active leaves at the heart.

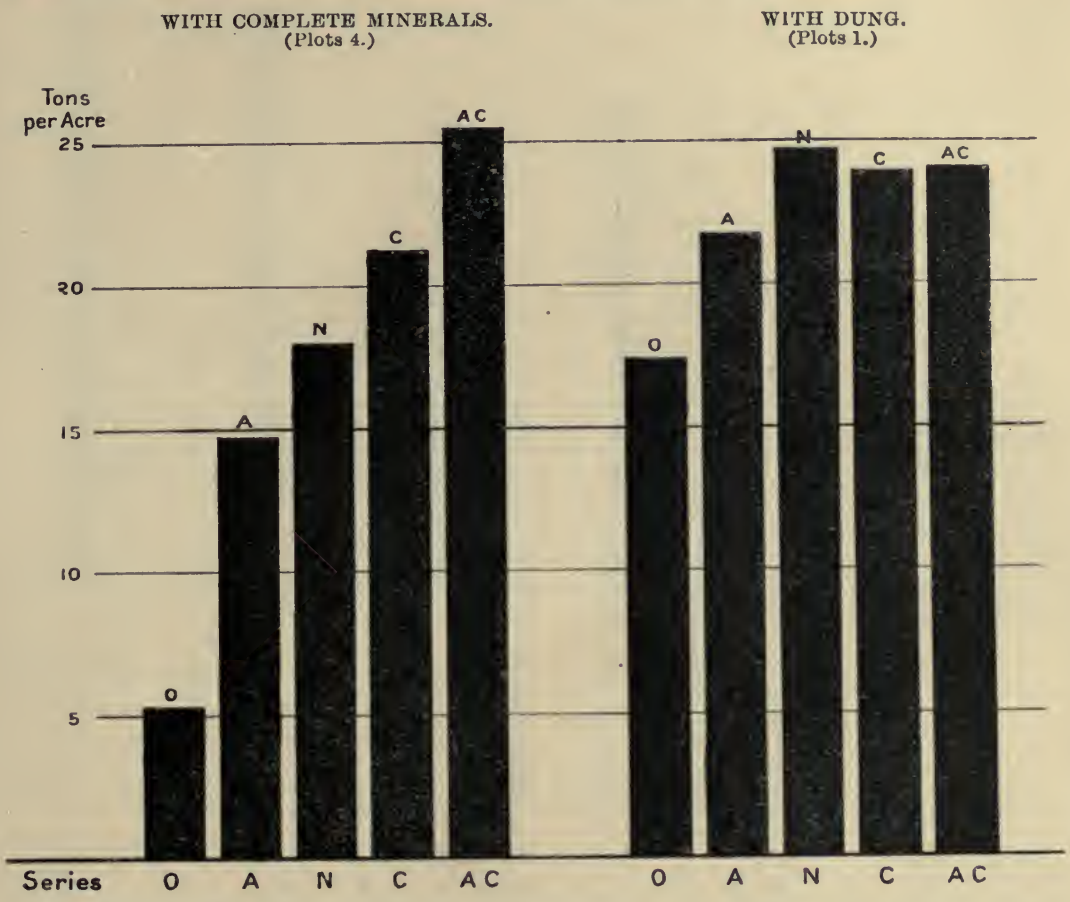

FIG. 3.—Mangolds. Effect of increasing amounts of Nitrogen. Average Produce of Roots per acre, 1876-1902.

O = No Nitrogenous Manure.
A = 86 lb. Nitrogen as Ammonium-salts.
N = 86 lb. Nitrogen as Nitrate of Soda.
C = 98 lb. Nitrogen as Rape Cake.
AC = 98 lb. Nitrogen as Rape Cake, and 86 lb. Nitrogen as Ammonium-salts.

Effect of Mineral Manures.

The effect of the different mineral constituents of a manure upon the mangold crop can be seen by an examination of Plots 4, 5, and 6.

The great increase of crop comes as a rule when potash is added to the superphosphate, and is to be correlated with the fact that the mangold is essentially a sugar-producing plant, and that large supplies of potash seem to be essential to the processes in the plant which result in the formation of sugar and similar carbohydrates.

The effect of potash and of the other saline manures is plainly visible in the appearance of the plants themselves. On the plots receiving potash the plant begins to ripen early, the leaves turn yellow and become flaccid, so that in October these plots may be seen outlined from the rest by their lighter tint.

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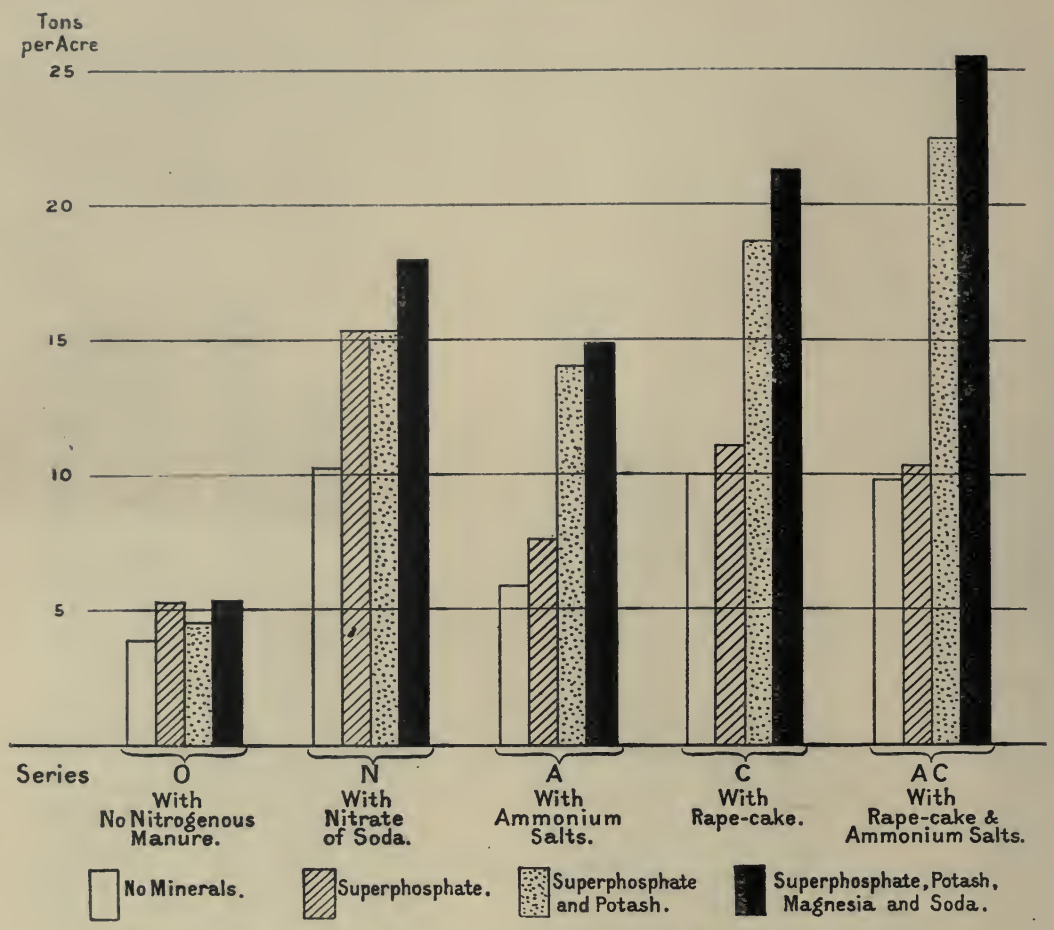

FIG. 4.—Mangolds. Effect of various Mineral Manures. Average Produce of Roots per acre, 1876-1902.

Effect of Artificial Manures with Dung.

A comparison of Strip 2 with Strip 1 shows the effect of adding superphosphate and sulphate of potash to the dung and nitrogenous manures applied to Strip 1. A heavier crop and a healthier plant is obtained, especially where a large amount of nitrogenous manure is used. Since in the earlier experiments it was found that superphosphate had no beneficial effect when used with dung, we can put down the superiority of Strip 2 over Strip 1 to the sulphate of potash which is now used.

Effect of Manures upon the Texture of the Soil.

On the strong Rothamsted soil several of the manures employed have an injurious action upon the texture of the soil and often prevent a satisfactory tilth being obtained in the spring, to the great injury of the crop. This is particularly seen where no organic manure is used; both dung and rape cake tend to keep the land in good condition. Of the artificial manures nitrate of soda and sulphate of potash have the worst effect upon the land, making it very sticky when wet, and hard and caked when dry. Superphosphate on the contrary promotes a friable tilth.

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