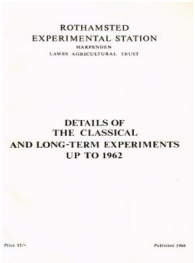
Details of the Classical and Long-term Experiments Up to 1962



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Classical Experiments

Rothamsted Research

Rothamsted Research (1966) *Classical Experiments ;* Details Of The Classical And Long-Term Experiments Up To 1962, pp 5 - 35 **- DOI: https://doi.org/10.23637/ERADOC-1-191**

BROADBALK WHEAT, 1843 ONWARDS

The first experimental crop was harvested in 1844 after a rotation of turnips (dunged) 1839, barley 1840, peas 1841, wheat 1842, oats 1843, the last four crops being entirely unmanured. Wheat has been grown experimentally every year since. The manurial treatments varied somewhat in the first eight years, but the experiment attained its permanent form in 1852. Most of the treatments, with certain exceptions noted below, have been applied to their respective plots year after year since that year.

Table 1. Manures applied per acre since 1852 unless otherwise stated

Plot Number	Treatment D tons	P P_2O_5 lb (1)	K K_2O lb (2)	Na lb (2)	Mg lb (2)	N N lb (3)	N′ N lb	R N lb	Notes
2A	14	-	-	-	-	-	-	-	(4)
2B	14	-	-	-	-	-	-	-	
3	-	-	-	-	-	-	-	-	(5)
5	-	65	98	100	100	-	-	-	
6	-	65	98	100	100	43(N_1)	-	-	
7	-	65	98	100	100	86(N_2)	-	-	
8	-	65	98	100	100	129(N_3)	-	-	
9	-	65	98	100	100	-	43(N'_1)	-	(6)
10	-	-	-	-	-	86	-	-	
11	-	65	-	-	-	86	-	-	
12	-	65	-	366	-	86	-	-	
13	-	65	98	-	-	86	-	-	
14	-	65	-	-	280	86	-	-	
15	-	65	98	100	100	86(N_2^+)	-	-	(9)
16	-	65	98	100	100	-	86(N'_2)	-	(7)
17	as plot 5 in odd years, as plot 10 in even years								
18	as plot 10 in odd years, as plot 5 in even years								
19	-	-	-	-	-	-	-	86	(10)
20	-	-	98	100	100	86	-	-	(11)

Plot sizes vary (8) but are approximately as follows:-
Full sections in fallowing cycle 0.10 acres, half sections 0.05 (approximately). Continuous wheat 0.028 acres.

Treatments: D: farmyard manure. P: superphosphate. K: sulphate of potash. Na: sulphate of soda. Mg: sulphate of magnesia. N. sulphate of ammonia. N′: nitrate of soda. R: castor meal.

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BROADBALK

Notes:

(1) Until 1888 superphosphate was made from 200 lb. bone ash and 150 lb. sulphuric acid; from 1889-1897 it was made from mineral phosphate; from 1898-1902 basic slag was used in place of superphosphate.

(2) Until 1858 the dressing of sulphate of potash provided 147 lb. K_2O and the sulphate of soda was applied at 200 lb. per acre. On plot 12 the sulphate of soda was 550 lb. and on plot 14 the sulphate of magnesia was 420 lb.

(3) Until 1916 those plots which now receive sulphate of ammonia had a mixture of equal parts of ammonium sulphate and ammonium chloride (the "ammonium salts" of the early reports). The ammonium salts were all applied in autumn till 1877, they were all applied in spring till 1883. In 1884 the present method was adopted of giving 21 lb. N in the autumn and the remainder in spring. Except for the short period 1873-1877 plot 15 has always had the whole of its nitrogen in autumn.

(4) Since 1885.

(5) Since 1840.

(6) Plot 9 tested nitrate of soda at various rates (usually 550 lb.) with or without minerals since 1852-1893.

(7) Since 1884. Plot 16 received 800 lb. ammonium salts with "minerals" as on plot 5 from 1852-1864. It was then unmanured from 1865-1883.

(8) The original plots consisted of 2 "lands" each of $\frac{1}{4}$ acre side by side. In the early days these lands sometimes carried different, but related, treatments. In 1894 the pairs of lands were thrown together to give $\frac{1}{2}$ acre plots each carrying a single treatment. It was these plots that were divided transversely into 5 equal sections in 1926.

(9) All in autumn.

(10) Castor meal since 1941, previously rape cake. From 1852-1878 the quantity of rape cake was 500 lb. in addition to superphosphate and ammonium salts. In 1879 the minerals were stopped and the rape cake dressing was increased to provide about 86 lb. N.

(11) Since 1906.

For more detailed description of the materials used and minor changes in procedure see Imp. Bur. Soil Sci. Tech. Commun. No. 40, (1940) pp. 162-163. Also Memoranda of the Field Experiments 1901, pp. 30-31; and J. agric. Sci. (1921), 11, 107.

Weeds have always been a serious problem on Broadbalk and in spite of regular hand-weeding and inter-row cultivation occasional bare fallows had to be given. The following is a record of the bare fallows and other cleaning operations:-

1889	The wheat on one half of the field was drilled in wide rows (about 16") to allow thorough inter-row cultivation.
1890	Same operation on the other half.
1904	Each plot was divided into halves longitudinally one half being cropped and the other bare fallowed.
1905	Strips reversed.
1906-1925	Crop grown on 12" rows to enable inter-row cultivation to be carried out.
1914	All the Western half bare fallowed.
1915	All the Eastern half fallowed.

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1926 The field was divided transversely into five sections.
1926, 1927 Sections I, II, III bare fallowed.
1928, 1929 Sections III, IV, V bare fallowed.

The whole field was cropped in 1930 and in 1931 a regular system of fallowing was started: the five sections being fallowed in turn, each section carrying four wheat crops in succession and then having one year's rest with sufficient summer cultivation to keep down weeds.

In 1956 Section I was divided into two: Ia nearest the farm was assigned to continuous wheat with weedkillers as required but no fallows, while Ib continued in the 5-year cycle. The situation in the years 1951-1961 inclusive is given in tabular form below.

System of Cropping and Fallowing

	Ia	Ib	II	III	IV	V
1951	F	F	4	1	2	3
1952	1	1	F	2	3	4
1953	2	2	1	3	4	F
1954	3	3	2	4	F	1
1955	4	4	3	F	1	2
1956	5	F	4	1	2	3
1957	6	1	F	2	3	4
1958	7	2	1	3	4	F
1959	8	3	2	4	F	1
1960	9	4	3	F	1	2
1961	10	F	4	1	2	3

1, 2, 3, 4.. . . . first, second, third, fourth . . . . crop after fallow (F).

Section Ia in cycle till 1955, then continuous cropping. The crop in Ia in 1956 is actually the 5th continuous crop on this land.

Wild oats (Avena ludoviciana) have been hand-pulled on Broadbalk regularly since 1943. For a summary of the results of the first 4 fallowing cycles, 1935-1954, see Rep. Rothamst. Exp. Sta. for 1955, pp. 161-165.

In recent years it was known that parts of Broadbalk were becoming acid. The acidity was partly due to position in the field but it mainly arose out of the continued use of ammonium salts and rape cake (now castor meal). In autumn 1954 a liming scheme was begun as follows:-

Yearly dressings:

(a) On plots receiving sulphate of ammonia, 100 lb. calcium carbonate per 14 lb. N as sulphate of ammonia.
(b) On plot receiving castor meal, 50 lb. calcium carbonate per 14 lb. N as castor meal.

In the first year the dressings of chalk on the ammonium sulphate and castor meal plots were applied at double the prescribed rates. Section V was divided transversely into two equal parts a and b which are harvested separately. Section Vb, nearest the drain, received a single corrective dressing of 5 tons of calcium carbonate per acre.

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BROADBALK

For details of the liming on Broadbalk see Rep. Rothamst. exp. Sta. for 1954, pp. 146-148.

Harvesting: Until 1900 by hand; 1901-1956 by binder; commencing in 1957 the plots were harvested by combine harvester, one combine cut per plot being weighed. Straw weights are taken after baling but some of the chaff, small cavings and dust is left on the plots.

Weedkillers: On Section Ia only, 1957 MCPA, 1958 mecoprop, 1959 2,3,6 - TBA/MCPA mixture, 1960 mecoprop, 1961 and 1962 2,3,6 - TBA/MCPA. Also, to stubble in autumn 1959, 2, 4-D.

Variety: Squarehead's Master since 1900. Previously Old Red Lammas 1844-1848, Old Red Cluster 1849-1852, Red Rostock 1853-1881, Red Club 1882-1899.

Results: Russell, E.J. & Watson, D.J. (1940). The Rothamsted experiments on the growth of wheat. Imp. Bur. Soil Sci. Tech. Comm. No. 40.

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Table 2

WHEAT - BROADBALK
Grain: cwt per acre
5 year means

years after fallow	Plot	Treatment Symbols	1935 - 39				1940 - 44				1945 - 49				1950 - 54				1955 - 59				Mean 1935 - 59				I A 1955-59
			1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	
	2A	D	20.6	14.6	15.4	13.7	25.8	22.4	19.8	15.0	27.3	21.7	20.1	17.5	26.9	21.4	21.8	21.3	27.2	23.4	21.1	20.0	25.5	20.7	19.6	17.5	19.8
	2B	D	21.2	18.5	16.3	14.9	26.9	24.1	24.5	19.4	28.3	25.1	21.6	18.9	26.4	22.8	22.4	23.2	27.8	24.8	22.7	22.8	26.2	23.1	21.5	19.9	20.2
	3	O	12.5	6.4	7.1	7.1	19.0	10.0	10.6	10.6	16.5	10.2	8.0	7.9	16.4	9.4	9.1	9.0	17.3	10.4	11.0	11.0	16.3	9.3	9.2	9.1	12.0
	5	PKNaMg	16.3	9.5	7.9	7.5	21.4	10.1	11.7	11.6	20.3	10.5	9.5	10.1	17.8	11.0	9.0	11.9	18.4	10.5	11.2	13.6	18.8	10.3	9.8	10.9	15.4
	6	N_1PKNaMg	19.4	11.9	10.0	10.9	24.3	14.3	15.2	15.3	23.1	14.1	11.4	11.4	21.3	15.1	12.7	14.2	22.0	15.3	14.7	16.8	22.0	14.2	12.8	13.7	16.6
	7	N_2PKNaMg	19.9	15.8	14.2	14.0	27.7	20.7	21.7	21.3	26.1	19.0	14.7	16.1	22.8	19.5	17.6	17.7	23.0	22.0	19.1	19.9	23.9	19.4	17.5	17.8	20.3
	8	N_3PKNaMg	20.7	18.5	15.8	14.9	27.2	22.9	22.9	23.4	27.0	24.1	20.4	19.3	24.2	23.0	20.8	22.6	26.1	25.0	21.1	21.0	25.1	22.7	20.2	20.2	21.8
	9	N_1PKNaMg	19.2	13.6	11.5	12.3	25.4	17.3	16.5	18.4	21.7	15.8	12.6	12.7	20.5	16.1	15.9	16.1	22.9	18.4	17.5	15.5	21.9	16.2	14.8	15.0	15.8
	10	N_2	14.5	16.2	12.6	12.4	18.4	19.9	17.3	17.2	17.3	18.8	13.1	11.8	18.4	19.6	16.9	16.1	17.1	17.5	14.8	15.7	17.1	18.4	14.9	14.6	16.5
	11	N_2P	14.5	13.6	11.9	10.9	20.5	19.0	16.5	16.3	16.1	16.9	14.3	13.1	17.5	17.5	16.9	16.1	16.9	19.9	15.6	15.1	17.1	17.4	15.0	14.3	18.6
	12	N_2PNa	16.1	15.1	12.9	13.3	24.8	20.1	20.3	20.0	19.7	18.6	15.0	14.9	20.4	20.1	18.1	17.6	17.9	20.1	17.3	17.3	19.8	18.8	16.7	16.6	21.1
	13	N_2PK	19.4	14.8	13.3	14.4	28.3	19.3	19.1	19.4	26.0	18.3	14.6	14.3	23.6	19.5	17.0	17.5	23.3	20.4	18.6	18.5	24.1	18.4	16.5	16.8	19.3
	14	N_2PMg	16.3	15.5	13.0	13.9	26.5	19.8	19.4	19.2	20.7	21.2	16.1	15.1	22.3	18.5	19.0	17.1	18.8	20.0	16.8	17.0	20.9	19.0	16.8	16.5	20.7
	15	N_2^+PKNaMg	18.8	14.4	12.9	14.0	26.4	17.9	18.3	19.3	23.3	16.6	14.5	14.4	24.6	15.6	14.9	15.0	22.6	16.2	15.3	16.4	23.1	16.1	15.2	15.8	17.8
	16	N_2^-PKNaMg	20.0	17.3	15.5	15.5	29.6	23.5	24.2	23.4	26.2	21.5	18.3	18.3	24.4	22.8	20.5	20.9	24.7	23.7	22.6	22.1	25.0	21.7	20.2	20.0	21.2
	17 & 18C*	PKNaMg	15.2	8.1	6.4	7.5	22.4	9.5	8.6	9.2	17.8	9.1	7.2	6.8	19.8	10.6	8.2	6.6	17.3	10.0	9.0	8.9	18.5	9.4	7.9	7.8	8.7
	17 & 18N_2*	N_2	18.0	14.9	14.7	14.8	27.2	20.1	21.2	21.0	22.4	16.8	16.7	17.5	23.7	19.0	17.3	19.0	24.6	16.9	19.2	20.6	23.2	17.5	17.8	18.6	19.1
	19	R	19.1	15.2	12.5	13.3	28.3	19.3	17.7	18.0	22.5	18.1	15.2	15.3	20.5	16.8	14.2	15.5	21.9	16.4	13.9	16.3	22.5	17.2	14.7	15.7	16.8
	20§	N_2KNaMg	20.4	20.3	9.7	7.0	23.6	20.3	17.2	17.3	11.8	20.4	14.9	13.2	19.0	21.1	14.1	16.4	23.6	15.6	17.2	13.4	19.7	19.6	14.6	13.4	16.4

* treatments in alternate years

§ Means of 2 years only per cycle

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HOOSFIELD BARLEY

1852 ONWARDS

Before the experiment started the land carried turnips (dung and superphosphate) 1847, barley 1848, clover 1849, wheat 1850, barley (ammonium salts) 1851. The first experimental crop was harvested in 1852, and with the exception of 1912, 1933, and 1943, when the plots were bare fallowed, barley has been grown every year since. The manurial treatments are:

Table 3

Manures per acre 1852 onwards unless otherwise stated

Plot Number	Treatment D tons	P P_2O_5 lb. (1)	K K_2O lb. (2)	Na lb. (2)	Mg lb.	Si lb. (5)	N lb. N (3)	N lb. N (4)	R lb. N (6)	Notes
1.0	-	-	-	-	-	-	-	-	-	
2.0	-	65	-	-	-	-	-	-	-	
3.0	-	-	98	100	100	-	-	-	-	
4.0	-	65	98	100	100	-	-	-	-	(7)
5.0	-	65	98	-	-	-	-	-	-	
1A	-	-	-	-	-	-	43	-	-	
2A	-	65	-	-	-	-	43	-	-	
3A	-	-	98	100	100	-	43	-	-	
4A	-	65	98	100	100	-	43	-	-	
1AA	-	-	-	-	-	-	-	43	-	
2AA	-	65	-	-	-	-	-	43	-	
3AA	-	-	98	100	100	-	-	43	-	
4AA	-	65	98	100	100	-	-	43	-	
1AAS	-	-	-	-	-	400	-	43	-	
2AAS	-	65	-	-	-	400	-	43	-	
3AAS	-	-	98	100	100	400	-	43	-	
4AAS	-	65	98	100	100	400	-	43	-	
1C	-	-	-	-	-	-	-	-	43	
2C	-	65	-	-	-	-	-	-	43	
3C	-	-	98	100	100	-	-	-	43	
4C	-	65	98	100	100	-	-	-	43	
7-1	-	-	-	-	-	-	-	-	-	(8)
7-2	14	-	-	-	-	-	-	-	-	
6-1	-	-	-	-	-	-	-	-	-	
6-2	-	-	-	-	-	-	-	-	-	(9)
1N	-	-	-	-	-	-	-	43	-	(10)
2N	-	-	-	-	-	-	-	43	-	(11)

Plot areas: Mostly 0.18 acres, none less than 0.09 acres.

Treatments: D: farmyard manure. P: superphosphate. K: sulphate of potash. Na: sulphate of soda. Mg: sulphate of magnesia. Si: silicate of soda. N: sulphate of ammonia. N´:nitrate of soda. R: castor meal.

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Notes:
(1) Until 1887 made from 200 lb. bone ash and 150 lb. sulphuric acid. 1888-1897 from rock phosphate. 1898-1902 basic slag.
(2) From 1852-1857 the K_2O was 147 lb. and the sulphate of soda 200 lb. per acre.
(3) Until 1916 the ammonium salts were equal parts of ammonium sulphate and chloride. From 1917 onwards only ammonium sulphate has been used.
(4) The nitrate of soda treatment in the AA and AAS series started in 1868. Originally ammonium salts at 86 lb. N 1852-1857; the dressing of ammonium salts was halved from 1858-1867.
(5) Silicate at 200 lb. sodium silicate and 200 lb. calcium silicate per acre was first applied in 1862: since 1868 400 lb. sodium silicate was given.
(6) 2000 lb. rape cake per acre until 1857, 1000 lb. until 1940, 1000 lb. castor meal 1941-1954; since 1955 the castor meal was adjusted to supply 43 lb. N per acre.
(7) Ammonium salts also in 1852 only.
(8) 1852-1871 14 tons dung.
(9) Until 1932 this plot received ashes from the laboratory furnace, subsequently no manure of any kind has been given.
(10) In 1852 plots 1N and 2N had 65 lb. P_2O_5 and 147 lb. K_2O but no nitrogen; the nitrate of soda treatment began in 1853.
(11) 86 lb. N 1853-1857.

Variety: From 1917 onwards the variety has been Plumage Archer. Previously Chevalier 1852-1880, Archers Stiff Straw 1881-1890, Carters Paris Prize 1891-1897, Archers Stiff Straw 1898-1916. In 1929-1932 the plots were drilled in 18" rows to allow inter-row cultivation. Alternate strips of Plumage Archer and Spratt Archer were compared during this period.

Weed Control: Commencing in 1944 the barley was sprayed with DNOC until 1956; since 1957 various selective weedkillers have been used. 1958 and 1959 the stubble was sprayed in autumn with 2,4-D to check coltsfoot (Tussilago farfara).

Plot areas were reduced by pre-harvest cuts in 1948, 1952, 1954, and 1955 to control wild oats (Avena fatua) which were hand pulled in the reduced area taken for yield. In 1953 the wild oats were so bad that the whole field was cut green and the produce removed.

Liming: In winter 1954-1955 5 tons of chalk per acre were applied to Strips 3 and 4 including plots 5A and 5.0. Regular chalk supplements to all plots receiving sulphate of ammonia and castor meal were prescribed at the rate of 100 lb. $CaCO_3$ per 14 lb. N as ammonium sulphate and 50 lb. $CaCO_3$ per 14 lb. N as castor meal. These supplements are given every 5 years at a rate corresponding to all the sulphate of ammonia and castor meal used over this period. The first dressing was applied in spring 1955. See Rep. Rothamst. exp. Sta. for 1954, pp. 146-148.

Harvesting: Commencing in 1958 the plots were harvested by combine harvester.

For further information on manurial dressings see Memoranda of the Field Experiments 1901, pp. 26-27.

Results: Russell, E.J. & Watson, D.J. (1938). The Rothamsted field experiment on barley 1852-1937. Part I Emp. J. exp. Agric. 6, 268-314; Part II Ibid. 7, 193-220.

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Table 4 BARLEY - HOOSFIELD 1852-1962

10-Year Means
Grain: cwt per acre

Plot	Treatment	1852-1861	1862-1871	1872-1881	1882-1891	1892-1901	1902-1911	(1) 1912-1921	1922-1931	(2) 1932-1941	(3) 1942-1951	(4) 1952-1961	Means 1852-1962 Grain cwt.per acre	Straw cwt.per acre	No. of years
1.0	O	11.4	8.8	6.8	6.2	5.3	5.2	6.5	3.7	6.9	9.3	7.4	7.0	7.9	107
2.0	P	13.9	11.8	9.0	9.6	7.1	9.3	10.2	6.7	11.6	11.7	10.6	10.1	9.8	107
3.0	KNaMg	12.5	10.2	7.8	6.0	4.8	5.5	7.5	3.8	9.0	11.7	7.6	7.8	9.0	107
4.0	PKNaMg	15.3	12.4	8.8	8.2	6.6	8.4	10.9	6.4	13.5	15.8	10.9	10.6	11.7	107
5.0	PK	12.3(a)	10.9	7.5	7.4	6.2	6.9	7.3	4.8	10.9	15.0	8.9	9.0	10.2	106
1A	N	17.0	15.8	13.2	12.0	8.8	10.7	11.2	5.4	10.4	11.5	10.8	11.6	13.2	107
2A	NP	22.9	24.7	20.4	18.0	15.5	16.1	16.2	11.8	18.8	15.9	16.8	17.9	19.4	107
3A	NKNaMg	17.8	17.8	15.0	12.4	11.8	11.0	11.3	6.0	13.2	14.4	13.4	13.1	15.9	107
4A	NPKNaMg	23.2	23.8	20.9	20.0	18.0	20.1	18.2	13.1	20.9	17.8	18.9	19.6	22.3	107
5A	NPK	21.7	23.1	19.8	15.0	14.1	15.2	16.1	10.9	19.5	14.2	19.8	17.2	21.9	106
1AA	N'		16.0	14.2	14.0	11.6	12.6	12.3	7.1	12.1	13.0	12.9	15.8	15.6	91
2AA	N'P		24.0	21.1	21.0	19.4	20.3	19.7	14.7	22.0	18.5	20.2	24.3	22.5	91
3AA	N'NaMg		16.5(d)	15.1	14.2	12.8	11.6	12.1	6.3	14.4	15.9	13.9	16.5	16.8	91
4AA	N'NaMg		24.0	21.6	20.1	18.5	19.8	18.9	13.3	21.8	21.4	19.9	24.1	22.8	91
1AAS	N'Si		18.7	17.7	17.1	16.0	14.9	14.9	8.6	16.4	16.1	17.0	16.4	18.4	91
2AAS	N'PSi		24.6(d)	22.3	22.2	20.3	19.5	19.7	14.9	21.4	20.4	22.9	21.7	23.4	91
3AAS	N'KNaMgSi		21.5	19.4	17.5	16.7	15.5	14.2	8.4	16.7	17.3	18.3	17.2	19.8	91
4AAS	N'PKNaMgSi		25.5	23.6	22.1	20.2	21.4	17.9	14.1	23.1	22.5	23.3	22.3	24.6	91
1C	R	23.4	22.5	19.8	17.5	16.0	17.5	13.5	11.4	18.4	15.6	17.2	17.6	19.9	107
2C	RP	23.9	23.7	21.2	19.1	17.1	18.3	14.6	14.8	21.3	20.9	19.5	19.5	21.4	107
3C	RKNaMg	22.1	22.4	19.0	16.8	15.1	17.4	12.2	10.0	17.6	21.1	17.0	17.4	20.1	107
4C	RPKNaMg	23.8	24.4	21.3	17.8	16.6	19.9	13.0	14.0	21.6	23.7	20.0	19.7	22.4	107
7-1	D until 1871			17.4	13.0	10.6	9.7	11.0	7.0	13.4	15.1	11.7	12.1	13.7	87
7-2	D	22.7	26.7	25.7	23.7	22.9	23.6	18.6	15.0	26.1	26.7	28.0	23.6	28.6	107
6-1	O	12.6	9.6	6.9	7.7	5.6	5.4	8.2	3.4	8.7	10.3	6.9	7.7	8.8	107
6-2	Ashes until 1932	12.1	10.2	7.7	8.2	6.1	7.1	9.9	4.4	8.9	9.8	8.7	8.4	9.4	107
1N	N'	19.0(b)	18.8	15.6	15.6	14.1	13.5	11.5	6.2	14.1	14.6	12.1	14.1	17.3	106
2N	N'	18.0(c)	20.5	17.9	17.0	16.8	16.8	14.8	9.4	17.5	18.1	15.9	17.7	19.4	101

(1) Omitting 1912 all plots fallowed (a) omitting 1852
(2) " 1933 " " " (b) " "
(3) " 1943 " " " (c) " "
(4) " 1953 No yields recorded (d) " 1852-1857
1852-1867 (plots 1AA, 2AA, 3AA, 4AA. 1AAS, 2AAS, 3AAS, 4AAS)
(e) " 1954 No yield recorded.

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ALTERNATE WHEAT AND FALLOW, HOOSFIELD 1856 ONWARDS

Two half-acre strips side by side, one carrying wheat while the other lies fallow these treatments alternating on their respective plots. No manure has been given since 1851. The varieties grown have been the same as those grown on Broadbalk. Squareheads Master since 1900.

In 1932 a modification was made to enable the effect of a 1-year fallow to be compared with that of a 3-year fallow. The strips were divided transversely into four equal sections. When a strip carries wheat only three of the four sections are cropped, the fourth section being left fallow. Each of the eight sections has the triple fallow in turn. The sequence in the 8-year cycle is as follows:-

	Strip A				Strip B			
	A_1	A_2	A_3	A_4	B_1	B_2	B_3	B_4
1956	F	C	C	C	F	F	F	F
1957	F	F	F	F	C	C	F	C
1958	C	F	C	C	F	F	F	F
1959	F	F	F	F	C	C	C	F
1960	C	C	F	C	F	F	F	F
1961	F	F	F	F	F	C	C	C
1962	C	C	C	F	F	F	F	F
1963	F	F	F	F	C	F	C	C

(F = Fallow C = Crop)

In autumn 1956 the strips were divided into halves longitudinally. The centre two halves carried on the 8-year cycle as before on plots of half the former width. The outer two strips were assigned to the Entomology Department for field studies on wheat bulb fly, the factors studied being plant density and various sequences of wheat and fallow. No fertilisers are used. All plots have been combine harvested since 1957.

Plot area for fallow effects 1956 onwards: 0.063 acres approximately.

For an account of the long-period results of the Wheat and Fallow experiment see Rep. Rothamst. exp. Sta. for 1956, 184-187. The yearly yields over the period 1851-1900 are given in Memoranda of the Field Experiments 1901, 32.

Table 5

Wheat after Fallow - Hoosfield
8-year means

	Grain cwt per acre. years of fallow		Straw cwt per acre. years of fallow	
	1	3	1	3
1934-1941	9.7	10.6	14.1	16.8
1942-1949	11.6	12.9	18.4	20.9
1950-1957	9.7	10.6	*14.5	*15.5
1934-1957	10.3	11.4	15.7+	17.4+

*Not recorded in 1957 mean of 7 years
+Mean of 23 years

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AGDELL,
4-COURSE ROTATIONS, 1848-1951

The experiment compared two 4-course rotations:-
Plots 2, 4, 6: Turnips, barley, red clover (or beans), wheat.
Plots 1, 3, 5: Turnips, barley, bare fallow, wheat.
The manures were applied to the turnips only at the following rates per acre:-

Table 6

1848 to 1948 unless otherwise stated.

Plot Number	Treatment P P_2O_5 lb.	K K_2O lb.	Na lb.	Mg lb.	N N lb.	R lb.
	(1)	(2)	(2)	(2)	(3)	(4)
5; 6	-	-	-	-	-	-
3; 4	85	245	100	200	-	-
1; 2	85	245	100	200	43	2000

Treatments. P: superphosphate. K: sulphate of potash. Na:sulphate of soda. Mg: sulphate of magnesia. N: sulphate of ammonia. R: castor meal.

Notes:
(1) Until 1884 made from 200 lb. bone ash and 150 lb. sulphuric acid supplying about 65 lb. P_2O_5 per acre. 1888-1892 ordinary superphosphate 68 lb. P_2O_5. 1896-1900 basic slag 108 lb. P_2O_5.
(2) Until 1892 the rates were 147 lb. K_2O, 200 lb. sulphate of soda, 100 lb. sulphate of magnesia.
(3) Until 1912 a mixture of ammonium sulphate and ammonium chloride.
(4) Until 1936 rape cake. The rape cake and castor meal each provided about 100 lb. N per acre.

The above arrangement gave 6 main plots each of 0.4 acres, but these were further subdivided to show the effect of carting the roots and leaves of the turnip crop off the land as compared with feeding them off by sheep or ploughing them in. This comparison was discontinued after the root crop of 1900; all roots and leaves have since been carted off.

Clover was grown in 16 seasons, and was replaced by beans in 10 seasons.

Varieties: Swedes: Since 1932 Bruce; previously several varieties had been grown for short periods only. In 1944 14 varieties of turnips and swedes were compared for resistance to club-root.

Barley: Plumage Archer since 1917, previously Chevalier and Archer Stiff Straw.

Wheat: Squarehead's Master since 1903 (Little Joss 1911), previously Red Rostock and Red Club. In 1947 winter wheat failed and was replaced by spring wheat, Atle.

Club-root (Plasmodiophora brassicae) was first mentioned as causing serious damage to the turnip crop in 1920, thereafter the yields declined rapidly and by 1948 the crop was not fit to weigh.

After the end of the 26th rotation in 1951 the experiment ended but cropping continued to measure the residual effects of the phosphate and potash applied to the root crop since 1848. Uniform

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dressings of nitrogenous fertiliser were given to all plots according to the needs of the crops. The cropping has been:-

1952 Bare fallow.
1953 Barley, Plumage Archer, unmanured.
1954 Barley, Plumage Archer, 1.0 cwt. N, divided dressing.
1955 Spring wheat, Koga II, 0.6 cwt. N.
1956 Winter beans, S.Q. Giant, unmanured.
1957 Potatoes, Ulster Supreme, 1.0 cwt. N.
1958 Italian Ryegrass S22. The original 6 plots were divided; one half of each was sown with ryegrass, the other was bare fallowed. The ryegrass was cut twice and 0.8 cwt. N per acre was applied for each cut.
1959 2nd year Italian Ryegrass; 3.2 cwt. N in four dressings. Fallow plots sown with strips of potatoes, sugar beet, barley, each crop testing 0.0; 0.25; 1.0 cwt. P_2O_5 as superphosphate.
1960 Cocksfoot S37 after Italian Ryegrass; 0.8 cwt. N for each cut. Rotation of potatoes, sugar beet, barley continued testing direct application 0.0; 0.25; 1.0; 1.5 cwt. P_2O_5.
1961 Second year cocksfoot; 0.8 cwt. N for each cut. Plots 1, 3, 5 only: crops in rotation, testing superphosphate as follows:- None; 0.75; 1.50 cwt. P_2O_5 either ploughed in or in seedbed; also 0.75 cwt. ploughed in plus 0.75 cwt. in seedbed.
1962 Third year cocksfoot; 0.8 cwt. N for each cut. Plots 2, 4, 6 only: treatments and cropping as in 1961 on plots 1, 3, 5.

Liming: In 1954 the plots were limed with ground chalk at the following rates in tons calcium carbonate per acre:- Plot 1 3 tons; plot 2 4 tons; plot 3 (part only) 0.5 tons; plot 4 parts at 0.5, 1.0 and 1.5 tons. See Rep. Rothamst. exp. Sta. for 1954, pp. 146-148.

For further details of the early years of the experiment and yearly yields see Memoranda of the Field Experiments 1901, 110-121.

For residual effects of the manures see Warren, R.G. (1957). Rep. Rothamst. exp. Sta. for 1957, 252-260.

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Table 7

CROPS IN ROTATION - AGDELL

1848 - 1919

Manure to turnips until 1948	None since 1848		Mineral manure* No Nitrogen		Mineral* and nitrogenous manure+	
Plot	5	6	3	4	1	2
Rotation	Fallow	Clover	Fallow	Clover	Fallow	Clover
Swedes, roots: tons per acre	1.7	0.6	8.8	9.6	18.0	15.9
Barley, grain: cwt per acre	11.4	10.8	12.0	12.0	16.4	18.4
Beans, grain: cwt per acre	-	7.7	-	10.7	-	13.1
Clover, hay: cwt per acre	-	30.7	-	58.6	-	60.2
Wheat, grain: cwt per acre	13.8	12.8	16.3	17.7	16.9	17.8

1920 - 1953

Manure to turnips until 1948	None since 1848		Mineral manure* No Nitrogen		Mineral* and nitrogenous manure+	
Plot	5	6	3	4	1	2
Rotation	Fallow	Clover	Fallow	Clover	Fallow	Clover
(1) Swedes, roots: tons per acre	1.00	0.35	7.69	10.84	13.88	6.99
(2) Turnips, roots: tons per acre	0.72	0.23	3.27	3.78	5.19	4.03
(3) Barley, grain: cwt per acre	7.7	6.5	11.1	14.5	10.8	10.7
(4) Clover, hay: cwt per acre	-	8.6	-	30.2	-	25.2
(5) Wheat, grain: cwt per acre	13.3	11.6	16.6	17.1	14.0	16.0

*P, K, N_a, Mg.

+Rape dust (or castor meal + sulphate of ammonia)

(1) Mean of 2 years 1920 and 1928
(2) Mean of 4 years 1924, 1932, 1936 and 1940
(3) Mean of 8 years 1921, 1925, 1929, 1933, 1941, 1945, 1949 and 1953
(4) Mean of 4 years 1922, 1926, 1930, 1938
(5) Mean of 7 years 1923, 1927, 1935, 1939, 1943, 1947, 1951

1937 Barley 1931 Wheat excluded crop failed

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BARNFIELD, MANGOLDS, 1876-1959
(WITH SUGAR BEET ALSO SINCE 1946)

The previous experimental crops on the Barnfield plots were:- white turnips 1843-1848, swedes 1849-1852, barley 1853-1855, swedes 1856-1870, sugar beet 1871-1875. The layout of the field and the manures applied for these crops were similar to those adopted for the mangolds, but there were some important changes. For details of dressings and yields obtained in these early years see Memoranda of the Field Experiments 1901, pp. 56-63. For the complete history of cropping and manuring 1843-1959 see Rep. Rothamst. exp. Sta. for 1961, p. 227.

The field is manured on a cross dressing system: the "mineral" manures P, K, Na, Mg are laid in various combinations on strips running North and South, the various nitrogenous manures are applied across these strips at right angles. The strips are (1) dung, (2) dung + PK, (4) PKNaMg, (5) P, (6) PK, (7) P Na Mg, (8) no minerals. The nitrogen cross dressings are 0: no nitrogen, N: nitrate of soda, A: sulphate of ammonia, AC: sulphate of ammonia and castor meal, C: castor meal. The actual rates of manuring are given in Table 8 below:

Table 8

Strip Manures applied annually since 1876 unless otherwise stated. Dung (D), superphosphate (P), sulphate of potash (K), agricultural salt (Na), sulphate of magnesia (Mg) per acre.

	Treatment					
Strip	D tons	P P_2O_5 lb. (1)	K K_2O lb.	Na lb.	Mg lb.	Notes
1	14	-	-	-	-	
2	14	65	245	-	-	(2)
4	-	65	245	200	200	(4)
5	-	65	-	-	-	
6	-	65	245	-	-	
7	-	65	-	200	200	(3)
8	-	-	-	-	-	

Cross Dressings (nitrogenous) per acre

Series	Nitrate of soda N lb.	Sulphate of ammonia N lb.	Castor meal N lb.	Notes
O	-	-	-	
N	86	-	-	(4)
A	-	86	-	(5)
AC	-	86	86	(6)
C	-	-	86	(6)

Plot 9: There are no cross dressings. The manures given since 1903 are sulphate of potash 245 lb. K_2O; agricultural salt 200 lb.; sulphate of magnesia 200 lb.; nitrate of soda 86 lb. N. See note (7).

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BARNFIELD

The individual plots are defined by their strip number and their series letter. Thus plot 5N has superphosphate (65 lb. P_2O_5) and nitrate of soda (86 lb. N).

Notes:

(1) Basic slag was used in place of superphosphate from 1896-1902.
(2) Until 1894 dung and superphosphate.
(3) Until 1902 the whole of strip 7 received 65 lb. P_2O_5 245 lb. K_2O and ammonium salts providing 8 lb. N. The present test of Na and Mg begun in 1903.
(4) In 1903 plot 4N was halved. 4Na carried the original manures; 4Nb received superphosphate 392 lb., calcium chloride 190 lb., potassium nitrate 570 lb., calcium nitrate 100 lb. per acre.
(5) Until 1916 equal parts of ammonium sulphate and chloride. (1887 ammonium sulphate only).
(6) Until 1939 rape cake @ 2000 lb. per acre (none 1917-1920); 1940-1954 2000 lb. castor bean meal; since 1955 86 lb. N as castor bean meal.
(7) 1876-1902 14 tons dung, 65 lb. P_2O_5, 86 lb. N as ammonium salts per acre.

Application of manures: Dung is ploughed in in winter; P, K, Mg, salt and castor bean meal and one third of the sulphate of ammonia and nitrate of soda are applied after the first cultivation but before the seed is drilled. The remaining two-thirds of the nitrogenous fertilisers are applied as a top dressing about the time of singling.

Variety of mangolds: Yellow Globe. Leaves apread on their plots and ploughed in. In 1908 and 1927 swedes were grown when mangolds failed. In 1931 a crop of mixed mangolds and swedes was grown. In 1935 the mangolds failed and the field was bare fallowed.

Since 1946 four rows of sugar beet (Kleinwanzleben E) have been drilled on the East side of every strip except strip 8 which has the sugar beet on the West side. Top weights are estimated from one random row per plot and the tops are spread on their plots and ploughed in except on the 0-series (less dung plots).

Since 1954 a space equal to four rows of mangolds has been kept free from crop along the East side of strip 1. This area receives the same manure as the adjacent cropped area.

In 1955 certain plots badly infested with twitch (Agropyron repens) were divided into two parts, one part being sprayed with sodium trichloroacetate (TCA). In 1956 the other half of these plots was similarly treated.

Chalking: In spring 1956 a corrective dressing of 5 tons of ground chalk per acre was applied to the A and AC series. After the crop had been removed a maintenance dressing was applied to balance the sulphate of ammonia and castor meal given over a 5-year period on series A, AC, and C, the rate being 100 lb. calcium carbonate per 14 lb. N as sulphate of ammonia and 50 lb. calcium carbonate per 14 lb. N as castor meal.

Leaf yields: Since 1942 the leaf yields have been estimated from the produce of two random rows per plot. Since 1954 the yields on the 0 series (except the dung plots) have been calculated from the two sample rows chosen for leaf weights. In 1955 it was decided that owing to the small amount of organic matter contained in the leaves of these plots, these leaves should in future be carted off.

The experiment ended in 1959. The land was fallowed in 1960 in preparation for experiments to study the residues of the former treatments.

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For a summary of Barnfield results up to 1940 see Watson, D. J. & Russell, E. J. (1943-46). The Rothamsted experiments on mangolds 1872-1940.

Part 1. Effect of manures on yield of roots. Emp. J. exp. Agric. 11, 49-64.
Part 2. Effect of manures on the growth of the plant. Ibid. 11, 65-77.
Part 3. Causes of variation of yield. Ibid. 13, 61-79.
Part 4. The composition of the mangold grown on Barnfield (i) The dry matter content of leaves and roots. Ibid. 14, 49-56 (ii) The nitrogen content of leaves and roots. Ibid. 14, 57-70.

See also Kalamkar, R. J. (1933). A statistical examination of the yield of mangolds from Barnfield at Rothamsted. J. agric. Sci. 23, 161-175.

For an account of the yields of mangolds and sugar beet 1941-1959 and analyses of crops and soils from Barnfield see Warren, R. G. and Johnston, A. E. Rep. Rothamst. exp. Sta. for 1961, 227-247.

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Table 9

MANGOLDS, BARNFIELD 1876-1959

Roots: tons per acre, means over 19, 37 and 9 years

Series	O			A			N			C			AC		
	No nitrogen			Ammonium sulphate			Sodium nitrate			Rape cake			Rape cake + Ammonium sulphate		
Strip	1876-94	1904-40	1941-59	1876-94	1904-40	1941-59	1876-94	1904-40	1941-59	1876-94	1904-40	1941-59	1876-94	1904-40	1941-59
8 No P or K	3.8	3.0	1.5	6.0	5.6	5.8	10.2	10.6	8.1	10.2	8.3	8.4	10.1	7.5	8.1
5 P	5.0	4.0	2.2	8.3	6.8	7.4	15.7	16.1	11.7	12.0	9.4	9.8	11.2	8.8	9.3
6 P K	4.5	3.8	2.1	13.7	14.5	11.7	15.5	16.8	12.3	18.0	17.6	14.4	22.1	22.0	18.9
7 P Na Mg	(5.9)	4.0	2.2	(15.0)	16.1	12.2	(15.9)	18.4	12.4	(18.9)	19.2	15.1	(22.0)	21.5	17.0
4 P K Na Mg	5.3	4.2	2.7	15.5	15.5	12.8	18.3	19.0	14.4	20.7	20.7	15.8	25.0	26.4	19.1
1 D	16.8	17.4	8.9	22.1	22.0	18.1	23.2	28.0	20.0	23.6	23.0	17.9	24.5	23.2	19.9
2 D P K*	(17.0)	19.9	11.3	(21.4)	26.9	19.6	(24.2)	29.4	21.7	(23.3)	27.8	20.7	(23.5)	29.4	23.5

* The figures in brackets are means for the period, but the treatments differed from that given later.

Table 10

SUGAR BEET BARNFIELD

Roots and tops: tons per acre, means over 14 years 1946-59

Strip,	Series O		A		N		C		AC	
	No Nitrogen		Ammonium sulphate		Sodium nitrate		Rape cake		Rape cake + ammonium sulphate	
	Tops	Roots	Tops	Roots	Tops	Roots	Tops	Roots	Tops	Roots
8 No P or K	2.0	1.5	4.9	4.2	6.1	5.0	7.5	5.6	9.0	6.4
5 P	2.1	1.9	4.8	5.0	7.4	6.7	6.6	6.9	9.3	7.2
6 PK	1.9	1.6	5.3	6.6	6.6	6.2	6.8	8.2	10.4	9.5
7 P Na Mg	2.1	1.8	6.4	7.2	7.8	7.2	8.4	7.7	11.7	9.0
4 P K Na Mg	2.0	1.8	5.8	7.2	7.5	8.0*	7.5	9.1	10.2	10.3
1 D	5.2	6.2	12.2	11.5	10.6	11.1	10.3	11.4	12.1	11.4
2 D P K	5.5	5.9	9.0	8.6	11.0	9.9	9.8	9.8	11.2	10.3

*Sodium nitrate replaced by a mixture of potassium and calcium nitrates.

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HAY, THE PARK GRASS PLOTS, 1856 ONWARDS

The Park has probably been in grass for some centuries. There is no record of any seed having been sown. The herbage has been cut for hay each year since manurial treatments were first applied in 1856. The management of the aftermath following the first hay cut in each season varied in the early years of the experiment. It was grazed by sheep in the years 1856 to 1872 except for 1866 and 1870. In 1866, 1870, 1873, 1874, 1876, 1884, 1885, 1887 the aftermath was mown but not removed from the plots. In all other years the produce of the second and sometimes third cut has been carted and weighed either as hay or green.

Table 11

Manures applied per acre, 1856 onwards unless otherwise stated.

	Treatment									
Plot	D tons	P P_2O_5 lb. (2)	K K_2O lb. (3)	Na lb. (4)	Mg lb.	Si lb.	N N lb. (1)	N N lb.	F cwt.	Notes
1	-	-	-	-	-	-	43(N_1)	-	-	(5)
2	-	-	-	-	-	-	-	-	-	(6)
3	-	-	-	-	-	-	-	-	-	
4-1	-	65	-	-	-	-	-	-	-	(19)
4-2	-	65	-	-	-	-	86(N_2)	-	-	(19)
5-1	-	-	-	-	-	-	-	-	-	(7)
5-2	-	65	245	-	-	-	-	-	-	(7)
6	-	65	245	100	100	-	-	-	-	(8)(19)
7	-	65	245	100	100	-	-	-	-	
8	-	65	-	100	100	-	-	-	-	(9)(19)
9	-	65	245	100	100	-	86(N_2)	-	-	
10	-	65	-	100	100	-	86(N_2)	-	-	(9)
11-1	-	65	245	100	100	-	129(N_3)	-	-	(10)(19)
11-2	-	65	245	100	100	400	129(N_3)	-	-	(10)(11)
12	-	-	-	-	-	-	-	-	-	
13	14	-	-	-	-	-	-	-	-	(12)
	-	-	-	-	-	-	-	-	6	
14	-	65	245	100	100	-	-	86(N_2)	-	(13)
15	-	65	245	100	100	-	-	-	-	(14)
16	-	65	245	100	100	-	-	43(N_1)	-	(15)
17	-	-	-	-	-	-	-	43(N_1)	-	(15)
18	-	-	245	100	100	-	86(N_2)	-	-	(16)
19	14	-	-	-	-	-	-	-	-	(17)
20	14	-	-	-	-	-	-	-	-	(18)
	-	33	49	-	-	-	-	26(N)	-	

Plot areas: For manuring mostly 0.5 acre and 0.25 acre, a few 0.17 and 0.12 acre. Most plots are divided into halves to test lime.

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Treatments: D: farmyard manure, P: superphosphate, K: sulphate of potash, Na: sulphate of soda, Mg: sulphate of magnesia, Si: silicate of soda, N: sulphate of ammonia, N': nitrate of soda, F: fish guano.

Notes:

(1) Until 1916 the ammonia nitrogen was supplied as a mixture of equal parts of ammonium sulphate and ammonium chloride. Since 1917 only ammonium sulphate was used.
(2) Until 1888 the phosphate was made from 200 lb. bone ash and 100 lb. sulphuric acid per acre, then superphosphate. 1897-1902 basic slag.
(3) Until 1878 the standard dressing of sulphate of potash was 147 lb. K_2O per acre, it was then raised to 245 lb. K_2O.
(4) Until 1863 plots 7, 9, 11-1, 11-2, 13, 14, 16 had 200 lb. sulphate of soda.
(5) Until 1863 14 tons dung also.
(6) Until 1863 14 tons dung only.
(7) After ammonium salts 86 lb. N until 1897.
(8) After ammonium salts 86 lb. N until 1868.
(9) Since 1862 147 lb. K_2O as sulphate of potash; 200 lb. sulphate of soda; 100 lb. sulphate of magnesia; 65 lb. P_2O_5. From 1864-1904 the dressing of sulphate of soda was 250 lb.. (500 lb. 1862-1863).
(10) Until 1881 the ammonium salts were applied at 172 lb. N except in 1859-1861 when the dose was 86 lb.
(11) The silicate dressing began when plot 11 was divided in 1862 and from 1862-1870 equal parts of calcium and sodium silicate were used.
(12) Until 1897 complete fertiliser as plot 9 with 2000 lb. per acre of cut wheat straw in addition. From 1898-1904 as plot 9, no straw. The dung has been applied once every 4 years starting 1905 and the fish meal once every 4 years starting 1907. Since 1959 the fish meal dressing has been standardised at 0.5cwt. N per acre (approximately 6cwt. meal).
(13) Since 1858.
(14) Since 1876. Nitrate of soda 86 lb. N 1858-1875.
(15) Since 1858.
(16) Since 1905. From 1865-1904 P, K, Na, Mg, Si, and N equal to the amounts contained in 1 ton of hay.
(17) Every 4th year since 1905. From 1872-1904 65 lb. P_2O_5; 142 lb. K_2O; and 43 lb. N as nitrate of soda.
(18) Dung every 4th year since 1905, fertilisers in intervening years. From 1872-1904 superphosphate 65 lb. P_2O_5 and potassium nitrate, supplying approximately 43 lb. N and 142 lb. K_2O.
(19) Sawdust at 18cwt. per acre was applied to plots 6, 8, 10 until 1862, and on plot 4 until 1858.

Liming: The first liming was done in 1881, when a strip 11 yards wide on the North side of plots 1-13 received 27cwt. chalk per acre. In 1883-1884 the plots were halved, one half having 18cwt. burnt lime per acre. In 1887-1888 the other halves of the plots were similarly treated. Plots 11-1 and 11-2 received a double dose on these occasions. In 1903 a regular liming scheme was started on the South halves of plots 1 to 4-2, 7 to 11-2, 13, 16. The dressing was 2000 lb. ground lime per acre every 4 years (missing 1911). In 1920 plots 14, 15, and 17 came into this scheme, all dressings being increased by one quarter to allow for the extra year, and plots 18,

https://doi.org/10.23637/ERADOC-1-191

PARK GRASS

Table 12

Hay - The Park Grass Plots, 1920 - 1959

Dry matter; cwt per acre

Plot	Treatment Symbols	1920 - 27 Not Limed 1st crop	1920 - 27 Not Limed Total	1920 - 27 Limed 1st crop	1920 - 27 Limed Total	8-year Means 1928 - 35 Not Limed 1st crop	1928 - 35 Not Limed Total	1928 - 35 Limed 1st crop	1928 - 35 Limed Total	1936 - 43 Not Limed 1st crop	1936 - 43 Not Limed Total	1936 - 43 Limed 1st crop	1936 - 43 Limed Total
1	N_1	13.6	20.9	15.7	21.3	11.7	15.7	15.1	18.4	6.1	10.8	12.4	16.2
2	O	10.3	15.7	12.1	16.2	11.3	14.6	11.6	14.3	7.3	10.6	8.4	11.1
3	O	8.8	12.8	9.6	13.2	9.7	12.4	9.6	11.8	6.5	9.2	7.9	10.6
4-1	P	13.0	17.7	11.8	15.8	13.8	17.1	10.9	12.8	9.4	12.7	8.9	11.7
4-2	N_2P	15.5	19.6	24.4	31.9	14.6	17.5	27.3	31.7	10.6	15.7	21.5	26.2
5-1	O	8.6	12.1	-	-	9.4	12.4	-	-	6.3	9.5	-	-
5-2	PK	15.1	20.9	-	-	15.5	19.9	-	-	12.8	18.3	-	-
6	PKNaMg	20.1	28.0	-	-	20.5	26.0	-	-	18.6	25.5	-	-
7	PKNaMg	20.0	28.2	24.3	31.2	21.8	27.7	27.8	34.6	19.3	28.3	24.3	31.8
8	PNaMg	13.4	19.4	11.3	16.2	15.3	19.9	12.1	16.2	12.8	17.9	10.5	14.6
9	N_2PKNaMg	26.2	35.6	38.7	48.6	32.9	39.9	45.0	52.3	26.2	36.2	33.3	41.8
10	N_2PNaMg	19.7	26.6	29.8	38.6	21.2	26.0	32.5	38.6	14.6	21.6	27.1	34.0
11-1	N_3PKNaMg	31.4	45.4	43.4	55.4	35.2	47.6	47.1	55.8	22.9	40.0	38.1	50.6
11-2	N_3PKNaMgSi	38.7	50.8	44.1	57.2	40.0	53.7	47.8	59.7	30.7	48.7	40.3	55.8
12	O	11.5	15.7	-	-	11.2	14.8	-	-	8.4	13.1	-	-
13	D; F	30.6	39.5	27.5	35.8	34.0	41.8	31.4	37.8	25.2	35.9	20.8	28.6
14	N_2'PKNaMg	39.4	49.5	35.9	43.0	42.7	52.1	41.8	47.9	36.6	45.9	34.7	41.7
15	PKNaMg	21.8	29.7	18.5	25.1	21.2	27.1	21.4	25.3	14.1	19.6	19.9	24.8
16	N_1'PKNaMg	27.5	34.9	26.7	33.6	31.1	37.1	26.7	31.4	25.4	32.0	25.6	31.4
17	N_1'	16.4	22.4	18.4	24.1	16.4	20.5	20.0	23.0	12.9	17.3	15.9	18.8
18	N_2KNaMg	16.2	27.2	25.8*	36.6*	17.6	23.8	32.3*	38.7*	7.9	16.3	18.2*	21.3*
				23.0+	31.7+			26.0+	31.3+			16.9+	20.5+
19	D	20.6	28.4	17.9*	23.9*	21.4	28.2	18.7*	23.5*	19.8	27.3	18.6*	24.5*
				18.8+	24.9+			20.5+	25.5+			19.4+	26.0+
20	D; N'PK	26.3	34.9(1)	25.7*	33.0*	31.6	38.0	28.8*	34.2*	26.9	34.4	23.7*	29.8*
				29.7+	37.1+			30.4+	36.0+			25.0+	31.4+

* Heavy Liming + Light Liming (1) Excluding second crop 1925

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Table 12 (continued)

Dry matter; cwt per acre

Plot	Treatment Symbols	8-year Means 1944 - 51 Not Limed 1st crop	Not Limed Total	Limed 1st crop	Limed Total	1952 - 59 Not Limed 1st crop	Not Limed Total	Limed 1st crop	Limed Total	40-year Means 1920 - 59 Not Limed 1st crop	Not Limed Total	Limed 1st crop	Limed Total
1	N_1	5.1	9.1	12.5	15.3	5.5	11.5	15.0	23.3	8.4	13.6	14.1	18.9
2	O	8.7	11.8	9.3	12.0	9.5	15.5	12.7	20.5	9.4	13.6	10.8	14.8
3	O	7.8	10.8	9.2	11.3	8.3	13.9	12.2	18.0	8.2	11.8	9.7	13.0
4-1	P	11.5	14.6	11.6	15.4	14.9	23.2	15.3	24.1	12.5	17.1	11.7	15.9
4-2	N2P	8.5	11.3	20.3	24.2	10.2	17.9	24.4	32.9	11.9	16.4	23.6	29.4
5-1	O	4.9	6.5	-	-	6.7	11.9	-	-	7.2	10.5	-	-
5-2	PK	11.0	15.9	-	-	17.5	27.1	-	-	14.4	20.4	-	-
6	PKNaMg	20.3	29.0	-	-	23.5	35.5	-	-	20.6	28.8	-	-
7	PKNaMg	18.7	27.4	29.0	36.9	22.6	34.1	29.5	41.8	20.5	29.2	27.0	35.3
8	PNaMg	15.8	22.3	11.2	15.1	18.1	27.8	15.3	23.9	15.1	21.5	12.1	17.2
9	N_2PKNaMg	26.1	38.0	29.4	35.0	23.7	36.4	36.0	46.6	27.0	37.2	36.5	44.9
10	N_2PNaMg	14.9	22.9	23.4	28.5	13.7	23.8	29.0	37.7	16.8	24.2	28.4	35.5
11-1	N_3PKNaMg	23.9	42.7	40.1	49.5	21.9	45.0	40.8	56.5	27.1	44.2	41.9	53.6
11-2	N_3PKNaMgSi	31.0	48.2	40.9	52.6	29.6	52.3	47.8	69.2	34.0	50.8	44.2	58.9
12	O	9.0	13.2	-	-	10.6	18.3	-	-	10.1	15.0	-	-
13	D;F	21.8	30.0	26.0	33.6	27.3	40.9	25.8	40.1	27.7	37.6	26.3	35.2
14	N_2'PKNaMg	34.2	44.7	32.8	39.7	39.1	55.2	39.2	53.7	38.4	49.5	36.9	45.2
15	PKNaMg	14.7	22.0	18.5	22.6	18.6	27.6	28.8	42.4	18.1	25.2	21.4	28.0
16	$N_1'^1$PKNaMg	22.1	29.3	24.8	30.9	28.5	40.7	33.8	49.7	26.9	34.8	27.5	35.4
17	N_1'	13.4	18.7	15.3	19.9	16.9	26.6	18.8	29.4	15.2	21.1	17.7	23.0
18	N_2KNaMg	7.9	13.2	19.8*	24.0*	8.7	17.4	20.6*	27.8*	11.7	19.6	23.3*	29.7*
				17.7+	22.5+			20.2+	29.1+			20.8+	27.0+
19	D	20.6	28.3	20.5*	26.5*	24.8	36.9	23.5*	35.2*	21.4	29.8	19.9*	26.7*
				22.2+	27.8+			25.8+	38.7+			21.4+	28.6+
20	D; N^1PK	26.8	34.2	28.4*	34.5*	29.3	42.4	30.2*	42.8*	28.2	36.8(1)	27.4*	34.8*
				28.3+	35.7+			28.8+	42.0+			28.4	36.4+

* Heavy Liming + Light Liming (1) Excluding 2nd Crop 1925

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19, 20 were each divided into three sections one being left unlimed and the other two limed every 4 years:-

Plot 18	61	and	35	cwt.	ground	lime	per	acre.
19	28	and	5	"	"	"	"	"
20	25	and	5	"	"	"	"	"

In 1956 the lime used contained a high proportion of calcium carbonate and it was decided that in future the whole dressing should be applied as calcium carbonate equivalent to 2000 lb.CaO per acre.

Harvesting: For many years all operations were done by hand The mowing machine was first used for the first cut in 1901 though it had been used for the second cut since 1881. The first cut was made into hay and weighed as such until 1959; the second cut is weighed green and yields are calculated from the dry matter figures. In 1959 a flail type forage harvester was compared with the ordinary cutter-bar machine on the first cut on parts of plots 1, 7, 11-1, and 13. The tabulated yields for this crop refer to hay made in the usual way. The second cut on all plots in 1959 was estimated entirely by forage harvester, taking two cuts per plot except plots 5 to 10, 13, 18 which had four cuts. From 1960 yields of both cuts have been estimated from 2 or 4 cuts by the forage harvester; at the first cutting the remainder of each plot is cut by mower and made into hay on the plot but at the second cutting the whole produce is cut by forage harvester and carried green.

Further details of manuring: Memoranda of the Field Experiments, 1901, pp. 20-23.

Yields and botanical composition: Brenchley, W.E. The Park Grass plots at Rothamsted. Revised by K. Warington. Harpenden: Rothamsted Experimental Station. 1958.

Brenchley, W.E.(1924). Manuring for hay. Rothamsted Monographs on Agricultural Science. London: Longmans, Green & Co.

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EXHAUSTION LAND
HOOSFIELD, 1850 ONWARDS

The experiments in progress on this land test the residual effects of manures applied in a classical potato experiment which occupied this site from 1876-1901(1). There were 10 plots of potatoes each of 0.167 acres, manured as follows:-

Table 13

MANURES APPLIED YEARLY PER ACRE 1876-1901

	Treatment							
Plot	D tons	P P_2O_5 lb. (6)	K K_2O lb.	Na lb.	Mg lb.	N_2 N lb. (5)	N'_2 N lb.	Notes
1	-	-	-	-	-	-	-	
2	-	-	-	-	-	-	-	(2)
3	14	-	-	-	-	-	-	(3)
4	14	-	-	-	-	-	-	(4)
5	-	-	-	-	-	86	-	
6	-	-	-	-	-	-	86	
7	-	65	147	100	100	86	-	
8	-	65	147	100	100	-	86	
9	-	65	-	-	-	-	-	
10	-	65	147	100	100	-	-	

Treatments: D: farmyard manure. P: superphosphate. K: sulphate of potash. Mg: sulphate of magnesia. Na: sulphate of soda. N: ammonium salts. N′: nitrate of soda.

Notes:

(1) Some of the treatments date back to a much earlier period:-
1850-1855 Wheat, unmanured.
1856-1874 Five strips of continuous wheat each 0.33 acres. Using the numbers of the potato plots given above the yearly manures to wheat were (with minor changes in the amounts of K, Na, Mg):-
1, 2, 3, 4 No manure.
5, 6 Ammonium salts 86 lb. N
7, 8 Ammonium salts 86 lb. N with complete mineral manure (see below).
9,10 Mineral manure superphosphate 65 lb. P_2O_5, sulphate of potash 98 lb. K_2O sulphate of soda 100 lb., sulphate of magnesia 100 lb.
In 1875 the wheat failed and the land was fallowed.
The yields of wheat for the first 8 seasons are recorded in J. Roy. Agric. Soc. (1864) 25. p.493.

(2) After 14 tons of dung until 1881.

(3) Until 1882, this plot also received superphosphate at 65 lb. P_2O_5 per acre.

(4) Also 65 lb. P_2O_5 until 1882 and also 86 lb. N as nitrate of soda until 1881.

(5) The ammonium salts consisted of equal parts of ammonium sulphate and chloride.

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(6) 1897-1901 Basic slag was used in place of superphosphate made from 200 lb. bone ash and 150 lb. sulphuric acid.

For fuller details yields and crop analyses see Memoranda of the Field Experiments 1901, pp. 86-108.

Residual years: The cropping from 1902 onwards has been:-

1902-1922 Cereals without manure, yields taken. 16 crops of barley, 3 of oats, 1 of wheat and a bare fallow in 1920. (Plots 5-10 red clover from 1905 to 1911). For details see Rep. Rothamst. exp. Sta. for 1921-22, p. 88.

1923-1939 Cereals without manure, no yields recorded except for wheat in 1935.

1940-1948 Cereals with nitrogen only, average dressing 0.6 cwt. N per acre. No yields taken.

1949-1958 Barley (Plumage Archer) with 0.5 cwt. N per acre, yields taken.

1957 The land was cropped in halves, the West half containing Plots 2, 4, 6, 8, 10 and the East half 1, 3, 5, 7, 9.
W. Half Bare fallow, except a narrow strip in barley.
E. Half Strips of spring wheat, barley, sugar beet, potatoes, kale, swedes divided into microplots to test residuals against direct application of P and K.

1958 W. Half Barley.
E. Half As in 1957 but on fresh land (headlands of 1957 experiment).

Since 1959 Both halves in Barley with 0.5 cwt. N per acre.

Liming: In the winter of 1954-55 calcium carbonate at rates varying from 2 to 5 tons per acre was applied as ground chalk to various parts of the experimental area according to their needs (For details see Rep. Rothamst. exp. Sta. for 1954, p. 148).

Part of plot 2 received ground chalk at 2 tons per acre in winter 1959-60.

For general account of Exhaustion Land see Rep. Rothamst. exp. Sta. for 1959, 230-239.

For preliminary results of diversified cropping in 1957 and 1958 see Rep. Rothamst. exp. Sta. for 1958, pp. 55-57.

For residual effects measured in barley see Warren, R. G. (1956) N. P. K. residues from fertilisers and farmyard manure, in long-term experiments at Rothamsted. Proc. Fertil. Soc. 37, 1-33.

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Table 14

EXHAUSTION LAND HOOSFIELD

Wheat Yields: cwt per acre
5-year means

Plot No.	1	2	3	4	5	6	7	8	9	10
Treatment	-		-		N_2		N_2PKNaMg		PKNaMg	
	Grain	Straw	Grain	Straw	Grain	Straw	Grain	Straw	Grain	Straw
1856-1860	11.1	16.8	9.0	14.0	15.8	26.6	20.0	36.9	9.9	15.5
1861-1865	8.1	12.3	5.7	8.7	10.2	16.2	20.3	31.6	7.5	10.7
1866-1870	6.3	9.2	6.0	9.0	7.3	11.3	11.5	18.5	7.4	11.2
1873-1874*	9.6	16.0	8.6	16.1	13.1	23.0	13.7	24.7	9.4	17.2

* Means of 2 years, crop failed 1871, fallow 1872 and 1875.

Table 15

EXHAUSTION LAND HOOSFIELD

Potatoes Total Tubers: tons per acre
5-year means

Plot No.	1	2	3	4	5	6	7	8	9	10
Treatment	-	-	D	D	N_2	N_2'	N_2PKNaMg	N_2'PKNaMg	P	PK
1876*	3.86	4.26	5.33	6.72	2.89	3.88	8.10	8.79	6.05	6.18
1877-1881	1.96	5.42	5.63	7.19	2.43	3.07	7.40	7.58	3.58	3.74
1882-1886	1.76	3.20	4.27	3.80	2.15	2.04	6.26	5.58	3.61	3.58
1887-1891	0.98	2.02	4.38	4.75	1.44	2.00	4.44	4.86	2.18	2.48
1892-1896	1.09	1.86	6.48	6.71	1.53	2.19	5.35	5.79	2.43	2.90
1897-1901	0.55	0.94	2.92	2.81	0.69	0.98	2.43	2.68	1.17	1.20

* Manures applied October 1874 and not again before 1876 potatoes

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EXHAUSTION LAND

Table 16

EXHAUSTION LAND HOOSFIELD
Barley

Means over 4 years 1949 - 52

Treatment Symbol	Plot	cwt per acre Grain	Straw
O	1	11.4	13.9
O	2	12.0	14.8
D	3	24.3	25.7
D	4	25.7	27.8
N_2	5	13.2	15.2
N_2'	6	13.0	14.5
N_2PKNaMg	7	22.6	24.2
N_2'PKNaMg	8	24.8	24.2
P	9	22.7	22.5
PK	10	25.4	25.9

Means over 4 years 1953-56

Plot	cwt per acre Grain	Straw
1	12.6	15.6
2	13.7	18.9
3	25.0	26.9
4	24.4	26.8
5	14.8	16.8
6	12.4	16.8
7	24.0	26.0
8	22.8	25.6
9	21.8	24.4
10	24.0	27.3

Means over 3 years 1960 - 62

Treatment Symbol	Plot	cwt per acre Grain	Straw
O	1	17.5	11.4
O	2	15.6	9.9
D	3	24.3	16.0
D	4	24.9	16.1
N_2	5	16.3	10.4
N_2'	6	14.8	9.8
N_2PKNaMg	7	20.8	13.9
N_2'PKNaMg	8	20.8	13.2
P	9	20.7	13.4
PK	10	21.7	14.6

Means over 11 years 1949-56 and 1960-62

Plot	cwt per acre Grain	Straw
1	13.5	13.8
2	13.6	15.0
3	24.6	23.5
4	25.0	24.2
5	14.6	14.5
6	13.3	14.1
7	22.6	22.1
8	23.0	21.7
9	21.8	20.7
10	23.9	23.3

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ROTHAMSTED GARDEN CLOVER, 1854 ONWARDS

First crop sown in spring 1854 on a plot in the kitchen garden of the Manor House, and resown when necessary ever since. Complete resowing or patching is now almost a yearly operation.

Variety: Red Clover.

In 1956 the plot was divided into two to test an annual dressing of muriate of potash at 2 cwt. per acre (4 cwt. per acre in 1961).

In 1960 the sub-plots were halved to test the effect of a foliage spray of molybdenum.

2 or 3 cuts of greenstuff are taken each season.

Whole plot area: 0.0022 acres.

For an account of the history and yields of this plot see Rep. Rothamst. exp. Sta. for 1956, pp. 187-189.

Table 17

CLOVER - ROTHAMSTED GARDEN

Dry matter: cwt per acre

Means over 6 years
1957-62

Muriate of Potash: cwt per acre

None	2*	Mean
18.1	34.6	26.4

NB For 1960-62 the yields from the plots sprayed with sodium molybdate have been excluded.

Means over 3 years
1960-62

Muriate of Potash: cwt per acre	Spray		Mean
	None	Sodium Molybdate	
None	9.3	3.7	6.5
2*	22.7	15.7	19.2
Mean	16.0	9.7	12.8

* 4 cwt in 1961

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WOBURN, STACKYARD FIELD
CONTINUOUS WHEAT AND BARLEY, 1877 ONWARDS

The experiments on wheat and barley tested the same set of manurial treatments under the same plot numbers. There were four periods (1) 1877-1906 during which the fertiliser dressings were on much the same scale as for continuous cereals at Rothamsted (2) 1907-1926 when additional treatments were tested and most of the nitrogen dressings were reduced by half (3) 1927-1959 when the manurial treatments were discontinued and only nitrogen was applied while the residuals of the former treatments were being measured (4) 1960 onwards a more detailed study of residual effects involving direct additions of P and K on micro-plots.

Commencing in 1898 certain of the plots were subdivided to test lime applications. These lime dressings are tabulated separately in Table 19.

Plot size: The main plots of the original experiment were $\frac{1}{4}$ acre.

Varieties: Many changes were made, 11 varieties of wheat and 8 of barley were grown during the course of the experiment. Since 1927 the varieties have usually been Squareheads Master wheat and Plumage Archer barley. The table gives the treatments applied from 1877-1926.

Table 18

Manures, lb. per acre. 1877 - 1926 unless otherwise stated.

	Treatments						
Plot (1)	P P_2O_5 lb. (2)	K K_2O lb. (2)	N N lb.	N N lb.	R N lb.	D N lb.	Notes
1	-	-	-	-	-	-	
2	-	-	20.5	-	-	-	(7)
3a	-	-	-	41	-	-	
3b	-	-	-	20.5	-	-	(7)
4	56	27	-	-	-	-	
5	56	27	20.5	-	-	-	(7)
6	56	27	-	20.5	-	-	(7)
7	-	-	-	-	-	-	
8a, 8b	PK and 41 lb. N as sulphate of ammonia alternately						(3)
9a, 9b	PK and 41 lb. N as nitrate of soda alternately						(3)
10a	56	-	-	20.5	-	-	(4)
10b	-	-	-	-	20.5	-	(5)
11a	-	55	-	20.5	-	-	(6)
11b	-	-	-	-	-	82	(7)

https://doi.org/10.23637/ERADOC-1-191

Treatments: P. superphosphate. K: sulphate of potash. N: sulphate of ammonia (until 1906 equal parts of ammonium sulphate and ammonium chloride) N : nitrate of soda. R: rape cake. D: farmyard manure.

Notes

(1) Subdivisions of the plots for liming are ignored in this table. See below.
(2) Until 1906 the "minerals" provided 65 lb. P_2O_5, 98 lb. K_2O, 100 lb. sulphate of soda and 100 lb. sulphate of magnesia.
(3) Until 1881 the plots were undivided and the minerals and nitrogen were applied in the same year.
(4) Dung 53 lb. N until 1881; unmanured 1882-1906.
(5) Dung 53 lb. N until 1887; unmanured 1888; rape cake 82 lb. N 1889-1906.
(6) Dung 105 lb. N until 1881; unmanured 1882-1906.
(7) 105 lb. N until 1906.

Liming: After 16 years of ammonium salts providing 41 lb. N per acre the barley yields on plot 2 began to decline. This plot was first limed for the crop of 1898 as was also its counterpart in wheat which was by then also showing deterioration but to a lesser degree. Thereafter lime has been applied to several of the plots in different amounts and years. The material used was high grade burnt lime, slaked before application. The details are:

Table 19

Lime (CaO) cwt. per acre and years of application

	5	10	20	40
		Wheat		
2aa	'05, '09, '10, '11	-	-	-
2b	-	-	-	'98
2bb	-	-	-	'98, '05
5b	-	-	'05	-
8aa, 8bb	-	'05, '18	-	-
		Barley		
2aa	'05, '09, '10, '11	'23	-	-
2b, 5b, 8aa, 8bb	-	-	-	'98, '12
2bb	-	-	-	'98, '05
4b	-	-	'15	-
5aa	-	-	'05, '16	-
3aa, 3bb	-	-	-	'21

From 1927-1940 the plots were cropped with Red Standard wheat (Million in 1929 and 1930) and Plumage Archer barley usually without manure. The plots were bare fallowed in 1927, 1928, 1934, 1935. In 1931 and 1932 the varieties Plumage and Archer were grown side by side in alternate strips on all the barley plots. Most of the plots were unmanured but plots 8, 9, 10a, 11a received fertilisers as detailed below.

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WOBURN CLASSICALS

Manures applied to certain plots 1931, 1932

lb. per acre

Plot	Super-phosphate P_2O_5 lb.	Sulphate of potash K_2O lb.	Sulphate of ammonia N lb.	Nitrate of soda N lb.
8	56	82	41	-
9	56	82	-	41
10a	56	-	-	42
11a	-	82	-	42

From 1941 to 1957 cropping was continued as before but nitrogenous fertilisers were given to all plots. In 1941 and 1942 sulphate of ammonia at 47 lb. N per acre was given as a basal dressing for both crops. In 1943 the plots, excluding 2, 5, and 8 which had received sulphate of ammonia, were divided into sets of three and dressings of 35 lb., 70 lb., 105 lb. N per acre as "Nitro-Chalk" were applied to the plots of each set in cyclical order. The sets were:

No PK	Plots 1, 3, 7
PK	Plots 4, 6, 9
Dung	Plot 11b (divided into 3 sections)
Various treatments	Plots 10a, 10b, 11a

The wheat plots were fallowed in 1947, 1948, 1955, 1956, 1957; the barley plots in 1947, 1948, 1949, 1956, 1957. No crop weights were taken on either experiment in 1950. In 1952 and 1953 the barley plots were divided to compare winter and spring sown barley.

Liming: In 1955 dressings of ground chalk ranging from 20-50 cwt. per acre, according to pH of the individual plots, were applied to both experiments in order to bring all plots to about pH 6.0.

In 1956 and again in 1957 further adjustments involving dressings ranging from 7.5-15 cwt. chalk per acre were made to both experiments.

1958 All main plots of both experiments divided into 4 sections carrying winter wheat, winter barley, spring wheat and spring barley respectively. The crops were uneven and were ploughed up in spring 1958.

1959-61. All main plots divided to test Squareheads Master wheat and Plumage Archer barley with a basal dressing of 102 lb N per acre.

1960 On the barley strip crossing plots 7, 8, 9, 11a, 11b on both experiments two sub-strips were put down one in Plumage Archer barley and the other in Majestic potatoes. These were divided into microplots to measure residuals against direct applications of P and K.

1961 As 1960 but microplots included also Klein E Sugar beet.

1962 Spring oats, variety Condor with a basal dressing of 56 lb. N per acre. A further small area was allocated for micro-plots on soil structure, occupying parts of plots 4, 5, 6, 11a and 11b of the Permanent Barley Site.

Summary of yields 1877-1926. Rep. Rothamst. exp. Sta. for 1927-28, pp. 104-107. Early results yearly in the J.R. agric. Soc., since 1921 yearly in the Rep. Rothamst. exp. Sta.

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Table 20

Continuous Wheat and Barley

Wheat Grain: cwt. per acre

Means over 7 years 1944, 45, 49, 51, 52, 53, 54.

Plot Numbers Treatment 1877-1926		1, 3, 7 No P or K	4, 6, 9 PK	10a, 10b, 11a, NP, R, NK	11b D	Mean
Treatment "Nitro-Chalk" 1944-54 cwt. per acre	2	8.3	9.5	8.6	11.1	9.4
	4	9.8	13.9	10.8	13.2	11.9
	6	12.1	14.5	13.3	16.3	14.1
Mean		10.1	12.6	10.9	13.5	11.8

(1943: failed. 1946: rejected (highest yield 6.7 cwt.). 1947, 48: fallow. 1950: failed. 1955: fallow).

Barley Grain: cwt. per acre

Means over 6 years 1943, 44, 45, 46, 52, 53.

Plot Numbers Treatment 1877-1926		1, 3, 7 No P or K	4, 6, 9 PK	10a 10b 11a NP, R, NK	11b D	Mean
Treatment "Nitro-Chalk" 1943-54 cwt. per acre	2	5.6	7.2	5.8	9.0	6.9
	4	7.4	11.2	7.2	9.9	8.9
	6	8.8	10.9	6.5	11.5	9.4
Mean		7.3	9.7	6.5	10.1	8.4

Note: no yield was recorded for plot 10a (N3) in 1952. A value (10.5 cwt.) was estimated and used in making the table.

(1947, 48, 49: fallow. 1950: failed. 1951: rejected - 3 plots not recorded, (highest yield 8.7 cwt.). 1952, 53: yields of spring-sown barley only used. 1954: rejected - 5 plots not recorded. 1955: not included - lime applied).

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