Details of the Classical and Long-term Experiments Up to 1967

Full Table of Content

Hoosfield Exhaustion Land - Barley (Formerly Wheat, Later Potatoes)

Rothamsted Research

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EXHAUSTION LAND, HOOSFIELD, 1850 ONWARDS

This experiment tests the residual effects of manures applied 1856–1901 after unmanured wheat 1850–55. The crops were wheat (till 1874) and potatoes from 1876. Treatments applied to the two crops differed somewhat (see Table 13 below).

TABLE 13

Manures applied annually

1856–1901

(Unless otherwise stated)

(i) *Symbols, materials and rates of application*

N	Ammonium salts supplying 86 lb N (1)
N*	Nitrate of soda supplying 86 lb N
P	Superphosphate supplying 65 lb P_2O_5 (about 30 lb P) (2)
K	Sulphate of potash (49% K_2O) supplying 147 lb K_2O (about 122 lb K) (3)
Na	100 lb sulphate of soda supplying about 14 lb Na
Mg	100 lb sulphate of magnesia supplying about 10 lb Mg
D	14 tons farmyard manure

(ii) *Treatments* (4)

Plot (8)	1856–74 To wheat	1876–1901 To potatoes
1	None	None
2	None	D (5)
3	None	DP (6)
4	None	DN*P (7)
5	N	N
6	N	N*
7	NPKNaMg	NPKNaMg
8	NPKNaMg	N*PKNaMg
9	PKNaMg	P
10	PKNaMg	PKNaMg

Notes

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

(2) 1897–1901: 400 lb basic slag. 1856–84: superphosphate made from 200 lb bone ash and 150 lb sulphuric acid.

(3) 1859–74: sulphate of potash at 98 lb K_2O.

(4) In 1871 and 1872 the crop was ploughed up in mid-season. Manures were not applied in 1872 and 1873. In 1874 N only was applied, at half the usual rate in spring. In 1875 P, K, Na and Mg were applied (but no N) and the plots were fallowed. For potatoes 1876 FYM and N were applied but no more P, K, Na or Mg.

(5) Until 1881; unmanured 1882–1901.

(6) Until 1882; D only 1883–1901.

(7) Until 1881; DP 1882; D only 1883–1901.

(8) The original five plots were divided into 10 and renumbered in 1876. The later numbering is used in this table.

Size of plots. 0·167 acre.

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EXHAUSTION LAND

Residual years. The cropping from 1902 onwards has been:

1902–22	Cereals without manure, yields taken: 16 crops of barley, three of oats, one of wheat and a bare fallow in 1920. (Plots 5–10 red clover from 1905 to 1911.) For details see (1).
1923–40	Cereals without manure, no yields recorded except for wheat in 1935.
1941–48	Cereals with nitrogen only, average dressing 0·6 cwt N as sulphate of ammonia. No yields taken.
1949–56	Barley (Plumage Archer) with 0·5 cwt N as sulphate of ammonia yields taken.
1957	The land was cropped in halves, the west half containing plots 2, 4, 6, 8, 10 and the east half plots 1, 3, 5, 7, 9. West half. Bare fallow, except a narrow strip in barley. East half. Strips of spring wheat, barley, sugar beet, potatoes, kale, swedes divided into microplots to test residual P and K against direct application of P and K.
1958	West half. Barley. East half. As in 1957 but on fresh land (headlands of 1957 experiment).
1959–62	Both halves in barley with 0·5 cwt N as sulphate of ammonia until 1960. Since 1961 'Nitro-Chalk'.
1963	Plumage Archer replaced by Proctor. Nitrogen was combine drilled.
1964–66	Variety Maris Badger with 0·7 cwt nitrogen combine drilled.
1967	Fallow.

Liming. In the winter of 1954–55 calcium carbonate at rates varying from 2 to 5 tons was applied as ground chalk to various parts of the experimental area according to their needs. See (2).

Part of plot 2 received ground chalk at 2 tons in winter 1959–60.

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TABLE 14

Exhaustion land, Hoosfield

Wheat: cwt, five-year means

Plot	Treatment	1856–60		1861–65		1866–70		1873–74*	
		Grain	Straw	Grain	Straw	Grain	Straw	Grain	Straw
1 and 2	None	11·1	16·8	8·1	12·3	6·3	9·2	9·6	16·0
3 and 4	None	9·0	14·0	5·7	8·7	6·0	9·0	8·6	16·1
5 and 6	N2	15·8	26·6	10·2	16·2	7·3	11·3	13·1	23·0
7 and 8	N2PKNaMg	20·0	36·9	20·3	31·6	11·5	18·5	13·7	24·7
9 and 10	PKNaMg	9·9	15·5	7·5	10·7	7·4	11·2	9·4	17·2

* Means of two years; no crop 1871, 1872 and 1875.

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TABLE 15

Exhaustion land, Hoosfield

Potatoes, total tubers: tons

Five-year means

Plot	Treatment	1876§	1877–81	1882–86	1887–91	1892–96	1897–1901
1	None	3·86	1·96	1·76	0·98	1·09	0·55
2	D†	4·26	5·42	3·20	2·02	1·86	0·94
3	DP†	5·33	5·63	4·27	4·38	6·48	2·92
4	DN*P†	6·72	7·19	3·80	4·75	6·71	2·81
5	N	2·89	2·43	2·15	1·44	1·53	0·69
6	N*	3·88	3·07	2·04	2·00	2·19	0·98
7	NPKNaMg	8·10	7·40	6·26	4·44	5·35	2·43
8	N*PKNaMg	8·79	7·58	5·58	4·86	5·79	2·68
9	P	6·05	3·58	3·61	2·18	2·43	1·17
10	PKNaMg	6·18	3·74	3·58	2·48	2·90	1·20

† For treatments see Table 13.

§ PKNaMg applied October 1874 and not again before 1876 potatoes. FYM and ‡N applied direct for potatoes.

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TABLE 16

Exhaustion land, Hoosfield

Barley: cwt

Plot	Treatment 1876–1901	Four-year means 1949–52	Four-year means 1953–56	Four-year means 1960–63	Three years 1964–66	15-year means 1949–56 and 1960–66	
		Grain	Grain	Grain	Grain	Grain	Straw
1	None	11·4	12·6	17·8	13·2	13·8	13·7
2	D†	12·0	13·7	15·3	11·9	13·3	14·0
3	DP†	24·3	25·0	25·0	34·2	26·6	23·7
4	DN*P†	25·7	24·4	25·0	31·5	26·3	23·6
5	N	13·2	14·8	15·7	12·3	14·1	13·4
6	N*	13·0	12·4	14·5	11·5	12·9	13·1
7	NPKNaMg	22·6	24·0	21·8	30·5	24·4	21·7
8	N*PKNaMg	24·8	22·8	20·8	27·3	23·7	20·7
9	P	22·7	21·8	21·9	28·7	23·5	20·5
10	PKNaMg	25·4	24·0	22·2	28·1	24·8	21·8

† For treatments see Table 13.

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