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### Exhaustion Land Spring Barley

#### Rothamsted Research

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Forms of nitrogen have not been tested since 1967 when a four level sub-plot N test started. PKMg applications on the old rape cake series were discontinued after 1979 and the silicate of soda test was modified in 1980 to include the four combinations of:

- (1) 0 vs silicate from 1980 with
- (2) 0 vs silicate 1862-1979

Recent yields (Table 4) continue to show the great importance of P to spring-sown barley as well as large positive interactions between N, P and K Mg. Until 1983 complete fertilizers gave yields as large as those from FYM. Since the introduction of the variety Georgie in 1980 and more especially Triumph in 1984, yields have increased on both treatments but more with FYM and, as on Broadbalk, greatest yields now come from the combination of FYM and nitrogen fertilizer. Silicate of soda continued to give substantial yield increases in the period 1984-90 on plots lacking P or K Mg but, unusually, had no effect on plots with these nutrients.

## EXHAUSTION LAND SPRING BARLEY

This area has had four phases since experiments started here in 1856 (ten plots from 1876):-

- (1) From 1856 to 1901 annual dressings of N, P, K or FYM (from 1876 only) were applied (Table 5), initially to wheat then to continuous potatoes from 1876.

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*Hoosfield* (see plan on opposite page)

*Nitrogen dressing in spring*

N-, 1, 2, 3 'Nitro-Chalk' supplying 48, 96, 144 kg N ha<sup>-1</sup>

The rates of N shown on the diagram are those applied to barley in 1991; they change cyclically, every year in order N3 following N- following N1 following N2.

*Organic* (applied before ploughing in autumn)

FYM 35 t ha<sup>-1</sup> farmyard manure

*Minerals* (applied before ploughing in autumn)

P 35 kg P ha<sup>-1</sup> as triple superphosphate (47% P<sub>2</sub>O<sub>5</sub>) discontinued to Series C since 1980

K 90 kg K ha<sup>-1</sup> as sulphate of potash (50% K<sub>2</sub>O) discontinued to Series C since 1980

S 450 kg ha<sup>-1</sup> silicate of soda since 1980, (S) each year until 1979

*Applied every 3rd year* (1989, 1992 etc.)

Mg 35 kg Mg ha<sup>-1</sup> as kieserite (15% Mg)

*Residual*

Na 15 kg Na ha<sup>-1</sup> as sodium sulphate discontinued in 1974 (applied with K and Mg)

*Series treatments* (discontinued 1968)

O None

A 48 kg N ha<sup>-1</sup> as sulphate of ammonia

AA & AAS 48 kg N ha<sup>-1</sup> as nitrate of soda

C 48 kg N ha<sup>-1</sup> as castor bean meal

**TABLE 5**

*Exhaustion Land Spring Barley*  
Number of annual dressings applied 1856-1901 and estimated amounts of P and K applied in FYM and fertilizer

	Plot number									
	1	2	3	4	5	6	7	8	9	10
	Number of dressings									
FYM	-	6	26	26	-	-	-	-	-	-
PK	-	-	-	-	-	-	42	42	17	42
P	-	-	7	7	-	-	-	-	25	-
N	-	-	-	6	43	43	43	43	-	-
	Nutrients applied (kg ha <sup>-1</sup> )									
P	0	235	1260	1260	0	0	1410	1410	1410	1410
K	0	900	3920	3920	0	0	5040	5040	1570	5040

**TABLE 6**

*Exhaustion Land Spring Barley*  
Mean yields of barley 1949-90 and recent soil analyses

Period	N kg ha <sup>-1</sup>	Variety	Plots	Plots 7,8*	Plots 3,4*	
			1,2,5,6* no P, no K	residues of PK fertilizers 1856-1901	residues of FYM 1876-1901	
Mean yields of grain, t ha <sup>-1</sup>						
1949-63	63	Plumage Archer	1.8	2.9	3.2	
1964-69	88	Maris Badger	1.7	3.6	4.3	
1970-75	88	Julia	1.8	4.2	4.8	
	0		0.9	1.6	2.1	
1976-79	48	Julia	1.3	2.9	3.5	
	96		1.4	3.0	4.0	
	144		1.6	3.1	3.8	
	0		0.7	1.5	2.3	
1980-83	48	Georgie	1.1	2.2	3.2	
	96		1.1	2.7	3.8	
	144		1.2	2.8	3.8	
	0		1.2	2.1	2.3	
1984-85	48	Triumph	1.5	2.5	3.0	
	96		1.6	2.8	3.4	
	144		1.7	3.0	3.4	
	0		1.1	1.5	1.9	
1986-90	48	Triumph	1.4	2.4	3.1	
	96		1.5	2.7	3.0	
	144		1.4	2.7	3.2	
Nutrients in air-dry soil and year of sampling						
N%			1974	0.102	0.100	0.124
			1951	7	21	27
			1965	6	12	18
P soluble in 0.5M-NaHCO <sub>3</sub> mg kg <sup>-1</sup>			1974	2	8	12
			1981	2	6	10
			1987	1	4	6
			1951	74	121	106
			1965	88	122	114
K soluble in M-ammonium acetate, mg kg <sup>-1</sup>			1974	69	89	87
			1981	66	85	81
			1987	74	92	83

\*Odd numbered plots not included after 1985