Report for 1968 - Part 1

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Field Experiments Section

G. V. Dyke

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FIELD EXPERIMENTS SECTION

G. V. DYKE

The field experiments at Rothamsted, Woburn and Saxmundham are controlled by the Field Plots Committee: D. J. Watson (Chairman), G. V. Dyke (Secretary), J. McEwen (Deputy Secretary), F. C. Bawden, G. W. Cooke, J. M. Hirst, F. G. W. Jones, J. R. Moffatt and J. A. Nelder. During the year F. Yates retired after 35 years service on the Committee; he was Chairman since 1954. C. A. Thorold retired after 11 years service.

Secretarial work for the Field Plots Committee and its Working Parties and Sub-Committees increased because the new Working Parties for Cereal Crops and Grass and for Root Crops held extra meetings, mainly on the farms.

Visitors came in the usual numbers in 1968 in spite of the indifferent weather, and showed much interest in the modified Classical experiments; a member of the Association of Applied Biologists, seeing the first crop

TABLE 1

Number of full-scale plots harvested in 1968

	Grain	Roots	Hay	Grazing	Total
Classical experiments:					
Rothamsted	453	67	200	—	720
Saxmundham	62	10	—	—	72
Long-period rotation experiments:					
Rothamsted	572	664	172	—	1408
Woburn	412	160	72	12	656
Saxmundham	36	—	—	—	36
Crop sequence experiments:					
Rothamsted	718	32	116	—	866
Woburn	406	296	—	—	702
Saxmundham	—	48	—	—	48
Annual experiments:					
Rothamsted	743	484	96	—	1323
Woburn	160	144	—	—	304
Totals:					
Rothamsted	2486	1247	584	—	4317
Woburn	978	600	72	12	1662
Saxmundham	98	58	—	—	156
Total	3562	1905	656	12	6135
Full-scale plots (no yields taken):					
Rothamsted					196
Woburn					10
Saxmundham					8
Microplots:					
Rothamsted					1258
Woburn					681
Saxmundham					214
				Total	8502

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of potatoes ever grown on the Broadbalk experiment, immediately requested samples which were supplied after harvest.

The small-plot staff settled down to their work on the Garden Plots and elsewhere. They assisted sponsors on 43 experiments. A secondhand tractor was obtained from the farm and we can now do our own ploughing. A Fiona mounted drill was bought and has proved satisfactory for sowing seed and fertiliser on small plots. The range of small machinery has been increased by the purchase of standard models, adaptation of existing machines and by building specialised equipment for drilling, cultivating, spraying and harvesting small plots.

Table 1 shows the number of plots on the three farms in 1968. The modifications to Broadbalk, Hoos Barley and Barnfield have doubled the number of separate plots on these experiments. The number of plots in annual experiments at Woburn was about the same as 1966 (there were exceptionally few in 1967).

The Classical experiments

The Broadbalk, Hoos Permanent Barley and Barnfield experiments all took a new form in 1968; details were given in the *Reports for 1966* and *1967*. Table 2 shows the yields of all crops with some of the more important treatments.

Broadbalk. The wheat variety, Cappelle Desprez (grown here for the first time), yielded generally more grain than Squarehead's Master in recent years. Wheat Bulb fly, however, did serious damage on a few plots of the section that was fallow in 1967. As in other seasons of severe attack, plots manured with N but not K suffered worst; plot 14, given K for the first time in 1968 in addition to its long-term treatment (PMg and 86 lb N) seemed to suffer no more damage than plot 13 (PK and 86 lb N for many years).

Plot 9 which in 1968 received PKNaMg as hitherto, plus 172 lb N, yielded 31 cwt (average of all sections in wheat) compared with 29 cwt on plot 8 (as plot 9 but 129 lb N) and 32 on plot 2B (FYM). Plot 2A, which received 86 lb N as 'Nitro-Chalk' in addition to the traditional FYM, yielded 36 cwt grain. The newly-formed plot 1 (FYM, PK and 86 lb N) which does not run the full length, yielded about the same as 2B.

Potatoes (variety Majestic) gave yields of 2·9–15·7 tons/acre total tubers. The maximum yield from inorganic fertilisers was 14·7 tons (PKNaMg plus 129 lb N as 'Nitro-Chalk', plot 8). Plot 9 (PKNaMg plus 172 lb N) gave 13·8 tons, plot 7 (PKNaMg plus 86 lb N) 12·4. FYM (plot 2B) gave 13·2 tons, FYM plus 86 lb N (plot 2A) 15·7 tons and the new plot 1 (FYM, PK and 86 lb N) 13·8. Plots 10, 11, 12 (N but no K) all yielded about 3 tons and plot 3 (unmanured) 4 tons. Plot 14 (K in 1968 only, plus PMg and 86 lb N) yielded 6·4 tons. Beans (variety Maris Bead) yielded very little grain without K. Plot 3 (unmanured) yielded 11 cwt, other plots without K 4–6 cwt, probably because the heavier wheat crops grown on these plots in the past removed more K. The plants on some of these

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plots, especially 12 (PNa and 86 lb N) were only 12–15 in. tall. K given only in 1968 (plot 14) produced 16 cwt, whereas K fertiliser given annually produced 27–37 cwt grain. FYM alone (plot 2B) produced 42 cwt grain (the greatest yield of beans at Rothamsted in 1968), FYM plus 86 lb N gave 36 cwt (plot 2A) and the new plot 1 (FYM, PK and 86 lb N) gave 26 cwt. For notes on the weedkillers used and the growth of weeds see p. 260 and p. 110.

Hoos Permanent Barley. Barley (variety Maris Badger) did not respond to N where P, K, Na, Mg, silicate or castor meal have not been applied; the mean yield on these plots was about 12 cwt grain. Where P alone has been applied annually maximum yields were about 34 cwt (with 86 or 129 lb N). With P and residues of castor meal, the greatest yield was 36 cwt (with 86 lb N). Without fertiliser-P, silicate of soda increased yield by 14 cwt, more than in most recent years. With KNaMg in addition to P, the maximum was 39 cwt (with 86 lb N). FYM applied annually, plus 57 lb N (the maximum applied on this plot) yielded 38 cwt.

Beans yielded about 24 cwt without and 33 cwt with KNaMg (both with residues of castor meal) P had little effect. The yields of potatoes ranged from 2·2 to 15·0 tons; P and KNaMg both increased yields, with a positive interaction. Castor-meal residues increased yields without either P or KNaMg, but not with both.

Barnfield. Following beans, uniformly treated with simazine in 1967, beans were again grown on the old Series 0, but in 1968 each plot was split for inter-row cultivations *v.* simazine spray (Table 3).

Without simazine the yields were much the same for all treatments except on strip 8, where P deficiency probably limited growth, and on strip 1. Simazine decreased yields on strips 4, 5, 6, 7 and 8 but only slightly on strip 2 (FYM + PK) where the extra organic matter in the soil presumably prevented the adverse effects of simazine seen on the fertiliser strips. On strip 1 (FYM) beans with simazine yielded 8 cwt more with than without simazine. The plot without simazine is at the western edge of the experiment. In recent years ploughing has been done across the plots and the outer edge of strip 1 may have been affected by the turning of the tractor. (In 1967 strips 1 and 2 gave about equal yields but, as the plots were not split then, the harvested areas were in the centre of the strips.) The same effect may have partly caused the poor yield on strip 8 with simazine, the plot at the eastern edge.

Barley and spring wheat, the first cereal crops grown on this land since 1856, both responded well to N. With FYM, 43 lb N gave the maximum yield of each crop; without FYM, 86 lb was needed for maximum yield of barley and 129 lb for spring wheat. Castor meal residues had little effect on maximum yields but gave substantial increases where no N or 43 lb was applied.

Best yields (40 cwt of barley and 43 cwt spring wheat) differed very little between the seven strip treatments. (None, PNaMg, PK, P, PKNaMg, FYM and PK, FYM alone, all applied for many years.) The exceptionally

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TABLE 2

Rothamsted Classical Experiments 1968; yields of crops from selected treatments

Grain, cwt/acre, total tubers, tons/acre

	Treatment											
	—				PKNaMg					FYM		P
Experiment	—	N1	N2	N3	—	N1	N2	N3	N4	—	N2	N2
BROADBALK												
Wheat												
(i) 1st after	15	—	8	—	23	29	31	23	27	39	34	6*
fallow	—	—	23†	—	—	—	—	—	—	—	—	—
(Section 3)												
(ii) 17th after	12	—	9	—	14	21	30	29	30	31	38	17
fallow	—	—	18†	—	—	—	—	—	—	—	—	—
(Section 0)												
Beans	11	—	6	—	32	34	37	37	36	42	36	4
	—	—	20†	—	—	—	—	—	—	—	—	—
Potatoes	4·0	—	3·0	—	4·4	8·3	12·4	14·7	13·8	13·2	15·7	3·3
	—	—	8·2†	—	—	—	—	—	—	—	—	—
HOOS BARLEY												
Barley‡	12	12	12	14	15	30	38	36	—	19	38**	31
	(27)	(37)	(34)	(34)	(30)	(34)	(38)	(32)	—	—	—	(36)
Beans	(25)	—	—	—	(36)	—	—	—	—	—	—	—
Potatoes	—	—	—	2·2	—	—	—	14·7	—	—	—	3·7§
	—	—	—	(9·0)	—	—	—	(15·0)	—	—	—	(8·4)§
BARNFIELD												
Spring wheat	8	21	24	40	16	22	34	28	—	18‖	21‖	36
	(20)	(33)	(38)	(43)	(18)	(29)	(34)	(23)	—	(22)	(22)	(37)
Barley	20	25	37	30	17	23	34	30	—	34	30	37
	(23)	(33)	(36)	(24)	(21)	(36)	(34)	(27)	—	(33)	(28)	(36)
Beans												
(i) Cultivated	26	—	—	—	31	—	—	—	—	19	—	33¶
(ii) Simazine	8	—	—	—	17	—	—	—	—	27	—	12¶

* Damaged by Wheat Bulb fly.
† 86 lb N as castor meal annually including 1968.
‡ Means of old Series O (no N) and Series A (sulphate of ammonia).
§ N3P.
‖ Damaged by birds. ** 57 lb N
¶ P alone.

Symbols: N1, N2, N3, N4 = 'Nitro-Chalk' at 43, 86, 129, 172 lb N (1968 only)—approximately 0·4, 0·8, 1·2, 1·6 cwt N.

P	Superphosphate annually, at 0·6 cwt P_2O_5/acre.
K	Sulphate of potash annually, at 0·9 cwt K_2O/acre (Barnfield 2·2 cwt K_2O/acre).
Na	Sulphate of soda annually, at 14 lb Na/acre (Barnfield, agricultural salt at 80 lb Na/acre).
Mg	Sulphate of magnesia annually, at 10 lb Mg/acre (Barnfield 20 lb Mg/acre).
FYM	Farmyard manure annually, at 14 tons/acre.
( )	Indicates yield with residues of castor meal last applied 1967 (Hoosfield), 1961 (Barnfield).

TABLE 3

Barnfield, spring beans

Grain, cwt/acre
(Old Series 0)

	Strip and treatment						
	8	7	6	5	4	2	1
	None	PNaMg	PK	P	PKNaMg	FYM,PK	FYM
1967	10	11	9	10	12	37	34
1968							
Cultivated	26	32	32	33	31	32	19
Simazine	8	12	16	12	17	30	27

poor yields on strip 1 (FYM) are attributable to severe damage by birds at harvest-time, but strip 2 (FYM, PK), where damage was negligible, yielded no more than the fertiliser strips. Indeed the best yields of spring wheat were recorded on the strip with neither FYM nor PKNaMg. This

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result is puzzling, but an observation made in May is perhaps relevant. Plots that gave poor yields then had many leaves yellow or dying at the tips; this was more evident in barley than in wheat. The symptom was not lessened by N and seemed worst on strips receiving K including strip 2 (FYM, P and K). A superficially similar symptom was seen on Hoos Barley but only on plots receiving P and either 43 lb N or none; K had no effect. 0·9 cwt K_2O is given on Hoos Barley, and 2·2 cwt on Barnfield, and this may have been too much for wheat and barley in 1968.

Another exceptional character of the Barnfield barley was that, on most of the plots without inorganic N (but including those with FYM), although the plants did not lodge at harvest time they had many fully-developed late tillers bearing green ears; these were nearly as many as the ripe ears. Roots of both crops sampled in May were unusually white and free from lesions, but whether this was the cause of the late development of ears is uncertain. The harvested grain from these plots was much more moist than from other plots:

N applied, lb/acre	% dry matter in grain
0	75·7
43	78·6
86	82·9
129	81·7

This suggests that most or all of the unripe grain came through the combine harvester and contributed to the recorded yields.

Exhaustion Land. Yields of barley after the bare fallow in 1967 were not greatly different from those of recent seasons. 10 cwt grain was produced on plots that have had no FYM, P or K since 1850; residues of FYM last applied in 1901 gave 32 cwt, residues of P alone 20 cwt and of PK 24 cwt. Lodging (as often happens) was worst on the FYM plots.

Rothamsted Garden Clover. Analyses of herbage by the Chemistry Department in autumn 1967 showed very small contents of magnesium. Accordingly the plot was further divided for a test of 0 v 100 lb Mg (as Epsom salt) on $\frac{1}{4}$ plots (50 lb in winter, 50 lb in summer). The basal potassium was also increased to 0·6 cwt K_2O after each cut except the last, with a winter basal manuring of 0·6 cwt P_2O_5, 0·6 cwt K_2O.

The first cut in 1968 was damaged by rabbits, mean yields of the second cut without and with magnesium were 12·2 cwt and 16·7 cwt dry matter respectively. (McEwan)

Annual summary of yields from standard experiments at Rothamsted and Woburn

On the Classical experiments and on some of the rotation experiments the conditions of growth of the various crops are as nearly as possible the same from year to year. The weather directly and indirectly (e.g. through its influence on the spread of diseases) causes yields to fluctuate but other causes of variation that affect most other crops are minimised. The same variety of seed is sown at the same seed-rate, and the husbandry of the

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crop (subject to weather) is much the same. All important decisions on the timing and choice of cultivations have for many years been made by the same person. The range of conditions in which crops are grown each year is extreme; wheat, barley, potatoes and beans are grown on land given FYM annually, fertiliser annually or no manure whatever for a century, and wheat and barley are grown after long monoculture and after an open rotation chosen to minimise soil-borne diseases.

From this year, the *Report* will include a summary of the yields recorded in some long-term experiments. Yields obtained in the best conditions, where losses from soil-borne pests and diseases are minimised and the supply of nutrients is as good as we can make it, should be of especial interest, and offer a basis for estimating differences between seasons.

Because of the great changes made in the experiments on Broadbalk, Hoos Barley and Barnfield in 1968, and the fallowing of the Exhaustion Land in 1967, yields recorded on these experiments in 1968 are not directly comparable with those of previous years. However, in years to come results from them will constitute the major part of the proposed summary.

This year only a brief account is included under crop headings.

Wheat. Before 1968 wheat in the Ley–Arable experiment always directly followed the treatment crops and was little affected by soil-borne disease, but changes in the test-cropping meant wheat in 1968 followed the sequence wheat, potatoes, barley on all plots (before that the plots had three years of their respective treatment crops). On Highfield the effects of

TABLE 4

Rothamsted Ley-Arable

Wheat, grain, cwt/acre

Previous cropping	1968 cwt N/acre				1967 Maximum yield	1967 (N)	1966 Maximum yield	1966 (N)
			Highfield					
	0·3	*0·6*	*0·9*	*1·2*				
Lu	21	24	26	26	55	(0·6)	51	(0·0)
Lc	37	33	33	33	62	(0·0)	52	(0·3)
Ln	35	34	33	33	54	(0·0)	48	(0·9)
Ah	25	29	30	31	60	(0·4)	50	(1·2)
R	37	37	34	34	—	—	—	—
Gc	25	27	24	27	—	—	—	—
Gn	24	28	23	24	—	—	—	—
			Fosters					
	0·4	*0·8*	*1·2*	*1·6*				
Lu	39	42	41	39	67	(0·4)	59	(0·4)
Lc	42	40	41	36	66	(0·4)	57	(0·8)
Ln	41	43	37	39	67	(0·4)	56	(0·8)
Ah	38	40	38	36	66	(0·53)	58	(1·07)
R	43	42	39	38	—	—	—	—

Symbols: Lu = lucerne (3 years).
Lc = clover/grass ley (3 years).
Ln = all-grass ley (3 years).
Ah = arable (hay, sugar beet, oats).
R = reseeded grass ploughed autumn 1964.
G = old grass ploughed autumn 1967, Gc without N, Gn with N to grass.

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take-all were evident before harvest, especially on plots following the 'arable' and 'lucerne' treatments. In autumn 1967 the crop on the newly-ploughed 'old grass' plots was thinned by insect pests and looked so much poorer than the other treatments that resowing was considered; however, it was not resown and the plots yielded as much grain as after lucerne (Table 4). The take-all which caused no obvious effects in autumn or spring did as much damage on these plots as the (very obvious) attack by insects.

On Fosters field there was no obvious effect of take-all but on both fields yields were about 20–30 cwt less than in 1967 and at least 10 cwt less than in 1966. Additional N did not increase yields.

At Woburn, the only relevant experiment is the Intensive Cereals on part of the site of the Classical Experiments. After a 2-year break, wheat yielded nearly a ton less than in 1967 (5 cwt less than in 1966) (Table 5).

TABLE 5

Woburn Intensive Cereals experiment

Wheat after 2-year break (1967: after 3-year break)

Grain, cwt/acre

1968 cwt N/acre 0·5	1968 cwt N/acre 1·0	1968 cwt N/acre 1·5	1968 cwt N/acre 2·0	1967 Maximum yield	1967 (N)	1966 Maximum yield	1966 (N)
28	34	33	29	53	(2·0)	43	(1·0)

TABLE 6

Rothamsted Ley-Arable

Barley, grain, cwt/acre

Previous cropping	1968 cwt N/acre to barley					1967 Maximum yield	1967 (N)	1966 Maximum yield	1966 (N)
	Highfield								
	0·0	*0·1*	*0·2*	*0·3*					
Lu	37	41	42	42		47	(0·3)	54	(0·3)
Lc	41	42	43	41		46	(0·3)	55*	(0·1)
Ln	41	40	41	42		47	(0·3)	56†	(0·3)
Ah	34	37	41	42		47	(0·3)	54	(0·3)
R	—	—	—	—		55	(0·1)	54	(0·1)
	Fosters								
	0·0	*0·2*	*0·4*	*0·6*	*0·8*				
Lu	33	39	41	41	—	55	(0·4)	56	(0·6)
Lc	34	36	40	38	—	52	(0·4)	57	(0·2)
Ln	33	39	39	40	—	53	(0·4)	56	(0·6)
Ah	29	—	37	39	38	56	(0·6)	55	(0·6)
R	—	—	—	—	—	56	(0·2)	58	(0·2)

* Previous cropping: grazed ley.
† Previous cropping: cut grass.

Symbols: Lu = lucerne (3 years).
Lc = clover/grass ley (3 years).
Ln = all-grass ley (3 years).
Ah = arable (hay, sugar beet, oats).
R = reseeded grass ploughed autumn 1964 (barley 1967), autumn 1963 (barley 1966).

Spring barley. In the Rothamsted Ley–Arable experiment where barley was the third test-crop in each of the years considered (Table 6) yields were smaller in 1968 than in 1966 or 1967, especially on Fosters. Dif-

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ferences in response to N seem not to explain these differences between seasons, though too little was given on Highfield to establish this point.

Barley yields in the Cultivation–Weedkiller Rotation experiment were about 10 cwt less than in 1967 and 7 cwt less than in 1966 (Table 7). In the Residual Phosphate experiments, barley with P yielded less than in 1965 or 1967, but without P yielded more than in 1967 (but less than 1965) (Table 8). In the Intensive Spring Barley Experiment 1968 yields were less than in 1966 or 1967, especially after the 2-year break of oats and beans (Table 9). At Woburn barley in the Intensive Cereals and Ley–Arable experiments yielded 10–17 cwt less than in 1966 or 1967 (Table 10).

TABLE 7

Cultivation–Weedkiller Rotation experiment

Barley, grain, cwt/acre

	1968	1967	1966
P	36	47	42
R	35	46	44
T	36	47	43

Symbols: P = ploughed.
R = rotary cultivated.
T = tine cultivated.

TABLE 8

Residual Phosphate Rotations

Barley, grain, cwt/acre

P_2O_5 (cwt/acre) as superphosphate	1968	1967	1965*	1968	1967	1965*
	Sawyers I			Great Field IV		
0	28	26	37	25	17	27
3·0 in 1960	30	37	38	25	38	28
0·5 annually	34	39	39	26	33	27

* Fallow 1966.

TABLE 9

Intensive Barley experiment

Barley, grain, cwt/acre

	1968				1967		1966	
	cwt N/acre				Maximum		Maximum	
	0·0	0·3	0·6	0·9	yield	(N)	yield	(N)
(*a*)	30	36	39	36	48	(0·9)	50	(0·9)
(*b*)	15	28	36	37	44	(0·9)	41	(0·9)

(*a*) Barley after oats, beans.
(*b*) Continuous barley since 1961.

TABLE 10

Woburn Intensive Cereals experiment

Barley after 2-year break (1967: after 3-year break)

Grain, cwt/acre

1968				1967		1966	
cwt N/acre				Maximum		Maximum	
0·4	0·8	1·2	1·6	yield	(N)	yield	(N)
30	34	29	27	46	(1·2)	51	(1·2)

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The barley introduced in 1968 as first test crop on the Ley–Arable yielded less with than without N; the maximum decrease was about 10 cwt.

Except on land lacking P, where barley always yielded poorly, yields were usually about 10 cwt less than in 1966 or 1967.

Spring beans. Good comparisons of bean yields with 1967 and 1966 are possible in the Cultivation–Weedkiller experiment and with 1967 in the Irrigation experiment. In both, yields were much less than previously (Tables 11 and 12); and less than from plots in the Broadbalk, Hoos

TABLE 11

Cultivation–Weedkiller Rotation experiment

Spring beans, grain, cwt/acre

	1968			1967	1966
	M	S	Mean	Mean	Mean
P	23	22	22	32	32
R	20	22	21	30	28
T	21	19	20	30	31
Mean	22	21	21	31	30

P = ploughed. R = rotary cultivated.
T = tine cultivated. M = mechanical inter-row cultivations.
S = simazine spray.

TABLE 12

Irrigation Rotation experiment

Spring beans, grain, cwt/acre

	1968	1967
O	19	33
A	18 (1)	37 (2)
B	19 (3)	38 (3)
C	17 (4)	39 (5)
Mean	18	37

O = no irrigation.
A = early irrigation.
B = late irrigation.
C = full irrigation.

(1) etc., indicates amounts of water applied (in.).

Barley and Barnfield experiments given PKNaMg for many years, which yielded 30 cwt grain or more (Table 2), except half-plots on Barnfield treated with simazine. The variety was the same in all these experiments; the dates of sowing and conditions of the seedbeds were also similar and no reason is known for the large difference in yield.

Potatoes. Majestic potatoes in the Rothamsted Ley–Arable experiment yielded about 6 tons less than in 1967 and 5 tons less than 1966 (Table 13), partly because the stock of bought seed was unsatisfactory (see p. 261).

By contrast, yields in the Cultivation–Weedkiller Rotation experiment, were about 3 tons more than 1967 and 1 ton more than in 1966 (Table 14). In the Residual Phosphate Rotations experiments (Great Field IV and Sawyers I) yields were less than in 1967 by 2 tons (Sawyers I) and 4 tons

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TABLE 13

Rothamsted Ley–Arable

Potatoes, means of plots with FYM, total tubers, tons/acre

	Highfield			Fosters		
	1968	1967	1966	1968	1967	1966
Lu	16·5	23·7	21·9	15·8	21·3	20·9
Lc	16·3	23·8	23·0	14·1	21·7	19·8
Ln	17·6	23·3	23·8	15·8	21·3	20·6
Ah	16·4	22·5	21·4	15·5	20·6	19·9
Mean	16·7	23·3	22·5	15·3	21·2	20·3
Date of planting	10/4	5/4	4/4	10/4	5/4	4/4

Treatment Crops
Lu = Lucerne.
Lc = Grass-clover ley.
Ln = All-grass ley.
Ah = Arable (hay, sugar beet, oats).
(After three years of treatment crops all plots carried winter wheat, then potatoes, variety Majestic.)

TABLE 14

Cultivation–Weedkiller Rotation experiment

Potatoes

Total tubers, tons/acre

	1968	1967	1966
P	18·2	14·8	17·5
R	15·7	13·4	15·6
T	16·6	13·1	15·1
Mean	16·8	13·7	16·1
Date of planting	29/3	4/4	31/3

P = ploughed.
R = rotary cultivated.
T = tine cultivated.

TABLE 15

Residual Phosphate Rotations

Potatoes, total tubers, tons/acre

cwt	Sawyers I			Great Field IV		
P_2O_5	1968	1967	1965*	1968	1967	1965*
0	12·3	14·0	13·9	11·9	15·7	15·3
3·0 in 1960	11·8	14·5	17·0	12·4	16·5	17·8
0·5 annually	13·5	14·3	18·3	12·3	17·8	19·5
Mean	12·5	14·3	16·4	12·2	16·7	17·5
Date of planting	29/3	17/4	14/4	28/3	17/4	14/4

* Whole area bare fallow in 1966.

TABLE 16

Woburn Intensive Cereals experiment

Potatoes, omitting plots given Mg, total tubers, tons/acre

After Classical Experiment on:	1968	1967	1966
Wheat	10·5	5·2	7·6
Barley	13·7	10·6	13·5
Date of planting	27/3	22/3	29/3

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(Great Field IV), although the setts were planted nearly three weeks earlier (Table 15). In the other experiments considered here, dates of planting did not vary much from year to year.

At Woburn, where the only useful comparisons come from the Intensive Cereals experiment, potatoes on the old barley land yielded about the same as in 1966 and 3 tons more than in 1967 (Table 16). On the old wheat land, omitting plots treated with magnesium (applied in 1968 only) yields were smaller than on the barley land but greater than in 1966 by 3 tons and than in 1967 by 5 tons.

Legumes and Barley Experiment, 1967–68

This experiment was a modified version of the one in Stackyard field in 1965–67 (*Rothamsted Report for 1967*, pp. 233–234). There was one preparatory year, in which various crops were grown on different plots. In the second year barley was grown with 4 amounts of 'Nitro-Chalk' applied to sub-plots. The site, in Highfield IV, had carried many cereal crops in recent years.

Treatments in 1967: B = spring barley; 0 = spring oats; Bt = barley undersown with trefoil; Ot = oats undersown with trefoil;

(These four treatments were combined with 0·4 or 0·8 cwt N/acre as 'Nitro-Chalk' in 1967); Ra = spring oilseed rape with 'Nitro-Chalk' at 0·8 or 1·6 cwt/N acre; Be = spring beans (no N); Cl = red clover cut for hay (no N).

All crops grew well in 1967. Trefoil undersown in either barley or oats grew well and decreased the yields of each nurse crop by about 1 cwt. All plots were ploughed early in December 1967, when bent couch grass (*Agrostis gigantea*), which was present on most of the plots, seemed less on plots with than without trefoil.

The yield of barley in 1968 was not affected by the amount of N given in 1967, except after rape where 1·6 cwt N in 1967 gave 5·8 ± 2·84 cwt more grain than 0·8 cwt N. The barley grew well but much of it lodged, more than half of it with 0·7 or 1·05 cwt N, or with 0·35 cwt N except after oats and barley not undersown.

TABLE 17

Mean yields of barley grain

(85% dry matter), cwt/acre, 1968

1967 crop N in 1968 (cwt/acre)	B	Bt	O	Ot	Be	Cl	Ra
0	17·7	32·6	24·2	29·8	28·1	37·2	26·8
0·35	29·2	35·3	34·0	36·4	37·0	29·4	37·4
0·7	35·2	31·9	35·1	31·4	33·3	29·2	34·8
1·05	31·6	30·2	29·8	28·9	29·5	28·1	29·2
Mean	28·4	32·5	30·8	31·6	32·0	30·9	32·0

Standard errors:

body of the table (approximate, for all comparisons): Be, Cl ±2·1, remainder ±1·5

Means: Be, Cl ±0·82, remainder ±0·58

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The maximum yield after each preparatory crop was 35–37 cwt grain; this was achieved with no N (after clover), with 0·35 cwt N (after rape, beans, barley with trefoil, oats with or without trefoil), with 0·35–0·7 cwt N (after barley). Provided at least 0·7 cwt N was given, barley did not benefit significantly from any of the break-crops tested, or from ploughed-in trefoil. Compared with barley in 1967, clover was worth 0·7 cwt N, oats (undersown or not), beans and rape 0·35 cwt, trefoil undersown in barley 0·35 cwt N.

Effects of N and growth regulators on spring beans. Work continued on the effects of 'Nitro-Chalk' and B-Nine on beans. A full-scale experiment at Woburn tested 1·5 cwt N applied in the seedbed, just before flowering or at both times. Additional factors were B-Nine growth regulator and irrigation. The only significant increase in yield was from 1·5 cwt N applied in the seedbed which increased the yield of unirrigated beans from 26·1 to 29·8 cwt. Examination of roots during the season suggested the presence of soil-borne pathogens; examination of soil samples by the Nematology Department disclosed the presence of many *Trichodorus* and *Longidorus*, free-living nematodes.

Two microplot experiments were done at Rothamsted. One tested the effects on plant height of B-Nine, applied on three occasions from 4-leaf stage to flowering or in combinations of these occasions; four amounts, from $\frac{1}{2}$ lb to 4 lb B-Nine (85% a.i.), were applied each time. B-Nine shortened plants by as much as 15 in. (untreated height 47 in.) depending on quantity applied and time of application. Single applications at the middle date, early June, were most effective and divided applications of 2 or 4 lb were no more effective than the same total quantity applied in early June. Increasing total quantity as a divided dressing (up to 12 lb/acre) increased dwarfing slightly—plants given 4 lb on three occasions were 3 in. shorter than those given 4 lb in early June only. The effects on yield were small and standard errors were large—probably because only two replicates were used—maximum increase was 12%, maximum decrease 17%.

The second microplot experiment tested none and 4 lb B-Nine on three occasions with all combinations of 0·0, 1·5 and 3·0 cwt N all in seedbed, all just before flowering or divided between these two times. Yields were much less than in previous years. Untreated beans gave 24·6 cwt grain. The mean effect of dwarfing with B-Nine was to increase yield by 0·9 cwt (2·6 cwt for beans without nitrogen). The mean effect of 1·5 cwt N was to increase yield to 29·5 cwt—there was no further increase from 3·0 cwt N. Nitrogen applied late had most effect and 1·5 cwt N just before flowering increased mean yield to 31·4 cwt. (McEwen)

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