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ROTHAMSTED RESEARCH

Rothamsted Report for 1967

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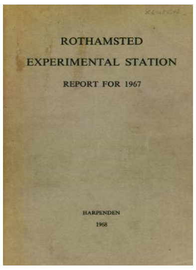

Field Experiments Section

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: F. Yates (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, C. A. Thorold and D. J. Watson. During the year P. H. Gregory retired and H. D. Patterson resigned.

The Working Parties for Agronomy Experiments and for Pathology Experiments were dissolved and replaced by Working Parties for Cereal Crops and Grass (Chairman, G. W. Cooke) and for Root Crops (J. M. Hirst). This change reflects the progressive mingling of the two major divisions of the Station's work in the field—the study of the physical and chemical factors affecting the growth of crops, on the one hand, and, on the other, the study of the biological factors. The effects of fertilisers on wheat and barley, for example, depend on the amount of take-all fungus in the soil, and without estimates of infection the interpretation of the results is incomplete, and a fumigant applied to the soil to kill nematodes also affects other microbes and makes more nitrogen available to the subsequent crop.

Considerations like these apply with more or less force to the interpretation of the results of all field experiments; a good example of the value of the integration of the two approaches is the series of modifications to the Ley–Arable experiments that have given the excellent yields of recent seasons (see pp. 316–331).

The attempt to classify experiments according to their crops has its difficulties also; more and more of our experiments involve short sequences of crops involving both roots and cereals, and these will be discussed by both of the new Working Parties.

The Section's work is now of three types. First, Dyke and McEwen act as secretaries of the Field Plots Committee and its Sub-Committees and Working Parties. Members of the Section, working from the decisions minuted, prepare detailed drawings and tables of quantities needed by the field staff in laying down and harvesting the experiments.

Notes are made of the appearance of the growing crops, and these (if in numerical form) are sometimes analysed on the Orion computer. The "Numerical Results" are prepared for publication jointly by the Section and the Statistics Department.

Secondly, members of the Section meet and guide most of the people who visit the Station out of general interest, and some of those with special interests. About two thousand visitors each year see some of the field experiments. The Classical experiments are still the biggest single attraction, but great interest is also shown in the Ley–Arable experiments, which have consistently given exceptionally large yields of cereals and potatoes in recent years.

Thirdly, the Section now has responsibility for the Garden Plots area.

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J. C. Wilson, who joined during 1967, and a small staff provide help in planting, harvesting, etc., to members of departments who have small-scale experiments on the Garden Plots or elsewhere at Rothamsted and Woburn. Some help is also given on experiments at outside centres. The programme of work in which the small-plot staff is involved is considered by the Committee for Garden Plots and Outside Experiments (Chairman, F. G. W. Jones), which has replaced the Garden Plots Committee.

Table 1 shows the numbers of plots on the three farms in 1967. The large increase in the number of cereal plots is caused by the use of the new PAM combine-harvester on many small plots that otherwise would have been cut by hand (and so would have been classified as microplots).

TABLE 1

Number of full-scale plots harvested 1967

	Grain	Roots	Hay	Grazing	Total
Classical experiments:					
Rothamsted	149	—	200	—	349
Saxmundham	60	84	—	—	144
Long-period rotation experiments:					
Rothamsted	580	218	268	—	1066
Woburn	106	366	64	12	548
Saxmundham	36	—	—	—	36
Crop sequence experiments:					
Rothamsted	818	32	178	—	1028
Woburn	465	200	4	—	669
Saxmundham	36	48	72	—	156
Annual experiments:					
Rothamsted	605	458	96	—	1159
Woburn	98	12	—	—	110
Saxmundham	15	30	—	—	45
Totals:					
Rothamsted	2152	708	742	—	3602
Woburn	669	578	68	12	1327
Saxmundham	147	162	72	—	381
Total	2968	1448	882	12	5310
Full-scale plots (no yields taken):					
Rothamsted					107
Woburn					58
Saxmundham					8
Microplots:					
Rothamsted					1008
Woburn					742
Saxmundham					24
				Total	7257

The Classical experiments

Broadbalk completed its last year in its present form; Hoos Barley was fallowed to give a clean start for the revised experiment, and Barnfield carried a crop of spring beans before starting in 1968 in its new form. The new experiments on Broadbalk and Hoos, including crops in rotation, were described in last year's Report (pp. 229–231).

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Barnfield. A four-course rotation will be introduced in 1968. The intention is to run the new scheme for about 4 years, measuring cumulative effects of the strip-manures on crops that should be free from soil-borne diseases and, in particular, to study the residual effects of castor meal (last applied in 1961). After that the plots will be split to compare residual and cumulative effects of P and K with those of newly applied P and K.

The rotation includes sugar beet, to maintain some continuity with the root crops grown for so many years. Potatoes and spring barley will be present on Barnfield, Broadbalk and the Hoos Barley experiment. The fourth crop on Barnfield is wheat, but spring-sown to obviate the difficulty of working autumn and spring seed-beds side-by-side on this difficult field.

Cropping. *Series N, A, AC and C:* four-course rotation: potatoes, spring barley, sugar beet, spring wheat. Each plot will carry two crops each year, starting with barley and wheat in 1968. *Plot 9* will carry one crop only each year—starting with barley in 1968. *Series 0 and the Valley:* spring beans each year, at least for a few years.

Manuring. The strip manures will continue as hitherto:

Strip 1	D
2	DPK
4	PKNaMg
5	P
6	PK
7	PNaMg
8	Nil
Plot 9	KNaMg

Symbols:

D: farmyard manure (14 ton/acre)
P: superphosphate (65 lb P_2O_5/acre)
K: sulphate of potash (245 lb K_2O/acre)
Na: agricultural salt (200 lb/acre)
Mg: sulphate of magnesia (200 lb/acre)

Beans on *Series O* will receive no other manures, but each plot will be split to test:

Inter-row cultivation *v.* simazine spray at 1 lb active ingredient/acre.

Series N, A, AC, C and Plot 9. Castor meal will not be applied. Each whole plot (already divided into halves for cropping) will be further divided into quarters, and four amounts of "Nitro-Chalk" will be tested in an arrangement balanced over pairs of Series (A and N, AC and C). Plot 9 will test all amounts of N on quarter plots.

Symbols:

NO: no nitrogen

N1, N2, N3: "Nitro-Chalk" to supply 43, 86, 129 lb N/acre to wheat and barley; 64, 129, 193 lb N/acre to potatoes and sugar beet. These applications are cumulative.

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Rothamsted Garden Clover. From 1956 to 1966 the area, which has grown clover since 1854, was divided for a test of potash by the Chemistry Department. In 1967 the area came under the management of the Field Experiments Section. The soil was brought to a uniform potash content by applying 7 cwt of muriate of potash to the half plot that had previously had none. Basal potash manuring at 2 cwt muriate of potash was applied to the whole area and the plot divided for a test of 0 *v.* 1·0 cwt nitrogen as "Nitro-Chalk". Yields of dry matter in the newly sown crop were 37·7 and 42·2 cwt respectively. (McEwen)

Effects of N and growth regulators on spring beans. Work continued to test the effects of "Nitro-Chalk" and growth regulators on beans. Two full-scale experiments, one at Rothamsted and one at Woburn, tested "Nitro-Chalk" at 1, 2 and 3 cwt N/acre. Growth regulators and different amounts and times of applying "Nitro-Chalk" were tested on microplots at Rothamsted.

The season was less favourable for beans than 1966. Crops were harvested in late August at Woburn, early September at Rothamsted—3 weeks earlier than 1966. Yields were less than in 1966 (mean 36 cwt at Rothamsted and 29 cwt at Woburn), and the increases from applied N were small (5–6%). Sideband placement of N, tested at Rothamsted, was less effective than broadcasting.

In the microplot experiment a yield of 40 cwt was obtained with 3 cwt N/acre applied as a divided dressing. (Yield without nitrogen was 37 cwt.) Single applications at the 4-leaf stage of "B-Nine" and chlormequat (CCC) did not increase yields, in contrast to 1966, when "B-Nine" gave a small increase. Chlormequat had no effect on plant height, "B-Nine" checked elongation of stems for 3–4 weeks after it was applied, but by harvest treated plants were only 3 in. shorter than untreated. However, in an additional, unreplicated microplot experiment applying "B-Nine" two to three times produced dwarf (2 ft 6 in.) plants, which at harvest were about half the height of untreated plants.

In 1966 yields of similarly treated plots in the microplot and large-plot experiment differed by 7 cwt, which was mainly attributed to loss of grain in combine-harvesting the large plots—the small plots were cut by hand. In 1967 the small plots yielded only 1 cwt more than the large, and counts of shed grain after combine-harvesting indicated a loss of only about ½ cwt this year. (McEwen)

Legumes and barley experiment 1965–67. This experiment compared the following ten sequences of crops:

	(*a*)	(*b*)	(*c*)	*d*)	(*e*)	(*f*)	(*g*)	(*h*)	(*i*)	(*j*)
1965	B	B	B	B	B	B	B	B	B	B
undersown	—	—	T	T	—	—	T	T	—	Cl
1966	B	B	B	B	O	O	O	O	Be	H
undersown	—	T	—	T	—	T	—	T	—	—
1967	B	B	B	B	B	B	B	B	B	B

(B = spring barley; T = trefoil; Cl = red clover; O = spring oats; Be = spring beans; H = clover cut for hay.)

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The site had carried several cereal crops before the experiment began; there were two replicates. In 1965 and 1966 each plot of barley or oats was split for a test of 0·4 *v.* 0·8 cwt N/acre as "Nitro-Chalk"; in 1967 four amounts of N (none, 0·3, 0·6, 0·9 cwt/acre) were tested on quarter plots. All plots (except those carrying clover) were ploughed during January in 1966 and 1967. The plot-yields in 1967 varied excessively, probably because the soil was wet in patches when the seed-bed was prepared, and only tentative conclusions can be drawn.

The trefoil undersown in 1965 established poorly, but that sown in 1966 established and grew well. Samples of roots plus tops taken before ploughing indicated that the trefoil contained about 0·33 cwt N, about three times as much as in the weeds on the plots not undersown. The yield of barley was little affected by the presence of undersown trefoil (1965 and 1966); the yield of oats (1966 only) was diminished by 7 cwt. The clover undersown in 1965, which established better than the trefoil, diminished the yield of the barley nurse-crop by about 1 cwt. The effects of ploughed-in trefoil on the subsequent crops were all small.

In 1967 yields after oats and barley increased almost linearly with N (each 0·3 cwt N gave 5–7 cwt more grain). After beans the response was irregular, but apparently little less than after the cereals. After clover hay, by contrast, yield with 0·9 cwt N was less than with 0·6 cwt N, although the increases for the 0·3 and 0·6 cwt N were about the same as after the other crops.

D. B. Slope's sampling on the 1967 crop indicates that there was little take-all after oats, beans or clover, but much after barley. The results

TABLE 2

Mean yields of barley grain (85% dry matter), cwt/acre, 1967

1965 crop	B	B	Bt	Bt	B	B	Bt	Bt	B	Bc
1966 crop	B	Bt	B	Bt	O	Ot	O	Ot	Be	H
N in 1967 (cwt/acre)										
0	14·2	10·1	9·2	16·1	17·1	18·7	19·5	18·4	21·2	31·4
0·3	16·1	25·1	17·4	19·0	33·5	28·8	23·9	27·9	17·5	36·3
0·6	20·8	28·3	22·5	20·0	32·7	38·8	41·0	31·4	32·1	41·0
0·9	34·4	31·7	24·1	21·8	37·2	34·5	39·4	44·1	38·1	38·7
Mean (±4·75)	21·4	23·8	18·3	19·2	30·2	30·2	30·9	30·4	27·2	36·9
% take-all in July (total)	58	59	45	40	11	8	7	8	10	11

(B = barley; t = trefoil undersown; c = clover undersown; O = oats; Be = beans; H = clover cut for hay.)

would have been more useful had the heaviest amount of N been greater than 0·9 cwt, but the yields indicate that beans were no better than oats as a break crop, and that clover was worth about 0·3–0·4 cwt N to the succeeding crop.

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