ROTHAMSTED RESEARCH

Report for 1980 - Part 1

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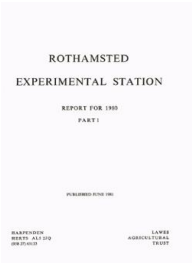

Field Experiments Section

G. V. Dyke

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FIELD EXPERIMENTS SECTION

G. V. DYKE

Staff

Head of Section G. V. Dyke, M.A.

Principal Scientific Officer
J. McEwen, B.SC.

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Introduction

Members of the Section continued to devote most of their time to the two types of service required, first, aiding the planning and execution of field experiments, and, second, helping visitors to see and discuss aspects of Rothamsted work that interest them.

In the first of these tasks we helped our colleagues to formulate clear proposals for effective field experiments and provided secretaries for the many meetings at which proposed experiments were discussed. We drew up the plans, schedules of quantities, etc., needed by the field staff of the two Farms, and our Small-plot Staff did some of the more specialised work on the plots. We consulted daily with the Head of Farms and advised sponsors on the state of the crops on their experiments. We helped the Statistics Department to produce the Station's annual publication *Yields of the Field Experiments*.

Field Plots Committee and Working Party for Field Experiments

The Field Plots Committee was dissolved late in 1979 and its functions are now discharged by the Working Party for Field Experiments which reports to the meetings of Heads of Departments. The present membership of the Working Party is: E. Lester, Chairman, W. Day, R. A. French, D. C. Griffiths, A. E. Johnston, R. Moffitt, A. W. Neill, R. D. Prew, R. K. Scott, A. G. Whitehead and F. V. Widdowson with Dyke and McEwen as joint secretaries. The Commodity Groups, Planning Group, etc., are unchanged. During 1980 a total of 24 indoor meetings and 15 tours of experiments at Rothamsted and Woburn were held.

Again the total number of plots has changed little (Table 1). Numbers of cereal plots increased because of changes on the Rothamsted Ley Arable and at Woburn because of the new experiment on Minimum Cultivation and Deep PK (240 subplots).

Small-plot Experiments

The Small-plot staff, with the area added in autumn 1979, now have 9 ha available. This made it possible to accept more experiments than in the past; they did all operations

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TABLE 1

Number of plots in 1980

	Grain	Roots	Hay and green crops	Total
Full-scale plots (yields taken)				
Classical experiments				
Rothamsted	377	19	237	633
Saxmundham	300	40	80	420
Long-period rotation experiments				
Rothamsted	224	—	120	344
Woburn	336	96	80	512
Crop sequence experiments				
Rothamsted	675	8	170	853
Woburn	598	196	—	794
Saxmundham	48	—	—	48
Annual experiments				
Rothamsted	1741	186	96	2023
Woburn	779	200	—	979
Saxmundham	64	—	—	64
Totals				
Rothamsted	3017	213	623	3853
Woburn	1713	492	80	2285
Saxmundham	412	40	80	532
Total	5142	745	783	6670
Full-scale plots (no yields taken)				
Rothamsted				506
Woburn				86
Microplots				
Rothamsted				2151
Woburn				308
All plots total				9721

on 58 experiments (2236 plots) and some operations on 11 others (545 plots). In particular 17 out of a total of 27 potato experiments at Rothamsted were on Small-plot land.

We have tried to solve the problem of spraying plots when the ground is wet and soft (for example in late autumn and early winter) without the use of wheels by constructing a back-pack sprayer. This is based on a design by ICI Ltd and consists of a pressure vessel from which the spray material is expelled by CO_2 from a small pre-charged cylinder. The material is applied from a hand-held boom of 3 m or less, offset to one side of the operator. (Wilson, Jones, Turnell, and Martin-Smith)

The Classical Experiments

The crop rotations which were introduced in 1968 on Broadbalk and the Permanent Barley Experiment on Hoosfield were reviewed. On Hoos Barley, where with plenty of applied N barley in rotation yielded little or no more than continuous barley the rotation crops are omitted, barley being sown on the whole area. On Broadbalk, where the rotation gave increases of 10–20% on plots given FYM or fertiliser-N at 96 kg ha^{-1} or more, beans are now omitted because of the infestation of stem nematode (*Ditylenchus dipsaci*) in the soil. The rotation on Sections 2, 4 and 7 will in future be fallow, potatoes wheat but in the transitional season of 1980 wheat followed two successive crops of potatoes. Sections 3, 5 and 6, which followed the rotation fallow, wheat, wheat, now revert to continuous wheat. Another change introduced in 1980 is a test of 48 kg N ha^{-1} as 'Nitro-Chalk' applied by combine drill at sowing in autumn. This will be given to plots 17, 18 in alternate seasons (17 for the 1980 crop); it is hoped it will help to explain

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TABLE 2

Broadbalk and Hoos Barley: yields of crops from selected treatments

Grain at 85% dry matter, t ha^{-1} and total tubers, t ha^{-1}

		Wheat (Broadbalk) (a) After 2-year break* (b) After wheat since 1952			Barley (Hoos) after barley			Potatoes (Broadbalk)		
		1980	1979	1978	1980	1979	1978	1980	1979	1978
Treatments	Variety	F	F	C	G	J	J	PC	PC	PC
None	(a)	2·2	2·6	3·2	1·1	0·9	1·0	10·8	6·1	11·1
	(b)	1·9	1·0	1·6						
N3PKMg(Na)	(a)	8·5	7·3	6·8	6·2	4·6	5·3	55·3	30·0	38·3
	(b)	6·6	6·3	6·0						
N4PKMg(Na)	(a)	8·8	7·6	6·4	—	—	—	50·7	31·1	48·4
	(b)	7·1	6·6	6·3						
FYM	(a)	6·4	6·9	7·9	6·8	3·3	5·1	52·5	24·0	32·6
	(b)	6·4	5·3	6·6						
FYM+N2	(a)	8·5	8·3	8·0	7·0	5·8	5·6	59·7	29·7	40·1
	(b)	8·4	6·6	6·0						
FYM+N2PK	(a)	8·4	8·7	7·8	—	—	—	52·9	25·6	29·1
(since 1968)	(b)	—	—	—						
					Date of planting			18/4	24/5	9/5

*Potatoes, beans for 1979, 1978 wheat; potatoes, potatoes for 1980 wheat

Symbols: F=Flanders, C=Cappelle, G=Georgie, J=Julia, PC=Pentland Crown

N2, N3, N4 = 'Nitro-Chalk' at 96, 144, 192 kg N ha^{-1}

P = Superphosphate annually, at 35 kg P ha^{-1}

K = Sulphate of potash annually, at 90 kg K ha^{-1}

Mg = Kieserite applied at 35 kg Mg ha^{-1} every third year

(Na) = Sulphate of soda annually until 1973

FYM = Farmyard manure annually, at 35 t ha^{-1}

the better yields often (not invariably) recorded from farmyard manure than from fertilisers alone, where 'Nitro-Chalk' is otherwise applied all in spring. Plots 17 and 18 now receive 144 kg N ha^{-1} in spring (formerly 96).

Wheat on Broadbalk was sprayed with both insecticide (demeton-S-methyl) and fungicide (triadimefon). Yields were generally good and with 144 kg N ha^{-1} or more as fertiliser (Table 2) and with FYM plus 96 kg N ha^{-1} wheat after potatoes gave exceptionally good yields, the 8·8 t ha^{-1} with 192 kg N ha^{-1} and PKMg being the best yield ever recorded on the experiment. With FYM (but not with fertilisers only) yields of wheat after wheat equalled those after potatoes.

The autumn N dressing to plot 17 gave, on average, an increase of about 0·3 t ha^{-1}; its mean yield was more than that from FYM alone, less than FYM plus 96 kg N ha^{-1}.

On Hoos Barley too, where the variety Georgie was grown for the first time, yields with N fertiliser and with FYM were outstandingly good.

Yields of potatoes on Broadbalk (planted earlier in 1980 than in 1979 or 1978) were good; with adequate nutrients from fertilisers or FYM 50–60 t ha^{-1} were harvested, roughly double the 1979 yields and 50% greater than those of 1978.

Garden Clover. In spring 1979 the area was returned to uniformity by sowing with Hungaropoly red clover and applying basal aldicarb at 10 kg ha^{-1} to the seedbed.

In autumn/winter a new test was started of benomyl, applied at 0·6 kg ha^{-1} on each of five approximately equally spaced intervals between 28 September 1979 and 11 February 1980 in an attempt to improve winter survival by control of *Sclerotinia trifoliorum*. Basal aldicarb was repeated in spring 1980 and basal N, P, K, Mg and Ca applied as hitherto. Even without benomyl about 80% of plants survived the winter, perhaps aided by aldicarb (*Rothamsted Report for 1977*, Part 1, 122), with benomyl virtually all survived.

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Growth was exceptional and five cuts were taken. Without benomyl the total yield of dry matter was 12·8 t ha^{-1}, with benomyl it was 14·6 t ha^{-1} the largest yield recorded from this site since 1855—the second year of the experiment. (McEwen)

Seed rates and divided N dressings for winter wheat. A factorial experiment was done at Rothamsted testing all combinations of seed rate, 100 and 200 kg ha^{-1}, nitrogen in early March, 0, 25, 50, 75 kg N ha^{-1} and nitrogen in mid-April, 75, 100, 125 kg N ha^{-1}.

Without early N yields from the lighter seed rate were less, by about 0·5 t ha^{-1}, with all rates of April N, than from the heavier seed rate; with 75 kg N ha^{-1} applied early yields were identical from the two seed rates at all rates of April N. (McEwen and Yeoman, with Moffitt, Farms)

Subsoiling and deep PK. In addition to the new experiment on this topic reported under 'Multidisciplinary Activities' (pp. 24–26) a further experiment was started at Woburn, on the heavy soil derived from Oxford Clay, which will study effects of subsoiling by the Wye College double digger and of deep PK on continuous winter wheat and winter barley and on the rotation winter oilseed rape, winter wheat, winter barley either conventionally sown or direct drilled. This was a preliminary year and direct drilling started in autumn 1980. (McEwen and Yeoman, with Johnston, Soils and Plant Nutrition Department, Neill, Farms and Prew, Plant Pathology Department)

We continued to study residual effects in continuous spring barley of treatments applied by hand at Woburn in 1973; the mean residual effect of subsoiling was to increase grain yield from 5·6 to 6·1 t ha^{-1} with no additional increase from PK to the subsoil. (McEwen and Yeoman, with Johnston, Soils and Plant Nutrition Department)

We also continued, in spring barley, the experiments started at Rothamsted and Woburn in autumn 1977 comparing the effects of mechanical subsoiling by a standard (wingless) subsoiler, the National College of Agricultural Engineering (NCAE) winged subsoiler and the Wye double digger, with and without PK incorporated into the subsoil by the NCAE and Wye machines. Subsoiling, but not PK incorporation, was repeated in autumn 1979 for the wingless and winged subsoilers only. Perhaps because of the unusually wet summer there were no significant effects of treatments although at Woburn all treatments increased yield by nearly 0·5 t ha^{-1}. (McEwen and Yeoman, with Johnston, Soils and Plant Nutrition Department, Dr M. K. V. Carr and Dr R. J. Godwin, NCAE, and Dr P. T. Gooderham, Mr I. B. Warboys and Mr J. M. Wilkes, Wye College)

Visitors

Excluding those who attended the Subject Days nearly 2000 visitors were guided by members of the Section; they came in 272 separate groups. Of these 800 (in 176 groups) came from overseas, the remainder from the United Kingdom. Universities, colleges and schools provided nearly 1300 visitors; farmers 71. Our system of storing and retrieving information about visitors on the 4-70 computer has been improved and will soon be available for use by all members of staff. (Parker ,with help from other members of the Section and from Christine Thomas, Computer Department)

Staff

Dyke took part in a Cocoa Black Pod Seminar at Rothamsted in June and attended an EEC Workshop on '*Rhizobium* and Nitrogen Nutrition of Legumes' at Norwich in September where he presented a paper on the 'Design of Field Experiments and Assessment of Yield and other Data'. D. S. Martin-Smith resigned.

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Publications

Paper in Rothamsted Report, Part 2

Johnston, A. E., Poulton, P. R. & McEwen, J. (1981) The soils of Rothamsted Farm. The carbon and nitrogen content of the soils and the effect of changes in crop rotation and manuring on soil pH, P, K and Mg. *Rothamsted Experimental Station. Report for 1980*, Part 2, 5–20.

Research Paper

McEwen, J., Yeoman, D. P. *et al.* (1981) The effects of irrigation, nitrogen fertilizer and the control of pests and pathogens on spring-sown field beans (*Vicia faba* L.) and residual effects on two following winter wheat crops. *Journal of Agricultural Science, Cambridge* **96,** 129–150.

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