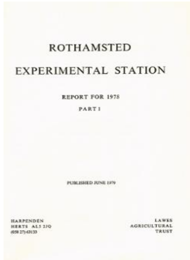
Report for 1978 - Part 1


ROTHAMSTED

EXPERIMENTAL STATION

REPORT FOR 1978

PART 1

Field Experiments Section

G. V. Dyke

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FIELD EXPERIMENTS SECTION

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Introduction

The two main tasks of the Section were, as in the past, providing advice and assistance at all stages to the sponsors of field experiments and providing a service to visitors to Rothamsted.

We helped sponsors to formulate proposals for experiments in standard form, taking account of land and machines available. We encouraged co-operation between research workers when a joint experiment seemed more efficient than two or more separate ones. We provided secretarial service to all committees and groups involved in decisions about experiments and formulated detailed plans based on their decisions.

We made systematic visual notes on the crops growing on plots and helped the Statistics Department in the preparation of the *Yields of the Field Experiments*. (Mainly McEwen, Barnard, Finch and Jones)

Visitors and Visual Aids

As well as the large numbers who came on the Open Days in July and the Subject Days in May, about 2500 visitors to Rothamsted were guided by the Section; we devised about 300 separate programmes according to the interests of the individuals and groups. The few who made no prior arrangement were welcomed. Most of the visitors saw something of the Classical and other experiments on the Farm. All departments helped us with visitors, the larger departments (Soils and Plant Nutrition, Entomology, Plant Pathology, Soil Microbiology) each being involved with 30 or more visits. The ability to store and retrieve information about visitors on the 4-70 computer has proved very useful and was used, among other things, to provide the basis of this paragraph.

In the last 5 years there has been little change either in the numbers of visitors coming to Rothamsted, or in the proportions in the different categories such as scientists, farmers, students. It is still true that the field experiments, especially the Classicals, are important to almost all visitors; on the few occasions that we have planned programmes excluding the experiments, we have usually been asked to make good the omission. The handling of groups indoors is still handicapped by the lack of an adequate reception/exhibition area and of a well planned and fully equipped lecture theatre. (Pattison, with help from other members of the Section, and from many colleagues in other departments.)

Our visual aid service expanded when we acquired a 16 mm sound projector and two more film loops, one on the Ryegrass Mite and the other on Pea Moth Monitoring. We also made two short 8 mm films, one on the Mobile Shelters and one on Tillage experi-

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ments. The range of items offered for sale to visitors also increased and includes colour and monochrome postcards, sets of slides of Broadbalk and Park Grass and a general set of Rothamsted, framed prints of Rothamsted Manor House and boxes of Rothamsted stationery. (Pattison)

Small-plot Experiments

The Small-plots staff of the Section continued to provide a specialised service for sponsors by doing the agricultural operations on experiments with plot sizes too small for normal farm machinery. This service continues to be in great demand for both small-plot experiments and in applying treatment sprays and other specialised operations on farm-scale experiments. This year the Small-plots staff did all operations on 47 experiments involving 1304 plots and assisted, mainly by application of treatment sprays, with a further 25 experiments involving 1069 plots. Many of the experiments required repeated spray treatments, and this aspect of the work continues to be a major commitment. (Wilson, with Jones, Turnell and Allingham)

Table 1 shows the number of plots on the three farms. This year the grand total was about 750 less than in 1977, mainly because there were less microplots. Full-scale cereal plots increased by 300; roots decreased by 200, hay and green crops by 300.

At Rothamsted root crops accounted for about 6% of the total, at Woburn 33%.

Seasonal effects on the Classical Experiments

No important changes of variety or husbandry were made on the Classical Experiments between 1977 and 1978 and the yields presented in Table 2 provide estimates of seasonal effects free as far as possible from such disturbances.

Yields of wheat (Cappelle) were greater in 1978 than in 1977 or 1976. Without fertiliser or farmyard manure (FYM) differences were less than 1 t ha^{-1} but with complete fertiliser or FYM differences were much greater, averaging 1·7 t ha^{-1} more than 1977, 3·3 t ha^{-1} more than 1976. The yield with FYM plus 96 kg ha^{-1} fertiliser N, 8·0 t ha^{-1} (64 cwt acre^{-1}), was probably the best ever recorded on Broadbalk, certainly the best since Cappelle was introduced in 1968. A new variety (Flanders) has been sown for the 1979 harvest and the crop rotation (hitherto potatoes, beans, wheat) will be fallow, potatoes, wheat; beans are discontinued because of the presence of damaging numbers of stem eelworm (*Ditylenchus dipsaci*). So there will be a break in the continuity of the series of wheat yields derived from Broadbalk.

Yields of barley on the Hoos Permanent Barley experiment were mostly rather less than in 1977; well-manured plots yielded on average 0·5 t ha^{-1} less. Yields in 1978 were, however, consistently better than in the dry season of 1976.

Beans, by contrast, yielded more on most plots than in 1977; the exceptional yield with FYM (only) on Broadbalk presumably has an element of random 'error' since the crop was badly damaged by stem eelworm. Yields in 1978 were three or more times greater than in 1976.

Potatoes, despite late planting caused by bad weather, generally yielded well in 1978 and responses to N fertiliser were exceptionally large; on Broadbalk with 192 kg N ha^{-1} the yield was nearly 15 t ha^{-1} more than in 1977, 20 t ha^{-1} more than 1976. With FYM alone, however, the 1978 yield was about midway between those of 1977 and 1976. The estimation of seasonal effects from a few plots on two fields, even though conditions are as fully standardised as is humanly possible, is far from easy.

To sum up, 1978 was a good year at Rothamsted for wheat, beans and potatoes and for barley about average.

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TABLE 1

Number of plots in 1978

	Grain	Roots	Hay and green crops	Total
Full-scale plots (yields taken):				
Classical experiments:				
Rothamsted	361	35	237	633
Saxmundham	240	40	100	380
Long-period rotation experiments:				
Rothamsted	176	—	96	272
Woburn	320	128	72	520
Crop-sequence experiments:				
Rothamsted	1011	54	186	1251
Woburn	352	276	—	628
Saxmundham	80	—	—	80
Annual experiments:				
Rothamsted	1495	136	56	1687
Woburn	228	108	56	392
Saxmundham	46	—	—	46
Totals:				
Rothamsted	3043	225	575	3843
Woburn	900	512	128	1540
Saxmundham	366	40	100	506
Total	4309	777	803	5889
Full-scale plots (no yields taken):				
Rothamsted				1228
Woburn				281
Microplots:				
Rothamsted				1490
Woburn				503
All plots total				9391

Spring beans (*Vicia faba*), seasonal variation and maximum yields

We completed the third season, on a fresh site, of the multifactorial, multidisciplinary experiment designed to study the causes of seasonal variation and to determine maximum attainable yields on our soil (*Rothamsted Report for 1976*, Part 1, 150–155 and *for 1977*, Part 1, 123–126).

The treatments were as in 1977 but with some changes of rates. Combinations of eight two-level factors were chosen:

(i) Full irrigation (75 mm) (limiting soil moisture deficit to 25 mm until pod set, 55 mm thereafter), none.
(ii) N at 150 kg ha^{-1}, as 'Nitro-Chalk 26', at flowering, none.
(iii) Aldicarb at 10 kg ha^{-1} to the seedbed, none.
(iv) Benomyl at 13·5 kg ha^{-1} to the seedbed, none.
(v) Fonofos at 5 kg ha^{-1} to the seedbed, none.
(vi) Permethrin at 0·15 kg ha^{-1} as a foliar spray in May and again in June, none.
(vii) Pirimicarb at 0·14 kg ha^{-1} as a foliar spray in May, none.
(viii) Benomyl at 0·6 kg ha^{-1} as a foliar spray in July and again in August, none.

The design used was a half replicate of 2^8 in eight blocks of two whole plots (for irrigation treatment) each split into eight sub-plots.

The season was particularly favourable to beans and, as in 1977, they ripened con-

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TABLE 2

Broadbalk (BK) and Hoos Barley (HB): Yields of crops from selected treatments

Grain, t ha^{-1} and total tubers, t ha^{-1}

Treatments		Wheat after potatoes, beans			Barley			Beans			Potatoes		
		1978	1977	1976	1978	1977	1976	1978	1977	1976	1978	1977	1976
None	BK	3·2	2·5	2·3	—	—	—	2·3	2·4	0·4	11·1	7·0	11·6
	HB*	—	—	—	3·3	2·2	2·6	2·6	1·8	0·5	16·5	9·8	12·3
	HB†	—	—	—	1·0	1·7	0·9	—	—	—	—	—	—
N3PKMg(Na)	BK	6·8	5·6	3·9	—	—	—	4·5	3·5	0·9	38·3	26·1	32·0
	HB*	—	—	—	5·7	6·1	4·5	3·6‡	2·9‡	0·6‡	—	—	—
	HB†	—	—	—	5·3	5·9	3·9	—	—	—	—	—	—
N4PKMg(Na)	BK	6·4	5·8	3·8	—	—	—	3·4	3·8	1·0	48·4	34·9	29·2
	HB*	—	—	—	—	—	—	—	—	—	43·7	43·7	40·3
FYM	BK	7·9	5·2	4·6	—	—	—	5·0	3·3	1·2	32·6	26·9	37·5
	HB†	—	—	—	5·1	5·2	4·6	—	—	—	—	—	—
FYM + N2	BK	8·0	5·8	3·9	—	—	—	3·6	3·0	1·1	40·1	30·2	36·6
	HB†	—	—	—	5·6	6·5	4·4	—	—	—	—	—	—
								Date of planting			9/5	19/4	29/3

* With residues of castor meal, crops in rotation barley, potatoes, beans
† After barley, no castor meal
‡ PKMg(Na)

Symbols: 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}

Yields of wheat of Broadbalk given in Table 2 of the *Report for 1977* were in error. The true yields are given above.

siderably later than usual; all plots were harvested on 5 October. Aldicarb, permethrin and foliar benomyl each increased grain yield and irrigation did so by a smaller amount; nitrogen fertiliser, fonofos and pirimicarb had little effect and seedbed benomyl lessened yield. Foliar benomyl with permethrin or aldicarb, or both, increased the grain yield averaged over other treatments but excluding seedbed benomyl treatment, from 5·7 to 6·4 t ha^{-1} (Table 3).

TABLE 3

Spring beans: effects of aldicarb, permethrin and foliar benomyl on yield

Yields of grain t ha^{-1} (means over other treatments but excluding seedbed benomyl)

	No permethrin		Permethrin	
	None	Foliar benomyl	None	Foliar benomyl
None	5·7	5·9	6·0	6·3
Aldicarb	5·8	6·4	6·2	6·4

Total above-ground dry matter was determined on three occasions. The first sample on 22 June, 10 weeks after sowing, showed a mean total dry matter of 1·9 t ha^{-1} with little effect of treatments except that seedbed benomyl caused a decrease of 0·5 t ha^{-1}. Mean total dry matter had increased to 8·4 t ha^{-1} by 27 July with largest effects from aldicarb (+1·1 t ha^{-1}), permethrin (+0·7 t ha^{-1}) and seedbed benomyl (−1·8 t ha^{-1}). At the third sampling on 24 August the mean was 12·1 t ha^{-1} with largest effects from aldicarb (+1·4 t ha^{-1}), permethrin (+0·7 t ha^{-1}), seedbed benomyl (−1·1 t ha^{-1}) and foliar benomyl (−0·7 t ha^{-1}). (McEwen and Yeoman)

Results from co-sponsors sampling are reported briefly below.

Sitona. On most bean fields at Rothamsted populations of *Sitona* larvae were similar to those in 1977, both in time of maximum abundance and in magnitude, but in this experiment numbers were fewer, reaching a maximum of 4·8 larvae per plant in mid-July on plots not given aldicarb, permethrin or pirimicarb—the three insecticides which significantly lessened larval numbers (Table 4).

TABLE 4

Spring beans: effects of insecticides on Sitona *larvae*

Numbers per plant (means over other treatments) on 11 July

Treatment	Numbers
None	3·6
Aldicarb	1·0
None	2·5
Fonofos	2·1
None	2·9
Permethrin	1·8
None	2·8
Pirimicarb	1·8
SED	±0·35

As in previous years aldicarb caused the greatest diminution in larval numbers; permethrin and pirimicarb were both effective whereas fonofos was not.

Both irrigation and fertiliser nitrogen also lessened larval numbers—by 45 and 33%

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respectively (meaned over other treatments). (Bardner and Fletcher, Entomology Department)

Viruses and vectors. *Acyrthosiphon pisum* (the pea aphid), the main vector of bean leaf roll and other aphid-borne viruses of field beans, was exceptionally rare and only 1–2% of plants in plots without insecticide (aldicarb, permethrin or pirimicarb) showed leaf roll or other virus symptoms when flowering ended in mid-July. (Cockbain and Bowen, Plant Pathology Department)

Fungal diseases. Root disease caused by fungi seemed to be of little importance in 1978 and although superficial blackening developed on roots sooner than in 1977 it was not affected by benomyl applied to the seedbed or by irrigation. The mean disease ratings of tap roots, based on the proportion of blackened roots (*Rothamsted Report for 1976*, Part 1, 153) were 6 and 33% at the end of June and in mid-August respectively and were decreased only by aldicarb and to a smaller extent by fonofos (Table 5).

TABLE 5

Spring beans: effects of aldicarb and fonofos on percent disease rating (16 August)

	Tap roots		Lateral roots	
	None	Fonofos	None	Fonofos
None	41·3	36·5	63·7	57·9
Aldicarb	30·5	23·4	53·8	46·8
SED	2·05		2·94	

In contrast to previous years chocolate spot, *Botrytis fabae* and *B. cinerea*, was prevalent by late July, although it did not become aggressive, and rust *Uromyces fabae* was abundant by the end of August. Benomyl applied as a foliar spray decreased the mean percent leaf area affected in early September by chocolate spot from 8·4 to 2·9% and that affected by rust from 9·6 to 4·2%. It also delayed leaf and stem senescence. (Salt, Plant Pathology Department)

Nematodes. Root lesion nematodes, *Pratylenchus* spp., were fewer in 1978 than in either 1976 or 1977. Populations reached maximum levels of 177 g^{-1} of fresh weight of root and 950 $litre^{-1}$ of soil. Only two species of this genus were found this year, *P. neglectus* and *P. thornei*, the latter accounting for up to 73% of the total population. *P. thornei* is moderately pathogenic to beans. *P. pinguicaudatus*, the highly pathogenic species present in previous years, was not found. Invasion was faster this year, counts in May showed a maximum of 177 *Pratylenchus* spp. g^{-1} of fresh weight of root compared with 98 g^{-1} in 1977 and 73 g^{-1} in 1976. This early invasion is attributed to above-average spring rainfall. Above-average rainfall in June probably lessened the damage that the heavy initial invading numbers might otherwise have caused.

Aldicarb significantly reduced numbers of *Pratylenchus*. Seedbed benomyl controlled populations of *Tylenchus* spp., *Aphelenchus* spp., Dorylaimids and Rhabditids—species which feed predominantly on fungi and detritus. (Webb, Nematology Department)

Nodulation and nitrogen fixation. Nitrogenase activity was estimated by the acetylene reduction assay on the three occasions when total above-ground dry matter was determined.

In contrast to 1976 and 1977 the first samples were taken 1 week after the application of nitrogen fertiliser but nitrogenase activity was not significantly affected probably

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because the fertiliser had not been washed into the soil in this period. Nitrogen fertiliser significantly reduced nitrogenase activity per plant by 37 and 31% respectively on the second and third occasions. Benomyl applied to the seedbed again had a small but significant deleterious effect on nodule function (8·3 and 10·4 μmol ethylene per plant h^{-1} with and without benomyl respectively) at the first sampling. Irrigation slightly increased nitrogenase activity on all occasions. Aldicarb significantly increased nitrogenase activity, the effect becoming greater on each sampling occasion.

The effects of treatments on percentage of nitrogen in the grain were slight; consequently effects on total uptake of nitrogen in grain were closely related to effects on yield. Aldicarb, permethrin and foliar benomyl together increased total N uptake from 206 kg ha^{-1} to 248 kg ha^{-1}. (Day, Roughley and Witty, Soil Microbiology Department)

Lupins

An experiment to compare yields of grain lupins, *Lupinus albus*, var. Kievsky mutant, at varying seed rates and row-spacings in the presence and absence of a range of pathogen control measures, was laid down in the spring. 4-in (10-cm) mesh netting failed to keep out domestic pigeons, which walked through the mesh at the sides of the cage. They damaged the crop so severely soon after it germinated that the experiment had to be abandoned, but observations were made on the effects on the surviving plants of aldicarb and drazoxolon applied to the soil. A proprietary mixture of terbutryne and terbuthylazine ('Opogard') was applied before emergence to control weeds but was only partially effective, probably because of poor competition by the thin crop. The crop was harvested by combine harvester on 12 October when the moisture content of the grain was 38% in spite of crop desiccation by diquat 10 days earlier. A test cut taken from an area least damaged by birds indicated a yield of 1·73 t ha^{-1} of grain at 85% dry matter.

This is the fourth season in which we have grown Kievsky lupins sown in spring. Best yields have been in the range 1·7–2·2 t ha^{-1}. These yields do not justify further work on spring sowings. We are trying to overcome problems associated with autumn sowings and hope that, if we are successful, we can achieve worthwhile yields. (Wilson, with Cockbain and Salt, Plant Pathology Department)

Professor Laloux's method of growing wheat

A factorial experiment was done at Rothamsted testing aspects of the method of growing wheat advocated by Professor Laloux (State Faculty of Agricultural Sciences, Gembloux, Belgium) (*Rothamsted Report for 1976*, Part 1, 156). All combinations of the following treatments were tested in a single replicate of 3 × 6 × 2 × 2:

(i) Precision sown with the Stanhay drill with seeds spaced 5 cm (2 in) apart within rows spaced 10 cm (4 in) apart (120 kg seed ha^{-1}), or sown by the Nordsten drill with seeds irregularly spaced within rows 10 cm apart at 120 kg seed ha^{-1} and at 240 kg seed ha^{-1}.

(ii) Six combinations of rates and times of applying nitrogen (as 'Nitro-Chalk') (kg N ha^{-1}):

	7 March	17 April	6 June
(1 + 3 + 1)	25	75	25
(1 + 4 + 1)	25	100	25
(0 + 4 + 0)	0	100	0
(0 + 5 + 0)	0	125	0
(0 + 6 + 0)	0	150	0
(0 + 4 + 1)	0	100	25

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(iii) None, chlormequat chloride (CCC) at 1·7 kg ha^{-1} at leaf sheath erect stage on 25 April.
(iv) None, fungicide—tridemorph at 0·45 kg + carbendazim at 0·21 kg + maneb at 1·33 kg + sulphur at 2·4 kg ha^{-1} on 12 June and 6 July.

The variety Maris Huntsman was grown and the mean yield was 9·0 t grain ha^{-1}. Yield was not increased by precision sowing nor by the greater seeding rate. Where nitrogen was all applied in April (our standard practice at present) the smallest rate gave significantly less yield than the mean but the two larger rates both gave 9·1 t grain ha^{-1}.
Dividing the nitrogen between three dates (Laloux method) was not beneficial, relative to the same total quantity applied singly, at the smaller rate tested but was for the larger rate of N which gave a mean yield of 9·5 t grain ha^{-1}. Unexpectedly this benefit was greater at the larger seed rate. Chlormequat gave a mean yield increase of 0·3 t ha^{-1} but there was little increase from the fungicides, applied in a year in which the incidence of foliar disease on wheat was small. (McEwen, with Moffitt, The Farms)

Herbage crops. Factors affecting yield

The experiment, started in 1977 (*Rothamsted Report for 1977*, Part 1, 123), in which we are co-operating in a joint ADAS/ARC project, received all planned treatments in 1978. These include, at both Rothamsted and Woburn, comparisons of ryegrass, ryegrass/clover mixtures, clover alone and lucerne alone, tests of cutting frequency (three and six times per year), nitrogen rates, pathogen control and irrigation.
Unfortunately bullocks entered the Woburn experiment and damaged many of the plots in the three-cut system, consequently full data are available only for plots in the six-cut system. Total yields of dry matter from these (Table 6) show much larger responses to nitrogen and irrigation at Woburn. With neither, yields of ryegrass and

TABLE 6

Herbage crops: effects of species, nitrogen rates and irrigation

Total dry matter (6 cuts) t ha^{-1}

Species	N rate*	Rothamsted None	Rothamsted Irrigated†	Woburn None	Woburn Irrigated†	Mean
Ryegrass (S.23)	0	2·5	2·7	1·1	1·8	2·0
	100	5·2	5·2	2·4	5·6	4·6
	200	9·2	9·4	6·9	8·2	8·4
	300	10·2	10·5	8·1	11·8	10·2
	400	13·3	13·1	9·4	14·6	12·6
	500	11·7	14·1	10·4	15·4	12·9
	600	10·6	13·4	11·7	15·8	12·9
S.23/Blanca clover mixture	0	10·2	10·7	7·0	12·4	10·1
	100	10·6	11·2	9·8	13·1	11·2
	200	11·4	11·6	10·0	12·9	11·5
	300	11·9	12·4	10·3	14·6	12·3
	400	13·0	12·5	11·9	14·3	12·9
S.23/S.100 clover mixture	0	9·4	9·4	4·8	10·1	8·4
	100	9·8	11·4	8·5	11·8	10·4
	200	11·2	12·2	8·5	13·1	11·3
	300	12·4	13·4	8·5	12·7	11·8
	400	11·7	13·4	12·0	15·6	13·2
Mean		10·2	11·0	8·3	12·0	10·4

* N total year^{-1} divided equally between cuts
† Irrigated to reduce a deficit of 25 mm to nil (175 mm water at Rothamsted, 238 mm at Woburn)

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ryegrass/clover mixtures were substantially less at Woburn than at Rothamsted but with both maximum yields at Woburn were about 2 t ha^{-1} greater. Productivity of the mixture of Blanca clover and S.23 ryegrass was greater than S.100 clover with S.23 when no nitrogen was given, particularly at Woburn, but was generally less at the largest rate of nitrogen.

Pathogen control treatment (aldicarb at 10 kg ha^{-1} in spring; phorate at 5 kg plus benomyl at 0·5 kg after each cut) was applied mainly to plots in the three-cut system. The limited results available suggest that effects were much less than in 1977 except at Woburn where this treatment increased the yield of clover by 1·0 t ha^{-1}. (McEwen, with Day, Roughley and Witty, Soil Microbiology Department, Jenkyn and Plumb, Plant Pathology Department, Johnston, Soils and Plant Nutrition Department, Henderson, Entomology Department, Legg, Physics Department, and Spaull, Nematology Department)

The effects of subsoiling and of incorporating P and K into the subsoil

The experiment testing the effects of hand subsoiling and incorporating a large dressing of P and K (1930 kg P_2O_5 ha^{-1} and 460 kg K_2O ha^{-1}) either into the topsoil or subsoil (*Rothamsted Report for 1974*, Part 1, 132 and *Rothamsted Report for 1977*, Part 1, 122) continued in spring barley alone following the four crops, potatoes, wheat, sugar beet, barley, previously grown in rotation.

The treatments, applied once only in the summer/autumn 1973, continued to show substantial effects. Mean yields are shown in Table 7.

TABLE 7

Hand-applied subsoiling and deep PK experiment

Yields of barley t ha^{-1}

Crop in 1977	None	Subsoiling alone	P and K to topsoil	P and K to subsoil
		SED, horizontal comparisons only, ± 0·48		
Potatoes	5·8	7·1	6·8	7·4
Wheat	4·7	4·8	5·0	5·8
Sugar beet	6·6	7·1	6·6	7·4
Barley	4·1	3·6	4·1	4·4
Mean	5·3	5·6	5·6	6·3
SED ± 0·24				

Yields of barley after either cereal were much smaller than after the root crops but with all previous crops largest yields came from incorporating P and K into the subsoil. (McEwen)

Two new experiments were started in autumn 1977 at Rothamsted and Woburn comparing the effects of mechanical subsoiling by a standard (wingless) subsoiler, the National College of Agricultural Engineering (NCAE) winged subsoiler and the Wye College double digger. The NCAE and Wye machines were also used for the mechanical incorporation into the subsoil of the same large dressing of P and K used in the earlier experiment. The test crop was barley given basal compound fertiliser 20–14–14, combine

TABLE 8

Mechanical subsoiling and deep PK experiment

Yields of barley t ha^{-1}

	None	Standard subsoiler	NCAE subsoiler	NCAE sub-soiler + PK to subsoil	Wye double digger	Wye double digger + PK to subsoil	SED
Rothamsted	4·4	4·6	4·6	5·1	5·2	6·0	± 0·43
Woburn	4·3	4·9	3·6	2·9	5·3	5·5	± 0·44

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drilled, at standard farm practice rates (440 kg ha^{-1} at Rothamsted, 400 kg at Woburn). At both stations the Wye double digger incorporating P and K into the subsoil increased yields substantially (Table 8) suggesting that this machine can be an effective replacement for hand operations. (McEwen, 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)

Leafless peas

We repeated the experiments done in 1977 on pathogen control at Rothamsted and Woburn (*Rothamsted Report for 1977*, Part 1, 127). Effects of treatments are reported by co-sponsors in other departments (pp. 91–92). In 1977 lodging was so severe on both sites that yields could be obtained only by hand-harvesting. In 1978 lodging was again severe and at Woburn hand-harvest was necessary. At Rothamsted it was just possible to harvest by combine. This was aided by desiccation with diquat a week before harvest. (McEwen, with Cockbain and Salt, Plant Pathology Department, Fletcher and Macaulay, Entomology Department and Whitehead, Nematology Department)

Staff

Dyke spent a year, ending in the autumn, writing up results of several series of experiments (see papers Nos. 1 and 2) and preparing a paper on the analysis of field experiments taking into account smooth variation of fertility across sites.

McEwen attended a joint ADAS/ARC Symposium on 'Maximising Yields of Crops' at Harrogate from 17–19 January and presented a paper on 'Practical Field Experimental Aspects and Experiences in the Conduct of a Multidisciplinary Experiment on Spring-sown Field Beans (*Vicia faba*)'. He also attended a meeting of the Society of Chemical Industry on Soil/Plant/Water Relationships on 18 April and presented a paper on 'The effects of subsoiling and incorporating P and K in the subsoil on crop yield'.

R. W. Allingham, S. P. Kerr, A. C. Pattison and C. J. Stafford resigned. P. H. Finch rejoined the Section after spending 6 years in the Nematology Department. H. L. Jones transferred from the Farm to replace Kerr.

Publications

Research Papers

1 Dyke, G. V. & Slope, D. B. (1978) Effects of previous legume and oat crops on grain yield and take-all in spring barley. *Journal of Agricultural Science, Cambridge* **91,** 443–451.

2 Prew, R. D. & Dyke, G. V. (1979) Experiments comparing 'break-crops' as a preparation for winter wheat followed by spring barley. *Journal of Agricultural Science, Cambridge* **92,** 189-201.

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