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Full Table of Content

Woburn Experimental Station

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WOBURN EXPERIMENTAL STATION

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January rain (2·93 in.) exceeded the average (2·13 in.), but February was unusually dry (0·34 in.) and allowed cereal sowing and potato planting to start early. March was exceptionally cold and rather dry, and monthly mean temperatures were below average until October (Table 1).

TABLE 1

Monthly mean temperatures (means of maximum and minimum), total rainfall and daily means of bright sunshine (departures from long-period means in brackets)

Month	Mean temperature (° C.)	Rainfall (in.)	Bright sunshine (daily mean) (hours)
March	2·2 (−3·4)	1·26 (−0·32)	3·16 (−0·75)
April	7·3 (−0·8)	1·71 (−0·22)	4·20 (−0·71)
May	9·9 (−1·0)	2·40 (+0·20)	5·03 (−1·01)
June	13·1 (−1·0)	0·29 (−1·41)	8·11 (+1·50)
July	14·7 (−1·6)	2·00 (−0·44)	3·79 (−2·25)
August	14·7 (−1·1)	3·02 (+0·69)	4·94 (−0·92)
September	12·5 (−1·1)	3·15 (+1·12)	4·38 (−0·25)
October	10·1 (+0·4)	1·18 (−1·12)	3·35 (−0·04)

Field Experiments

Continuous wheat and barley land. In three years of successive cropping with wheat and with barley on the "continuous wheat and barley" land wheat yielded more on the old barley land than on the old wheat land, whereas barley yielded more on the old wheat land.

As the take-all fungus (*Ophiobolus graminis*) was prevalent, spring oats (Condor) were grown on both lots of land in 1962, and harvested by plots, to see whether previous cropping affected yield.

TABLE 2

Mean yields of grain and straw (cwt/acre) in plots 1 and 7 (unmanured) and 11b (farmyard manure) and 6 (NPK) of "continuous wheat" and "continuous barley" land in period 1959–62.*

	"Continuous wheat" land		"Continuous barley" land	
	Grain	Straw	Grain	Straw
1959–61 wheat	17·2	23·3	21·6	29·1
1962 oats after wheat	23·9	12·1	27·0	12·9
1959–61 barley	22·2	15·3	19·8	12·6
1962 oats after barley	26·2	13·9	28·9	15·8
1962 oats (mean)	25·1	13·0	28·0	14·4

* N as $NaNO_3$.

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Table 2 shows that oats did better on the old barley land than on the old wheat land, which may mean the old barley land is the more fertile. However, on both lots of land oats did better after barley than after wheat, though the difference was small on the old barley land. There was no evidence that take-all or other disease accounted for the difference in oat yields, but cereal-root eelworm (*Heterodera avenae*) was noted over the whole area of the experiment.

Ley–arable rotations experiment. This experiment, laid down in 1937, compares four rotations, comprising a 3-year ley, 3 years of lucerne, and arable rotations with and without a 1-year ley, followed by two test crops. Half the plots continue the same rotation in successive 5-year periods, and half alternate between the ley and arable rotations. Until 1955 the first test crop was potatoes and the second barley. Since 1956 sugar beet has replaced potatoes as the first test crop, because potato-root eelworm (*Heterodera rostochiensis*) was causing losses, particularly in the arable rotation, where potatoes were also grown as a treatment crop.

The plots are subdivided for farmyard manure applied at 15 tons/acre to the first test crop. The same "subplots" always receive farmyard manure and are referred to later as the plots "with dung".

It was originally intended that inorganic fertilisers should be used liberally and that the different rotations should receive the same amounts of phosphate and potash, but although the levels given at the start were generous compared with farm practice at the time, they were small compared with current usage.

TABLE 3

Mean yields of potatoes in period 1941–55, as total tubers (tons/acre)

	Ley	Lucerne	Arable with hay	Arable with roots	Mean
With dung	13·91	14·13	12·86	12·03	13·23
Without dung	12·30	11·23	10·05	9·29	10·72
Difference	1·61	2·90	2·81	2·74	2·51

Table 3 shows that the mean potato yields were increased by dung in all rotations, but least after grazed ley. Mann and Boyd (*J. agric. Sci.* (1958), **50**, 297–306) ascribed much of the difference in potato yield between grazed ley and other rotations to inadequate manuring. Plant analyses show that arable crops without dung remove more potassium than is added, whereas farmyard manure supplies more than is removed.

Table 4 shows that the yields of sugar beet for 1956–61 were affected by rotation and dung in much the same way as the potatoes.

Because of the differences in the amount of potassium removed by the different crops, which meant that potassium was accumulated in some plots and being depleted in others, the practice of applying equal fertiliser dressings to all rotations was abandoned. A scale of fertiliser applications was introduced in 1962, designed to eliminate potassium differences. Basal dressings of fertilisers to the crops in the treatments years were

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TABLE 4

Mean yields of sugar-beet roots (washed) in period 1956–61 and 1962 (tons/acre)

	Ley	Lucerne	Arable with hay	Arable with roots	Mean
			1956–61		
With dung	18·10	17·03	16·17	17·30	17·15
Without dung	15·84	14·09	12·35	13·11	13·84
Difference	2·26	2·94	3·82	4·19	3·31
			1962		
With dung	15·22	15·35	14·87	15·45	15·22
Without dung	13·68	13·73	13·32	13·45	13·55
Difference	1·54	1·62	1·55	2·00	1·67

increased to suit each crop, and the following changes made for the first test crop (sugar beet):

(i) Applications of potash to correct differences indicated by soil analyses.

(ii) Basal phosphate on plots without dung was increased to 0·9 cwt P_2O_5/acre (previously 0·72 cwt/acre), and lessened to 0·3 cwt P_2O_5/acre on plots with dung (previously 0·72 cwt/acre).

(iii) The amount of potash given to the plots without dung was increased from 0·9 to 3·0 cwt K_2O/acre.

Table 4 shows that after these treatments the differences in yields of sugar beet after different rotations were much smaller than previously and the response to dung was also less and more uniform.

Irrigation experiment. Proctor barley was grown with and without irrigation and at two levels of nitrogen (0·2 and 0·4 cwt N/acre). Water was first given on 3 May, when the irrigated plots received the equivalent of ½ in. of rain, but no more was given that month because rain exceeded the average by 0·2 in. and was well distributed (27 days with 0·01 in. or more). June had only 0·29 in. rain, and irrigation equivalent to 2¼ in. rain was given; after this there was only one watering, on 3 July, when ¾ in. was given.

TABLE 5

Soil moisture as mean percentage of the weight of samples taken at 9–18 in., in two irrigated and two unirrigated lucerne plots

Sampling date	4 April	18 July	21 August	4 October
With irrigation	11·6	7·4	9·4	11·0
Without irrigation	10·4	4·0	7·8	10·0

The unirrigated barley showed symptoms of the condition described as "drought scorching", especially on some of the plots given most nitrogen; unirrigated barley gave a mean yield of 23·4 cwt grain/acre and irrigated barley 38·5 cwt grain/acre.

Soil moisture was measured at two depths (0–9 in.; 9–18 in.) on two irrigated plots and two unirrigated plots carrying lucerne. Table 5 shows

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the results at 9–18 in., where moisture changes are particularly interesting. The irrigated lucerne received the equivalent of 2¾ in. of rain in June and 1¼ in. in July.

The lucerne was drilled in April 1962 and cut three times, on 17 July, 20 August and 3 October; only the July cutting was increased by irrigation from 14·4 to 26 cwt dry matter/acre.

Market-garden experiment. The numbers of red-beet plants in different plots of the market-garden experiment differ greatly. H. H. Mann and H. D. Patterson (this Report, pp. 186–193) report more in the period 1944–60 on plots given organic manures than on those given fertilisers. In 1961 this was also true on plots with organic manures (78·3 thousands/acre) and 66·5 thousands/acre on plots receiving fertilisers. In 1962 sowing at two depths was compared on plots split longitudinally instead of the previous one shallow sowing. Red-beet seed, variety Detroit, was drilled at about 11 lb/acre on 27 April in rows 19 in. apart. Subsequent observations indicated that the two depths were about ¾ in. and 1½ in., referred to later as "shallow" and "deep" respectively.

On 29 May the seedlings per foot length of row were counted before thinning; the "deep" sowing on plots with and without organic manures averaged 91 thousands/acre, and the "shallow" sowing 152 thousands/acre. Growth was unsatisfactory and many bolted, and the crop was lifted prematurely on 12 July.

Green-manuring experiment. Results from this experiment since 1955 are summarised by Barnes and Clarke elsewhere in the Report (pp. 193–197). Potato-root eelworm (*Heterodera rostochiensis*) was prevalent in 1962, and the Ulster Chieftain yielded only 3 tons tubers/acre, half the mean yield of the previous 7 years.

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