ROTHAMSTED RESEARCH

# Report for 1956

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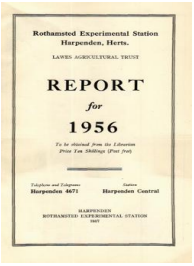


## Woburn Experimental Station

### H. H. Mann

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# WOBURN EXPERIMENTAL STATION

H. H. MANN

## SEASON

The year 1956 brought a spring drought, a very wet summer and a damp but not very rainy autumn, while temperatures were low during the greater part of the year. In fact, after May, the mean maximum temperature for each month was considerably below normal as the following figures show :

TABLE 1

*Mean maximum temperatures*

| | Normal, ° F. | 1956, ° F. | Deficiency in 1956, ° F. |
|---|---|---|---|
| June ... ... ... | 66·8 | 61·7 | 5·1 |
| July ... ... ... | 70·4 | 68·1 | 2·3 |
| August ... ... ... | 69·6 | 63·9 | 5·7 |
| September ... ... | 64·7 | 64·4 | 0·3 |
| October ... ... | 56·7 | 55·0 | 1·7 |
| November ... ... | 48·5 | 47·2 | 1·3 |

Low temperatures during the growing season had a serious effect on the yields of many crops, including both winter- and spring-sown cereals, and, especially, exotic crops which, in any case, are only

TABLE 2

*Meteorological records for* 1955–56

| Month | Rainfall: Total fall, inches | Rainfall: No. of rainy days | Bright sunshine, hours | Temperature: Max., ° F. | Temperature: Min., ° F. | Temperature: 1 ft. in ground, ° F. | Temperature: Grass min., ° F. |
|---|---|---|---|---|---|---|---|
| 1955 | | | | | | | |
| October ... | 1·79 | 13 | 116·1 | 55·5 | 40·4 | 49·4 | 36·0 |
| November ... | 1·26 | 14 | 52·1 | 49·6 | 37·5 | 43·9 | 32·8 |
| December ... | 2·28 | 20 | 61·1 | 48·0 | 35·4 | 41·0 | 31·9 |
| 1956 | | | | | | | |
| January ... | 3·98 | 21 | 62·8 | 43·3 | 32·0 | 37·5 | 29·5 |
| February ... | 0·54 | 11 | 66·0 | 35·5 | 22·7 | 33·6 | 22·1 |
| March ... | 0·77 | 7 | 149·5 | 50·6 | 34·5 | 40·6 | 29·1 |
| April ... | 1·35 | 8 | 148·6 | 52·4 | 33·8 | 45·0 | 29·8 |
| May... ... | 0·43 | 5 | 225·2 | 64·5 | 42·3 | 54·2 | 37·3 |
| June ... | 2·48 | 17 | 139·3 | 61·7 | 47·2 | 57·1 | 43·7 |
| July... ... | 3·69 | 13 | 162·6 | 68·1 | 52·5 | 62·1 | 49·7 |
| August ... | 4·19 | 22 | 146·4 | 63·9 | 49·1 | 58·1 | 46·6 |
| September ... | 2·16 | 11 | 98·8 | 64·4 | 50·4 | 56·9 | 47·5 |
| October ... | 1·50 | 15 | 108·4 | 55·0 | 41·0 | 49·6 | 38·2 |
| November ... | 0·75 | 11 | 66·8 | 47·2 | 35·9 | 41·9 | 32·7 |
| December ... | 2·93 | 21 | 20·1 | 39·1 | 37·8 | 41·0 | 34·3 |
| Total or mean for 1956 ... | 24·77 | 162 | 1,394·5 | 53·8 | 39·9 | 48·1 | 36·7 |

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grown with difficulty in England. On the other hand, the heavy rainfall from June to September enabled root crops to give large yields. Grass was short in spring, rather too abundant in summer and more or less normal in autumn. The meteorological records from October 1955 to the end of 1956 are shown in Table 2.

## Field Experiments

The field experiments at Woburn are now conducted under the direction of the Field Plots Committee at Rothamsted, and that committee will report on them separately so far as the yields are concerned. There are, however, a few points in connection with them that may be recorded here.

### *Permanent wheat and barley*

The year 1956 is the eightieth since the Woburn Station was started in the autumn of 1876 with the permanent wheat and barley experiments, which still exist. On these plots no crop other than wheat or barley respectively has been grown, though there have been a number of years of fallow due to difficulties in controlling weeds, especially twitch grasses (*Agrostis gigantea*), which necessitated a period of rest to clean the land. In recent years there has, moreover, been an increase in acidity on almost all the plots on this lime-deficient land, and at present an attempt is being made to rectify this by applying carbonate of lime according to need, in order to bring all plots to about the original pH value of 6·0. At the same time, an attempt is being made to do away with twitch by treatment with trichloracetic acid. At present it is not clear how effective this is, but a preliminary test in June 1956 showed a decrease in the amount of twitch amounting up to 80 per cent. At the same time, there is the possibility that the land, by long cultivation with one crop, is losing its power to grow that crop even when sufficient manurial constituents are present. This suspicion was voiced by Russell in 1940 in his full account of the Rothamsted wheat experiments, published by the Commonwealth Bureau of Soil Science, and the following up of this line will be one of the great interests in the future of these experiments.

### *Potato root eelworm at Woburn*

Among the rather disquieting features of 1956 has been the discovery that many of the fields where potatoes have been grown frequently are badly infected with potato-root eelworm (*Heterodera rostochiensis*). Already in 1955 its presence had unfortunate consequences in one of the blocks in the ley–arable experiment, and its abundance there led to an examination of most of the fields on the farm. Certain of the fields, notably Butt Furlong and Long Mead, were found to be so badly affected that no potato crop can be grown on them for several years to come. In other cases, the infection was very much slighter, and one experiment in Butt Close was laid out with potatoes. Unfortunately it proved to be infected in patches, and consequently it is very unlikely that reliable results will be obtained from the experiment. Arrangements have now been made for the intensive study of this pest by the Nematology

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Department, and a special area of the farm has been allotted for the purpose apart from a general study of the increase or decrease of the pest on other areas.

*Ley–arable and green-manuring*

In two of the long-term experiments, namely those on green manuring and on the value of leys in maintaining the fertility of land, the results are now available for many years—in the former case from 1936 to 1953 and in the latter from 1938 to 1955. These results are now being worked up for complete publication. In the former case this is being done by D. A. Boyd and H. H. Mann, and in the latter by H. H. Mann. In the experiment on the value of leys in the maintenance of fertility, a number of fresh points have recently arisen, notably the question of potash exhaustion, and the investigation of this has been taken up intensively by the Chemistry Department at Rothamsted. The results so far available will be dealt with in the forthcoming publication on the green-manuring experiment, which will also deal with a number of points which have recently arisen suggesting that the moisture condition of the soil when green manures are buried and the percentage of nitrogen in the material used are perhaps the most vital factors in determining the value of green-manuring.

*Relative effects of nitrogenous manures on grain and straw production*

One interesting point has arisen from recent experiments on various quantities of nitrogen (as " Nitro-Chalk ") applied to spring wheat and barley. In these experiments, dressings of 2, 4 and 6 cwt. " Nitro-Chalk "/acre were applied to the crops, and the relative effect of the applications on the yield of grain and of straw were determined. In all cases it was found that while the increase in nitrogen always led to an increase in grain, there was at the same time a far larger increase in the amount of straw. In one experiment, for instance, it was found with spring wheat, taking the amount of grain as 100, the amount of straw was as follows :

| | |
|---|---|
| No Nitrogen ... ... ... ... ... | 133 |
| 2 cwt. " Nitro-Chalk " ... ... ... | 154 |
| 4 cwt. " Nitro-Chalk " ... ... ... | 169 |
| 6 cwt. " Nitro-Chalk " ... ... ... | 180 |

These figures are based on samples drawn from the plots just previous to harvest. Similar results have been obtained with barley.

*Irrigation experiment*

In 1956 irrigation has been of little or no value, except in spring, when there was a drought after the barley was sown, and consequently the watered barley was distinctly better. The yields of barley grain are shown in Table 3.

There was thus an increased yield due to irrigation of 5·7 cwt./acre (25 per cent) with low nitrogen, and of 2·8 cwt./acre (9 per cent) with high nitrogen in this rather unusual season. It will also be noticed that irrigation has increased the proportion of straw.

The effect of irrigation on cut grass was almost confined to the

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TABLE 3

*Yield of barley*

| Treatment | Yield per acre, cwt. | Straw as percentage of grain |
|---|---|---|
| *Not irrigated:* | | |
| Low nitrogen ... ... ... | 22·4 | 83·5 |
| High nitrogen ... ... ... | 31·2 | 84·7 |
| *Irrigated:* | | |
| Low nitrogen ... ... ... | 28·1 | 103·2 |
| High nitrogen ... ... ... | 34·0 | 116·6 |

spring, when there was drought; for the rest of the season it made little difference to the yield. This is shown by the following figures:

TABLE 4

*Yield of grass*

| Treatment | Dry matter per acre: 1st cutting, 28 May, tons | Dry matter per acre: Remaining 5 cuttings, 22 June to 19 November, tons | Total, tons |
|---|---|---|---|
| *Not irrigated:* | | | |
| Low nitrogen ... ... | 0·70 | 2·08 | 2·78 |
| High nitrogen ... ... | 0·86 | 3·23 | 4·09 |
| *Irrigated:* | | | |
| Low nitrogen ... ... | 1·32 | 2·29 | 3·61 |
| High nitrogen ... ... | 1·55 | 3·43 | 4·98 |

The pure stand of cocksfoot which was sown three years ago is still very pure, and even the minor grasses with which it was contaminated have largely disappeared. The sward, which will apparently stand further years, has been left down for 1957.

*Soils of the Woburn farm*

On the Woburn farm there are two types of soil well represented, namely a light loam based on the Lower Greensand, on which most of the experiments have been and are being conducted, and a rather impervious silt soil overlying clay. On the former class of soil one of the very striking features has been the lack of response to potash or phosphate. This was shown by several experiments in 1956; but an experimental crop of beans on the heavier soil gave quite different results. Although phosphate gave no response, the effect of potash was very great on this land, for it produced an increase in grain of 45 per cent with a moderate dressing and even of 68 per cent with a high one.

*New crops*

The work of testing the suitability of some new crops for this country has continued, and the fact that 1956 had such a cold and

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wet summer lent special interest to their behaviour under these circumstances.

*Maize*

In the last report it was noted that for a period of seven years it had been possible to get a mean yield of 34·7 cwt./acre of grain from hybrid maize, using seed obtained in the early years from Wisconsin (U.S.A.) and more recently from Holland. This made the growing of maize for grain under suitable conditions a practical proposition, at least for smallholders. It was therefore of special interest to see how far the crop would stand up to the cold and wet conditions in 1956, using seed of the best Dutch variety (Prior). The seed was sown on 28 April, and the crop was harvested from 16 October to 29 November. In spite of the cold, wet summer, it grew well, but was late in forming ears, and although they were small, in the end there were 1·47 ears per plant. In the damp autumn harvesting was late and difficult and the grain had to be artificially dried. A yield of 14·9 cwt./acre of dry grain was obtained, which is less than half the mean yield of the previous seven crops. Though this does not necessarily condemn the crop for local use, it shows that, while a normal crop of over 30 cwt./acre can be usually obtained, a much smaller yield in at least one year in eight may be expected.

*Soya beans*

If the cold summer gave a small crop of maize, its effect on soya beans was much worse. The few rows which were grown in 1956 never came to seed, and confirmed the conclusion (recorded in the last report) that soya beans seem to have little future in this country.

*Fodder crops*

*Sweet lupins.* The suitability of sweet lupins for semi-acid soils such as those at Woburn is now clear, and 1956 has shown that they can do well in a wet summer, when grown for fodder to be used in September or October. On this point we now have records for every year since 1951 :

TABLE 5

*Yield of sweet lupins*

| Year | Green stuff per acre, tons | Dry matter, % | Dry matter per acre, tons |
|---|---|---|---|
| 1951 ... ... ... | 14·1 | 12·6 | 1·70 |
| 1952 ... ... ... | 15·7 | 12·1 | 1·90 |
| 1953 ... ... ... | 27·8 | 12·4 | 3·45 |
| 1954 ... ... ... | 16·1 | 9·6 | 1·55 |
| 1955 ... ... ... | 3·0 | 14·9 | 0·45 |
| 1956 ... ... ... | 20·8 | 13·1 | 2·77 |
| Mean ... ... ... | 16·3 | 12·5 | 1·97 |

These figures suggest that on soil similar to that at Woburn, namely a light or sandy loam slightly acid (pH 6·0 or less) in fairly good agricultural condition, an average yield of over 15 tons of green fodder can be obtained in September. Tests showed that about



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25 per cent or more of this would be inedible. In a wet summer the yield may be much higher than this, but in such seasons there will be little or no good seed. By reaping earlier the percentage of inedible matter could be decreased, but with a corresponding loss of yield. It appears that there is a great opening for growing sweet lupins as a fodder crop on suitable land in this country.

*Serradella.* The same adaptation to acid soils has been found with serradella, which has been grown for a number of years as a fodder crop for use in September when grass is beginning to fail. The seed used at Woburn was originally obtained from the U.S.A., but it has been possible to maintain our area with home-grown seed obtained in the drier years. This crop contrasts with sweet lupins in that it is eaten greedily by all classes of stock. In wet years, such as 1954 and 1956, it gave large yields of green stuff in September, especially in 1956, when 30·16 tons/acre were grown containing 10·9 per cent dry matter, or 3·29 tons/acre of dry forage. On the other hand, no seed was obtained in 1956, while in the dry season of 1955 it was abundant and of good quality.

*Birdsfoot trefoil.* Types of birdsfoot trefoil developed in the U.S.A. have roused much interest in recent years. An advantage is that they will grow on poorer land than clover and give a good yield of fodder, particularly in the latter part of the season, for at least three and possibly more years. The crop was grown at Woburn from 1952 to 1954 in two varieties, and gave very good yields in the latter part of the year of sowing, very high yields in the second year and moderate produce in the third year, when, however, the crop became overrun with grass. It was found that the crop grew very slowly in early summer but abundantly after the middle of July.

A new consignment of seed was obtained in 1956, and, though it came very late, it was sown in the middle of June. It grew slowly at first, but vigorously after July. When cut on 23 October it gave 4·7 tons green stuff/acre containing 16·6 per cent dry matter or 0·77 tons dry matter/acre. It has now been left for a second year. These American improved types of birdsfoot trefoil seem to have prospects as fodder crops in this country.

*Jerusalem artichokes.* Last year's report contained an account of the first two years of experiments with an improved type of Jerusalem artichoke introduced into this country from Germany under the name "Topine". Tests with this crop have been continued in 1956, and in the very different conditions of the three years in question we have obtained yields as follows :

TABLE 6

*Yield of Jerusalem artichokes*

| | Artichoke tops | | | Artichoke tubers | |
|---|---|---|---|---|---|
| | Green stuff per acre, tons | Dry matter, % | Dry matter per acre, tons | Per acre, tons | Per plant, lb. |
| 1954 ... ... | 17·6 | 18·8 | 3·34 | 8·5 | 0·73 |
| 1955 ... ... | 9·4 | 30·1 | 2·82 | 14·5 | 1·50 |
| 1956 ... ... | 14·1 | 22·2 | 3·12 | 13·5 | — |
| Mean (3 years) ... | 13·7 | | 3·09 | 12·2 | |

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Since artichokes would be most useful as pig food, the results were compared with an adjoining plot of Majestic potatoes, similarly manured with a dressing of 10 cwt./acre of potato fertilizer. A yield of 19·8 tons of potatoes/acre was obtained, and this yield must be compared with those given above for the artichokes. In the latter case it is presumed that the artichoke tops would be converted into silage after being torn up in a suitable machine.

On the whole, it can be said that the crop, in the special luxuriant types now available, is promising. Only further trials can determine its ultimate utility in British agriculture.

## Laboratory Work

The laboratory work at Woburn is almost exclusively related to the field experiments and has, in 1956, been very largely taken up with the analysis of soil and produce from the ley–arable experiment, and with the determination of the permanence of organic matter added to soil, as farmyard manure, sewage sludge and composts. The results will be included in reports of the various experiments involving these materials.

The work in the laboratory has fallen almost entirely on Mr. Barnes, the chemist to the Station, and his staff, and they have been fully employed in this and other directions during the year.

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