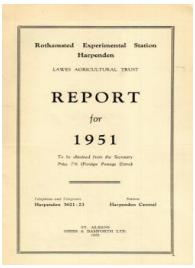
ROTHAMSTED RESEARCH

# Rothamsted Report for 1951

*Full Table of Content*




## Woburn Experimental Station

### H. H. Mann

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# WOBURN EXPERIMENTAL STATION

By H. H. MANN

## SEASON

The year 1951 was the second in succession with an abnormally large rainfall at Woburn, and this exceeded even the earlier year in amount in almost every month. This was accompanied by coldness in almost every month, where, except in July, the mean temperature was even lower than in the previous year. This condition of things prevailed until September, 1951, after which, if anything, the season was a little warmer than usual. The spring was especially wet, leading to very late sowing or planting of spring crops, and being specially unfavourable for the semi-tropical exotic crops which are one of the special studies at Woburn. The meteorological records from October, 1950, to the end of 1951 are shown below.

*Meteorological Records for* 1950-51

| Month | Rainfall | | | Temperature | | | |
|---|---|---|---|---|---|---|---|
| | Total fall | No. of rainy days | Bright sunshine | Max. | Min. | 1 ft. in ground | Grass Min. |
| 1950 | ins. | | hours | F. | F. | F. | F. |
| October | 0·50 | 6 | 105·0 | 55·5 | 42·3 | 49·9 | 38·6 |
| November | 4·27 | 22 | 60·2 | 47·4 | 36·6 | 42·8 | 33·7 |
| December | 1·40 | 16 | 36·5 | 37·0 | 28·5 | 35·8 | 27·1 |
| 1951 | | | | | | | |
| January | 2·57 | 17 | 44·4 | 43·4 | 33·6 | 37·7 | 31·4 |
| February | 3·54 | 21 | 65·9 | 43·0 | 33·3 | 37·3 | 30·4 |
| March | 3·46 | 21 | 92·0 | 45·1 | 33·3 | 39·5 | 31·2 |
| April | 3·02 | 12 | 184·9 | 52·4 | 35·4 | 44·6 | 33·0 |
| May | 2·41 | 15 | 144·3 | 57·4 | 42·4 | 50·5 | 41·2 |
| June | 0·83 | 11 | 242·9 | 66·6 | 47·1 | 59·5 | 43·5 |
| July | 1·76 | 10 | 190·9 | 71·5 | 51·5 | 64·8 | 45·0 |
| August | 3·77 | 20 | 171·0 | 67·0 | 51·5 | 61·0 | 45·9 |
| September | 2·05 | 13 | 119·6 | 64·9 | 50·2 | 57·4 | 44·8 |
| October | 1·24 | 11 | 100·8 | 55·8 | 39·2 | 49·0 | 34·8 |
| November | 4·35 | 26 | 62·9 | 51·8 | 41·9 | 45·9 | 37·1 |
| December | 1·56 | 16 | 60·8 | 47·0 | 35·7 | 41·0 | 31·4 |
| Total or mean for 1951 | 30·56 | 193 | 1480·4 | 55·5 | 41·3 | 49·0 | 37·5 |

## 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 separately on them. There are, however, a few points in connection with them which may be recorded here.

In the last report mention was made of the fact that, even after three years of fallowing accompanied with intense cultivation, a crop of barley was almost smothered by the weed *Spergula arvensis* (spurrey), which had previously infested the land. The same ground was again sown with barley in 1951 and again spurrey appeared in very large amount and on most of the plots apparently almost smothered the barley. It is clear that, with this weed at any rate, fallowing, even with almost continuous cultivation, will not, even in four years, get rid of the weed. It is also fairly resistant to most



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of the herbicides now in use and furnishes one of the continuing troubles on the light semi-acid soils at Woburn.

I might mention, in connection with weeds, the comparatively recent appearance of another acid-loving weed on the permanent wheat plots at Woburn. This is *Scleranthus annuus* (knawel) which was first noticed on the plots which had become acid by continued treatment with sulphate of ammonia a very few years ago. Though this area has been under no other crop but wheat since 1877, yet when I studied the weeds on the various plots 20 years ago, this weed was not found at all. Now, it is rapidly spreading over the area especially on the plots which have till recently, never received nitrogenous manures either in the form of nitrate of soda or farm-yard manure.

The Woburn studies of weeds by pot culture have now been extended to the more general question of the influence of one plant on another and a paper is now in the press on the mutual effect of barley and clover when sown together under conditions made as favourable as possible for the barley, as is usually the case when barley is undersown with clover. These conditions involve a nitrogenous dressing to ensure a full crop of barley and so remove any question of its dependence on the clover roots for the nitrogen which it needs. This being the case, the two plants, at every thickness of planting, act as pure competitors, the presence of the clover acting as a reducer of the barley, while the barley, still more markedly, reduces the growth of the clover till after the corn crop is removed.

## New Crops

As noted in previous reports, one of the matters which have been, for a number of years, a feature of the Woburn Station is the growing of certain exotic crops which seem to have possibilities in this country especially on the well-drained and semi-acid soil which is characteristic of the Woburn Station. For such of these crops, like hybrid maize and soya beans, as are accustomed to a hot season for growing, the year has been an exceedingly unfavourable one. The absence of any real spring, with ground saturated with water, delayed the planting of these crops nearly a month—a fatal incident in attempting to grow crops which have difficulty in ripening in the English climate. The Swedish soya beans, which seem the most promising for this country, and a Dutch variety of similar type, have nevertheless ripened without difficulty even in 1951, but it seems difficult to obtain a yield of more than about 10 cwt. of dry beans per acre in such cool and wet seasons, as compared with over 14 cwt. in a more suitable year such as 1949. As noted in my last report, it seems difficult to get properly nodulated roots of soya beans in such a wet year in spite of careful inoculation of the seed. The possibility of finding a variety and a method of cultivation suitable for Britain remains doubtful.

A year ago I reported on the successful growing of some of the early varieties of hybrid maize, obtained from the United States, in three successive years, with an average yield of dry grain of 32·5 cwt. per acre. In the even more unfavourable year 1951, the same varieties grew quite well and, in addition, we have obtained equal results from similar types bred in Holland. Two great difficulties

*https://doi.org/10.23637/ERADOC-1-73* 

have been emphasized in the present year. The first of these is the necessity of sowing early, say not later than the first week in May, if ripening is to take place before the wet autumn days in October. The other is the great danger of birds and vermin at every stage of the crop. When maize is just appearing above ground it seems to have an extraordinary attraction for birds and this year I lost a good part of my crop on this account : when the corn is ripening, again, there seems great danger of the grain being picked out from the cob. In consequence it would seem that the future of the growing of maize for grain in this country is as a small-holders' crop to fill in small areas near houses where any other grain would be unsuitable, and to use the grain, without threshing, for feeding chickens and the like. For this purpose there is no longer any doubt that these early hybrid maizes may be of great advantage in this country.

Another set of crops which have been grown at Woburn in 1951 are sweet lupins and some other fodder crops which grow quickly and which can be so cultivated as to give a large amount of fodder about the end of August when the grass in pastures is beginning to reduce its yield. There are several such crops which are suitable for chalk soils, such as sainfoin, but for semi-acid light soils, such as that at Woburn, there is definitely a deficiency. For such conditions, however, sweet lupins seem to fill the gap, at any rate in summers when the weather is not too dry. This year we have grown four different types of sweet lupins, and three of them have given yields and edible produce which would seem to make them worth far more widespread cultivation than they have yet received. The position in the country up to 1950 has been well summarized in a recent article by A. W. Oldershaw. This year the several varieties were sown at Woburn on May 16th. They were (1) Weiko, grown from our own seed produced in 1950, (2) Nobe, (3) Neven and (4) Namar, the last three being grown from seed obtained from the National Institute of Agricultural Botany. These were all, except the last, varieties with yellow flowers, No. 4 being a blue type. I may say at once that the blue variety, as in previous years, proved so susceptible to the wilt fungus (*Fusarium avenaceum*) that it was useless. Most of the plants after growing healthily up to flowering, then began to wilt and within a month almost all the plants had died. The yellow types seemed almost if not entirely immune to this blight, and grew well. By the latter part of August, they had given a thick heavy growth of green stuff, had flowered and were forming pods though these were still in the green stage. They were then cut and gave yields as follows :—

| 1951 Variety | Weight of Green Stuff per acre tons | Dry Matter in Green per cent |
|---|---|---|
| Weiko ... ... | 14·1 | 12·6 |
| Nobe ... ... | 22·2 | 12·1 |
| Neven ... ... | 26·4 | 12·1 |

The yield of Weiko followed a production of 17 tons of green stuff in 1950, so that in a wet year there is no doubt that a very heavy yield of green fodder can be obtained from good strains of sweet lupins on land such as we have at Woburn. The fodder is not very palatable to stock, but it was eaten after some hesitation, and would doubtless

*https://doi.org/10.23637/ERADOC-1-73* 

be accepted willingly if fodder were otherwise short. All the varieties seeded profusely and though we lost most of our seed this year by vermin, yet there will be no real difficulty in obtaining a good amount of seed from a comparatively small plot.

Two other leguminous fodder crops which we have tried for a similar purpose as sweet lupins, and for a similar class of land, are serradella and birdsfoot trefoil, both of which have been very successful in 1951. The former, which had given a yield of 11·6 tons of green fodder (containing dry matter 15·7 per cent) on August 16th in 1950, this year gave 6·8 tons (containing dry matter 16·6 per cent) on August 23rd but the fodder was greedily consumed by grazing animals. Before cutting, enough seed had fallen to give another green carpet by October, and the growth continued till a really heavy frost occurred in the early winter.

As regards birdsfoot trefoil, which was sown on May 17th, a crop of 9·7 tons of green fodder per acre was reaped at the beginning of November. This crop grew very slowly at the beginning and till the late summer did not seem likely to give a serviceable yield, but finally it covered the ground well and was still growing vigorously when cut. Birdsfoot trefoil is a perennial, and it will be remembered that in the second year on a previous occasion (1950) it gave a yield of 19·4 tons of green fodder per acre in July.

Altogether, we seem to have reached a point when several fodder crops which will grow on light semi-acid land have been obtained which can be relied on, at least in a moderately wet season, to give a good yield of green fodder in the autumn when the normal sources are tending to decline.

## Irrigation Experiments

In my last report I noted that it was intended to initiate experiments on the value of spray irrigation for several of the ordinarily grown farm crops. This intention was carried out in the spring of 1951 and a large series of experiments with early potatoes, sugar beet, barley, cabbages and freshly sown grass were started. The actual direction of the experiment has been with Dr. Penman of the Rothamsted Physics Department, and that department will report on the results, both as to the amount of water which it was necessary to use and on the crops obtained. I may, however, say here that, even in a wet season like 1951, in every case (except with the cabbages which are not yet reaped at the time of writing) substantial benefit was obtained in the crop as a result of the watering. This was especially the case with the yield of early potatoes and with the first and second crops of grass. Woburn is particularly suitable for such an experiment with its light sandy loam soil, over sand, without any watertable within a good many feet of depth.

## Pot Experiments

### *Clover Sickness*

One of the chief objects of study in the pot culture station for the last 15 years has been the partial or complete failure of clover when it is frequently grown on the same land, even in the absence of any

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known parasite. The explanation of this failure is at last becoming clearer and the results obtained in 1951 have made it possible to formulate, at least provisionally, conclusions on which we can base further experiments. These conclusions are as follows: (1) The failure of clover is due to an exudate from the roots of the living clover plant, which is toxic to clover, particularly to young clover plants, is sensitive to heat, cannot be readily washed out of the soil, and is not easily oxidized. (2) Partial sterilization of the soil, except by heat, but by such materials as toluene or formalin, has very little effect on the sickness of the soil or on its capacity to grow clover. (3) Soil which is toxic to growing clover shows little or no toxicity to gramineous plants such as barley or Italian ryegrass, but, on the other hand, it is very toxic to lettuce, radishes, or spinach beet. (4) Failure of clover does not seem to be due to any product of rotting either of clover roots or of buried clover tops. In the presence of a large amount of such rotting material perfectly normal plants of clover are obtained, though there seems to be some retardation of growth. (5) The addition of certain, though not all, colloid materials to the soil tends to reduce its toxicity to clover, though it has not been possible by this means to bring back soil to a completely non-toxic state. It is possible that the beneficial effect of farmyard manure may in part be due to its colloid constituents. On the other hand, a purely inorganic colloid like bentonite had no similar effect.

It will be seen that we have not yet been able to isolate the toxic material and determine its nature. This will be the next stage in the inquiry, together with a determination of the possibility that crops, such as the grasses, not affected by it, can be used to destroy this toxic material rapidly in the soil.

*The nutrition of crops under very acid conditions*

The work on this question, which has been one of the main concerns of the Woburn Station for a number of years, has continued in 1951. It was intended to publish the results up to 1950 but certain doubtful points emerged and it was decided to carry on another year's work before compiling the results. This is fortunate because it has become clear that certain contrasted effects on barley with calcium and sodium nitrate seem to depend very largely on the degree of acidity and on the amount of soluble sodium which is already there. At a pH value of 4·2, with little previous addition of sodium salts, sodium nitrate is always a more effective material on barley than is calcium nitrate: at a somewhat lower acidity, where such sodium has been added as sodium bicarbonate, calcium nitrate always gives a much more normal plant, while sodium nitrate led to a low growing bushy barley with much flabby soft leaf growth and only a few immature ears. The total results of the last three years of experiment are now being worked up.

## Laboratory Work

The time of the laboratory staff has been taken up almost entirely with work in connection with the field and pot experiments. Most of this falls on Mr. Barnes and his staff, and they have been fully employed in these directions during the last year.

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