Report for 1949

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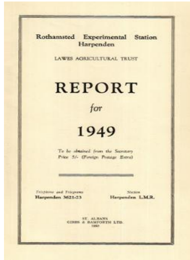

Woburn Experimental Station

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WOBURN EXPERIMENTAL STATION

By H. H. Mann

Season

The season of 1949 was as great a contrast with that of 1948, as it is almost possible to conceive, and the very dry summer months, especially June, July and September, made many of the usual operations in those months exceedingly difficult and sometimes impossible. All experiments which involved transplanting of crops during those months were affected, and in some cases, notably in the cabbages following green manuring crops, the results were consequently very different from what we have been accustomed to get in this experiment. The amount of grazing during the summer in the ley experiment was far less than usual, but, on the other hand, corn crops were at least up to the average and in the experiments where sugar beet or potatoes were grown, the reduction in yield, even on a light land farm like Woburn, was far less than might have been expected. The meteorological records from October 1948 to the end of 1949 are shown below.

Meteorological Records for 1948-1949

Month	Rainfall: Total fall	Rainfall: No. of rainy days	Bright Sunshine	Temperature: Maximum	Temperature: Minimum	Temperature: 1 ft. in ground	Temperature: Grass minimum
1948	in.		hours	F	F	F	F
October	2·27	12	98·2	56·3	42·3	51·1	37·7
November	1·21	15	74·7	49·8	37·7	44·7	34·1
December	2·25	18	58·4	47·1	36·3	41·9	32·3
1949							
January	0·96	12	69·0	46·5	35·3	40·2	30·2
February	1·13	10	116·5	48·9	33·8	39·5	27·0
March	1·35	8	103·4	46·8	33·1	40·6	28·1
April	1·65	11	184·2	58·7	41·0	49·9	36·0
May	2·14	12	213·5	60·5	41·4	53·8	36·3
June	0·74	6	230·1	69·1	48·1	63·2	42·0
July	0·93	6	236·6	74·9	51·7	68·3	44·5
August	1·69	9	222·6	73·6	51·6	64·6	45·1
September	0·81	6	153·7	71·2	53·3	62·8	47·4
October	5·02	15	129·2	60·3	45·4	53·5	40·2
November	2·66	18	74·9	48·7	36·9	42·4	32·6
December	1·20	16	57·8	47·1	37·2	40·9	32·4
Total or Mean for 1949	20·28	129	1791·5	58·9	42·4	52·1	36·8

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 that may be mentioned here.

In connection with the very serious infestation of wild oats on the permanent barley plots in Stackyard Field, records were maintained as to the number of plants which grew on this area, which, fortunately, was again kept fallow in 1949. On the worst portion of this area, the number of growing wild oat plants was counted on sample plots before most of the cultivations during the year. As noted last year, after a year of fallowing and intensive cultivation in February 1948, there were nearly 4½ million wild oat plants per acre and 3½ million a couple of months later. It is in the spring that most of the dormant wild oat plants germinate with a subsidiary period of germination in the autumn. The gradual disappearance of the pest and the length of time it takes to get rid of it once the ground is badly infested is shown in the following series of figures.

	Number of wild oat plants per acre
May 1948	2,400,000
September 1948	1,200
November 1948	584
March 1949	32,625
May 1949	14,888
October 1949	4,400
January 1950	3,108

It is evident that one year's fallow leaves still enormous numbers of viable wild oat seeds in the soil: two year's fallow gets rid of most of these, but even after three years there are still quite a fair number of seeds still capable of growing. Two other interesting points emerge from our observations. First, practically all the wild oat plants spring from seeds in the top few inches of the soil: it is rare to find a living oat plant rising from below the plough level. Second, the greater number of autumn plants in 1949 over 1948 seems probably to be connected with the dry summer in 1949 which would lead to the greater likelihood of water penetrating the hard skin of the wild oat seed. On the whole, it is clear that even three years of intensive fallowing will not entirely eradicate wild oats when once they have really become a heavy infestation.

One of the matters which have for a number of years been a feature of the Woburn Station has been the growing of certain exotic crops, which seem to have possibilities in this country, especially on the well drained but semi-acid soil which is characteristic of the Station. For most of the crops which we have studied, 1949 has been a very good season, giving some of those more suited to warmer climates a greater chance of ripening than was the case, for example in 1948. The crops of this kind grown in 1949 have been hybrid maize from the United States, soya beans bred for long days in Sweden, serradella, and birdsfoot trefoil for forage.

With regard to maize, where we grew several of the early Wisconsin hybrids (seed of which was kindly supplied by Dr. Neal of that State), we were able to ripen all the types supplied and to get a crop much earlier than was the case in 1948. The yield was also much higher, and the ripening about 30 days earlier than in 1948. The yields obtained are shown below:—

Variety	*Note as to earliness*	*Yield of dry grain per acre*
Wisconsin 275	Very early: rather dwarf plants	2·20 tons
Wisconsin 240	Fairly early: taller than 275	1·69 tons
Wisconsin 1600	Earliness as 240	1·03 tons
Wisconsin 255	Latest of the four varieties and the tallest	1·20 tons

The only manuring given was 3½ cwt. of sulphate of ammonia per acre on May 17th, the maize having been sown on April 21st. To get these yields it is necessary to obtain seed direct from the breeders: to test this point we grew Wisconsin 240 from our own seed of this

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variety grown in 1948; this only gave a yield of 1·20 tons per acre as against 1·69 tons for the freshly imported seed. It seems that these early hybrid varieties of maize could have an important place in British agriculture, especially among small holders, very little seed being needed and the crop being used for feeding without threshing, after grinding the whole of the cob together.

With regard to soya beans, we have grown a number of varieties developed by Holmbergs of Sweden, as suited for higher latitudes than the soya bean areas of the U.S.A. and so ripening under our conditions when the usual American types will not do so. The usual difficulties with this crop in the past have been that the high yielding varieties would not ripen, and the types which could be relied on to give ripe beans were very poor yielding. The Swedish soya beans that we have grown in 1949 are dwarf types and can be grown much closer spaced than is usually the case, but even with our usual spacing we were able to reap 13¼ cwt. of dry beans of some of the varieties per acre. This certainly gives promise that when proper spacing is adopted we shall reach a commercial yield under British conditions.

Other exotic crops that have done well at Woburn in 1949 have been serradella and birdsfoot trefoil, both suitable crops on semi-acid soils for fodder growing. The latter, grown from American seed, gave just under three tons of green fodder per acre on July 7th from seed sown near the end of April, while it has continued to grow and appears likely to give at least the same amount of fodder in 1950.

Pot Experiments

Clover sickness

We have been working at the question of the failure of clover to give a remunerative yield when grown too frequently on the same land, for a number of years, even in the absence of any known pathogen, and we have ventured to bring our results before one of the scientific societies during the past year. The cause of the failure is still undetermined, but we seem to be approaching a solution and we can perhaps summarize the present position here. Tests made over a number of years made it clear that even in the absence of clover rot fungus and the well known stem eelworm, clover growth became less and less in successive years if any of the usual varieties were grown year after year on the same soil. After growing clover for about five years in this manner, the soil became so clover sick that only tiny plants could be produced, and no known pathogen has been found which would account for the reduction in size.

We investigated the question as to whether the production of the sick condition in the land could be speeded up by increasing the temperature at which the clover is grown, by growing the plants under semi-waterlogged conditions, and by other methods. The only striking result has, however, been obtained by increasing the proportion of growing clover to soil, i.e. by growing as much clover as could be crowded into a pot, on very shallow soil. Under these conditions the soil becomes sick very much more quickly and this suggests the possibility that the clover itself leaves something in the soil which is inimical to further growth of clover.

It quickly became evident that the addition of plant foods to the soil in the form of fertilizers would do little, if anything, to restore the healthy and proper growth of clover. This was found by Lawes and Gilbert nearly 100 years ago, and we can confirm their conclusions. They, however, state that if the soil contains large amounts of organic matter clover sickness does not appear nearly so soon as in other cases. Hence we tried the effect of addition of large amounts of farmyard manure to the sick soil and at once we obtained again a normal growth of clover. The effect did not last long, and on continuing to grow clover in succeeding years, the soil quickly reverted to the sick condition. Next we tried the effect of heating the soil in a moist condition to 70°C. for two hours, with the result that normal growth was again obtained though not quite up to the standard of fresh soil. This has been repeated several times, always with the same result. If the soil is heated in the dry condition, little effect is found. Other methods we have tried are (1) treatment of the soil with toluene to remove any active organisms. This gave no improvement of the clover on the sick soil, (2) treatment of the soil with formalin and then washing out the formalin with water. In this case slight but not very marked improvement was shown, but nothing like the growth on fresh soil was obtained; (3) the treatment of the soil with hydrogen peroxide so as to oxidize the more labile materials, and then washing out the reagent. In this case no improvement was reached. Negative results were also obtained when we tried to wash out any leachable materials from the soil, after which there was practically no improvement in clover growth, while the leachates applied to clover in healthy soil did little or nothing to bring about the dwarfing of the plants.

This is the stage at which the matter now rests. No definite pathogen has been identified which causes the condition here described, but its production can be intensified and quickened by increasing the proportion of clover to soil. The sick condition cannot be remedied by any addition of the ordinary plant foods to the soil, but can be temporarily got rid of by the addition of large amounts of farmyard manure or by heating the moist soil to 70°C. Washing the soil has no improving effect and the washings had no harmful effect on clover in fresh soil. Neither treating the soil with toluene nor partial oxidation with hydrogen peroxide did any good, while formalin had only a slight effect.

Competition of crop plants grown together

Starting as an investigation into the competitive power of several weeds with the barley crop, this work has been widened in the last two years into a study of the mutual effect of two crop plants usually grown together. In 1948 we studied the effect of barley and clover when grown together, and in 1949, the mutual effect of ryegrass and clover when laid down together, as is usual in an ordinary grass seed mixture. The results are now being worked up and promise to give results of distinct value. It is hoped to publish the results of the two years' work in the course of the next few months.

The nutrition of crops under very acid conditions

For a number of years an investigation has been in progress to find out why barley will not grow under conditions more acid than

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that represented by a pH value of 4·7 to 5·0. The special points that have been worked at in 1949 have been the relative effect of acidity (pH value), presence and absence of soluble phosphates in the soil, and the question of whether the actual amount of calcium present has any effect on the growth of the barley. The plan of the experiment enabled us to separate clearly the effect due to the several factors mentioned, and we are now working up the results with a view to early publication. It is clear, however, that while the dominant factor in the failure of barley on the very acid soil is the presence of something which can be precipitated by soluble phosphates even if these do not cause any reduction in acidity, there is a clear effect of calcium salts which do not raise the pH value. A still more striking result was obtained with lucerne, which was made to grow on soil at a pH value of 4·2 after the addition of sodium phosphate in large quantities.

Laboratory Work

Changes in the sulphur content of soils under long treatment with artificial and other manures

At Woburn we have land which has been under barley for nearly eighty years being treated with various manures every year, and from these plots samples of the soil have been taken from time to time at least during the first fifty years. In some quarters the changes in fertility have been attributed in some measure to changes in the available sulphur content of the soils. This matter has now been under investigation for several years and the work is now drawing to a close. It is hoped to complete it during the next few months.

Most of the time of the laboratory staff is usually taken up with the analyses, etc. in connection with the field and pot experiments. Most of this work falls on Mr. Barnes and his staff, together with the detailed carrying on of the pot experimental work.

At the end of the year, Mr. Barnes has also taken over a good deal of the recording of the field experiments, and has also become resident on the Station itself.

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