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Report for 1955

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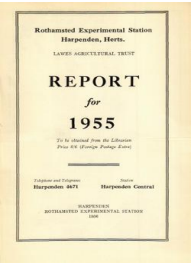
Rothamsted Experimental Station
Harpenden, Herts.

LAWES AGRICULTURAL TRUST

REPORT
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ROTHAMSTED EXPERIMENTAL STATION

Woburn Experimental Station

H. H. Mann

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WOBURN EXPERIMENTAL STATION

H. H. Mann

Season

The year 1955 was in great contrast to 1954 in regard to the weather. After a very wet winter and spring (except for the month of April) the summer months of June, July, August and September were dry, leading to excellent corn crops but relatively small yields of roots and potatoes. The soils at Woburn are light, sandy loams, but they have, in nearly all cases, a fairly moist subsoil, which even in the driest summer allows deep-rooted crops like sugar-beet or lucerne to maintain fairly good growth. The only crops which really suffered from the drought were potatoes, where irrigation almost doubled the yield of the main crop, and grass, where, after good growth up to June, there was hardly anything to cut from July to October. The meteorological records from October 1954 to the end of 1955 are shown below.

Meteorological records for 1954–55

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.)	Grass min. (° F.)
1954							
October ...	2·28	21	99·6	59·3	47·6	52·8	43·6
November ...	4·17	23	55·3	50·3	37·6	44·6	32·5
December ...	2·24	15	61·4	48·1	42·4	41·1	33·5
1955							
January ...	2·44	17	37·9	40·8	30·9	36·9	29·5
February ...	1·63	17	81·0	38·8	28·5	36·7	26·8
March ...	1·13	12	142·2	44·5	28·9	37·1	24·6
April ...	0·47	10	155·1	57·2	40·0	48·4	35·3
May	4·57	17	195·8	57·3	41·5	51·2	37·5
June ...	2·15	12	150·6	65·3	48·1	59·1	47·7
July... ...	0·19	2	242·2	74·0	51·6	65·7	47·8
August ...	0·70	7	170·6	74·0	54·4	66·0	47·8
September ...	1·65	10	158·2	65·9	48·7	58·3	44·2
October ...	1·79	13	115·1	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
Total or mean for 1955 ...	20·26	151	1,561·9	55·9	40·5	49·5	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 on them separately so far as the yields are concerned. There are, however, a few points in connection with them which may be recorded here.

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Continuous barley

In this experiment (in which barley has been grown since 1877) it has been shown that the falling off in the yield of barley in recent years was, at least in part, due to the development of soil acidity. It is well known that the lime content of the Woburn soil is very low, and pH determinations plot by plot in 1953 and 1955 showed that in many cases the pH value had gone down below 5·0; it was therefore decided to treat the whole area with chalk in the spring of 1955 so as to bring the pH value to the original figure of about 6·0. This was done in three instalments, with cultivation between the applications, between 14 February and 6 April, barley being sown on 7 April. It would not be expected that the benefit of the chalk dressings would be immediate, but all the plots where the acidity had been at all marked did show considerable improvement, and in those which had been the least acid the crop was higher than for many years. It is not clear whether, when the chalk applications have been fully effective, the yields recorded in the early years of these trials will again be obtained, for the plots have become extremely weedy, especially with twitch (*Agrostis*), which is very common in this field. This point will be tested in the future years after a fallow in 1956 to get rid, as far as possible, of the twitch and other weeds.

Ley–arable experiment

This experiment, which has been going on since 1938, and is now yielding very valuable results as to the relative value of grazed leys or hayed lucerne leys and an entirely arable rotation, was continued in 1955. The results show regularly that the following crops of potatoes and barley are substantially better after each of the ley treatments. The results seemed now to be so clear that they could be published with confidence; but the discovery this year of an accumulation of potato-root eelworm in certain of the potato crops leads to some hesitation in the matter, and the result of a careful examination of the eelworm status of every plot in this experiment is now awaited.

Irrigation experiment

1955 was a year when the effect of irrigation would probably be felt to the greatest extent in increasing crop yield. The numerical results are discussed by the Physics department, but there are two or three points which may be mentioned here. The most outstanding increase in yield took place with the main crop potatoes (Majestic), when the plots which were watered throughout the season gave nearly double the yield obtained from the unwatered crop. The watered potatoes remained in flower for 10 days to a fortnight after the flowers had all disappeared from the other plots. This would probably account in part for the increased yield, and it was noticed on every one of the completely watered plots.

In the case of the grass plots which were sown with pure cocksfoot in 1954, it is interesting to note that practically all the weeds and weed grasses had disappeared by the summer of 1955. The *Poa annua*, which was quite abundant a year ago, has not been able to stand frequent cutting either on the watered or on the unwatered plots, and so has left an almost pure stand of cocksfoot.

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Nitrogen fertilizers on spring wheat and barley

Experiments were conducted on the effect of increasing the application of nirrogenous fertilizer in the form of " Nitro-Chalk " from 2 to 4 and 6 cwt./acre, and on its application at different times during the growth of the crops. The results will be discussed elsewhere, but it is clear that even at 6 cwt. " Nitro-Chalk "/acre, the grain yield is still going up with both wheat and barley. The main point of interest in the experiment has been the mechanism of the increase; namely whether nitrogen increases the straw more than the corn, and whether the increase in corn is obtained by the presence of a larger number of ears, by an increase in the size of the ears or by a greater weight of the individual grains. Samples were, therefore, taken just before harvest and threshed by hand. Data were obtained on the number of ears per unit of row length, the weight of corn and the weight of straw for a similar length of row. The results are similar in the cases of spring wheat (Koga II) and spring barley (Herta), and indicate that when the nitrogenous manuring is increased beyond a very small dose, both grain and straw give a greater yield, but the straw responds far more than the grain. As an illustration of this the figures are given for spring barley (Herta) in 1955.

	Yield per acre		Percentage increase	
Manuring per acre	Grain (cwt.)	Straw, etc. (cwt.)	Grain	Straw, etc.
No " Nitro-Chalk " ...	21·4	12·8	—	—
2 cwt. " Nitro-Chalk " ...	32·4	22·7	51·6	77·1
4 cwt. " Nitro-Chalk " ...	41·4	33·6	93·6	161·8
6 cwt. " Nitro-Chalk " ...	46·9	44·5	119·0	247·3

Thus it appears that, with a large dressing of " Nitro-Chalk ", while the grain yield goes up by 119 per cent, the straw increases by double this amount.

It was found that the number of ears per unit length of row increased by 26 per cent in Herta barley with the first 2 cwt. of " Nitro-Chalk ", by 12 per cent with the second 2 cwt. and by only 2 per cent with the third 2 cwt./acre. On the other hand, the length of the ears increased very closely in proportion to the amount of nitrogenous fertilizer added. These result, which are only provisional, throw some light on the cause of the increase of yield by nitrogenous fertilizers.

Effect of manuring on weed herbage

The results of long-continued observations on the weed herbage of land farmed with large amounts of bulky organic manures have been compiled during the year, and will shortly be published. The manures were farmyard manure, sewage sludge and composts made with straw activated with dung or with sewage sludge. The observations have shown very little difference in the effect of the various manures on the character of the weeds, but in all cases the use of the organic manures has led to an increase in the weeds of about 30 per cent. Doubling the amount of the bulky manure has not further increased the weediness, except in the case of the annual nettle, which flourished most where the organic additions were greatest. Perhaps the most striking effect was produced by even a slight change in the acidity of the soil. It was remarkable how

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spurrey (*Spergula*) and even mayweed (*Matricaria*) disappeared when acidity was reduced by the treatment, and how they immediately came in again when the land became more acid. The results of this work will be shortly published in the *Journal of Ecology*.

New crops

The work of testing the suitability of new crops, chiefly semi-tropical ones, for this country has been continued. The summer was warm but not hot, and the drought which prevailed for most of July and August had a large effect on the growth and success of this year's crops. The investigations have chiefly been concerned with types of hybrid maize, of soya beans as developed in Sweden, of a type of Jerusalem artichoke developed as a fodder crop and of fodder crops suitable for semi-acid soils such as at Woburn.

Maize

Some of the early hybrid types of maize of either American or Dutch breeding can now be confidently recommended for growing under suitable circumstances in this country. In 1955 between 25 and 30 cwt. dry grain/acre has again been obtained from two Dutch types known as C.I.V.2 and C.B.30, in a year when the crop had a bad start in the cold May, and then had drought conditions from the beginning of July. The crop, however, ripened perfectly and, contrary to what we have found in our usual wet autumns, could be harvested without any serious danger of the cobs going mouldy in storage. We have been trying to grow maize for grain since 1934. At first we used old Canadian types and failed completely to get varieties which were much use in England. Either they ripened well but yielded badly or they were not able to ripen in our damp, cool summers. With the introduction of early hybrids, originally obtained from Wisconsin (U.S.A.), but now developed and improved in Holland, the position changed. Since 1948, we have been able to get yields every year (except 1951), which make the growing of these hybrids practical in this country. The yields are as follows :

1948 (Wisconsin 240)	27·5	cwt./acre
1949 (,,)	33·8	,,
1950 (,,)	36·6	,,
1952 (,,)	38·0	,,
1953 (Dutch)	31·0	,,
1954 (Dutch C.I.V.2)	41·7	,,
1955 (,,)	28·0	,,

The mean yield of all the crops quoted is 34·7 cwt./acre, and has been obtained on ordinary farm land with never more than a manurial dressing of 3 cwt. of sulphate of ammonia or "Nitro-Chalk" per acre. In order to obtain these yields it is necessary to get fresh seed each year, as we have shown that the use of our own seed for a season gives considerably lower yields. The period of growth of all the hybrids is very much longer than in the countries where they have been developed, probably owing to the cooler summers that we have in England. The falling off in yield in 1955 is probably due to the maize ears being smaller than in previous years owing to the long drought in July, August and September.

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Soya beans

We have also been experimenting with soya beans since 1934, at first with varieties brought from Canada coupled with others which had been developed by pioneers in this country and the United States. But all the varieties either never ripened or gave such small yields that it was clearly not worth while growing them. The best yield of dry beans was 14·5 cwt./acre from an American variety until, 5 years ago, seed was obtained from Sweden, where types had been produced which seemed to have more promise than any available elsewhere. The results found from 1949 to 1953 seemed very promising, and though the best yields were from 10 to 11 cwt./acre, it seemed possible that by closer planting of these dwarf varieties the yield could be pushed up to a profitable point. The cold, wet season of 1954 was, however, very unfavourable for soya beans, hardly any seed ripened, and what did ripen was very inferior. The same seems to have happened in Sweden, where the breeders reported that they also had great difficulty in getting good seed. They, however, sent a small amount of seed of several strains which we tried to grow in 1955. With the inferior seed and a cold May after the seeds were planted, they never came to anything, and we are losing confidence in the possibility of growing any of the types now available for the commercial production of soya-bean seed in England. It is only the dwarf types which will ripen in this country, and the production of seed of these varieties is so uncertain at present that there does not seem to be a type that can be recommended.

Exotic fodder crops

The other side of the work on exotics is concerned with fodder crops suited to semi-acid soils, which will grow quickly to give a heavy crop of attractive fodder in September or October, when the grass crop is declining in quantity. In last year's report *birdsfoot trefoil* was mentioned as one of the best crops of this class. It has the additional advantage of being a perennial, lasting two or three years for one seeding, and will grow in less fertile soils than ordinary red or crimson clover. Two other crops have given so much promise that the time seems ripe for their use on a larger scale than hitherto. These are *Sweet Lupins* and *Serradella*. We have sufficient experience with each of these crops to expect them to grow in any summer that is likely to occur. In this sense, the last two years have been a great test. 1954 was cold and wet; 1955 started with a wet and cold May, but had a drought from July to September. The effect of the drought in 1955 was shown in very much reduced crops, especially with sweet lupins, but in both seasons the crops grew healthily and yielded good fodder. The actual weights of fodder are shown below.

	Wt. green stuff per acre (tons)	Dry matter (%)	Dry matter (tons)
Sweet Lupins (variety *Weiko*):			
1954	16·1	9·6	1·55
1955	3·03	14·9	0·45
Serradella:			
1954	14·7	11·5	1·69
1955	4·96	24·4	1·21

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It will be seen that in the case of both these fodder crops the drought of July and following months in 1955 has very much reduced the yield per acre. This was to be expected, as the crops were not sown till 6 June to see how quickly a crop of fodder could be obtained. The fodder was far drier than in 1954, as would naturally be expected.

Artichokes

Another new crop of considerable interest is the so-called "*Topine*", a strain of Jerusalem artichoke which is reputed to be specially luxuriant and consequently of special importance for fodder. The results of our first year's experience with this crop in 1954 appeared to be promising, for we had nearly 18 tons of green stuff in October from tubers planted at the end of April. The tubers from that crop were dug in February and March 1955 and gave a yield of 8 tons/acre or 0·73 lb. per plant. The present year was a good test of the capabilities of the crop on account of the drought. Tubers were planted on 26 April and grew well, giving plants which were more bushy and rather shorter than in 1954. They showed little or no sign of suffering from the drought till near the end of October, when the tops seemed slightly drooping, while the leaves were somewhat damaged by a severe frost on 16–18 October. The crop was cut on 31 October, when 9·4 tons of green tops per acre were obtained containing 30·1 per cent dry matter. This means a dry matter yield of 2·82 tons/acre, as against 3·34 tons/acre in 1954. Thus the reduction due to the drought was only moderate as compared with that given by the other fodder crops tested. The yield of tubers has not yet been determined, as they will be left in the ground till February, for they cannot be clamped like potatoes. On present information artichokes still appear to be promising. It has been proved in many tests in the United States that the tubers compare very well with potatoes as a food for pigs.

Laboratory Work

Among the more interesting pieces of work that have been completed in 1955 has been a study of the permanence of organic matter in the soil when applied from various sources. This work has been based on experience with a field experiment in which large quantities of bulky organic manures, including farmyard manure, sewage sludge and composts, had been added to market-garden crops for a series of years. Material for 8 years was available, and the conclusions reached were that: (1) The materials divide themselves into two classes. On the one side is farmyard manure, in which the organic matter appears to be considerably more active than in any of the other materials used and so disappears more quickly. The least active is that contained in sewage sludge. In composts made with farmyard manure the addition of more straw slowed down the rate at which the organic matter disappears. (2) Except with farmyard manure the addition of sulphate of ammonia slightly retarded the disappearance of organic matter. Doubling the amount of organic manure applied led to its more rapid disappearance, except again with farmyard manure.

Work on the pot-culture station and in the laboratory has been

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again restricted in 1955 by the demands of the irrigation experiments, and has hence been almost entirely concerned with control of the field experiments. Most of this work falls on Mr. Barnes and his staff, and they have been fully employed in these directions during the year.