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WOBURN EXPERIMENTAL STATION

By H. H. MANN

SEASON

The season of 1950 will be long remembered for its wetness, its high atmospheric humidity, and its apparant coldness. The rainfall was the highest on record, with one exception (1937) since 1925, and the humidity was substantially above the average for every month except March and October. There was a violent tornado on May 21st, when with a rainfall of nearly two inches within two hours, crops were drowned and silted up and soil was washed from one experimental plot to another. Most of these difficulties have been successfully met. The meteorological records from October 1949 to the end of 1950 are shown below.

METEOROLOGICAL RECORDS FOR 1949-50.

	Rainfall		Bright sunshine hours	Temperature 1 ft. in ground			Grass Min.
	Total fall	No. of rainy days		Max.	Min.	F.	
1949	ins.		hours	F.	F.	F.	F.
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
1950							
January	0.65	10	34.6	43.5	33.8	39.9	30.3
February	3.68	18	59.1	48.0	35.9	40.3	31.3
March	0.69	12	135.6	53.2	36.7	43.9	31.1
April	1.96	18	156.5	53.3	37.9	46.4	33.8
May	4.61	13	155.2	59.2	43.2	52.8	39.6
June	1.58	6	269.7	71.5	51.6	64.9	46.7
July	5.34	17	193.8	68.7	52.7	63.5	49.6
August	2.59	18	183.1	68.8	52.0	62.2	48.6
September	3.10	22	122.3	62.1	48.9	56.2	46.6
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
Total or mean for 1950	30.37	178	1511.6	55.7	41.7	49.9	38.1

FIELD EXPERIENTS

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.

Weed Studies : In 1947 it was necessary to fallow the permanent barley plots on account of a very severe infestation of wild oats. Very thorough fallowing has been continued ever since, and it is only in the fourth year that the land may be regarded as being free of wild oats, for during the growing season of 1950 practically no living plants could be found. It was observed that during the whole period the growing plants almost always originated in the top two or three inches of soil and rarely from deeply buried seeds. Periodical counts of seedlings during the course of the fallows were published in the last report.

This same area, and particularly the plots which had received many annual dressings of sulphate of ammonia, were also badly infested with spurrey (*Spergula arvensis*), and observations were made to see how far the fallowing had got rid of this weed. In 1950 however, it was found that spurrey appeared in almost as great quantity as at the beginning. Barley will again be sown on this area in 1951, and we shall be able to see how far the buried spurrey seeds have been able to survive over four years of careful fallowing.

Work has been carried out at Woburn on the relative effect of various weeds as competitors with barley. Three such annual weeds have now been studied, namely spurrey, mayweed (*Matricaria inodora*), and chickweed (*Stellaria media*), all of which are very common on the Woburn soil. Of these, it is found that a thick crop of barley can almost smother spurrey however thick the latter may be; the smothering is not nearly so complete with mayweed though the weed is very largely reduced; with chickweed, increasing the thickness of planting of the barley has very little effect on the vigour of the weed, which was able very largely to smother the barley. These weed studies have now been extended to the more general question of the influence of one plant on another. An account is being prepared for publication dealing with the mutual effect of barley and clover when sown together, under conditions made as favourable as possible for the barley.

The bolting of Beet Crops : In 1950 bolting of beet crops, which has been under observation at Woburn for a number of years, was very marked, particularly among red beet. As is shown in a publication now in the press any manure which causes more vigorous growth of sugar beet or red beet leads to an increase in bolting. Dung applied in the previous autumn slightly increased the number of sugar beet plants which went to seed, and when applied just before sowing it had a more marked effect. In all cases, sulphate of ammonia, and each of the organic manures, increased the amount of bolting of red beet, and a doubling of the amount of manure or the addition of sulphate of ammonia caused a further increase. Sewage sludge gave an abnormally large amount of bolting.

Exotic Crops : The possibilities of exotic crops on the well drained semi-acid soil at Woburn have been examined for many years. Among the crops tested are hybrid maize grown for grain, and soya beans of Swedish origin; work was also done on serradella, birdsfoot trefoil grown for fodder, and sweet lupins for fodder or seed. The very wet season of 1950 had been a real test of the economic cultivation of several of these crops, particularly early hybrid maize and Swedish soya beans.

In spite of the very unsuitable season for maize, we harvested excellent crops of grain with several of the Wisconsin hybrids. The strain W.240 has now yielded well in all three years during which it has been grown, giving 27.5 cwt. per acre in 1948, 33.8 cwt. in 1949, and 36.6 cwt. in 1950, or a mean for the three years of 32.6 cwt. per acre. This seems the most promising type and it is now evident that it can flourish even in a most unfavourable year. The length of time between sowing and ripening which in 1950 amounted to 177 days is far longer than in the U.S.A. Another test will be made in 1951, and if this gives results as good as those hitherto

obtained, it would seem that suitable hybrid maize varieties can be confidently recommended, at least as smallholders' crops.

The story is very different with the varieties of soya beans which have been developed in Sweden and gave results of great promise in the dry warm summer of 1949. Soya beans are very sensitive to excess of water in the soil and when this occurs it is difficult to get properly nodulated roots even with inoculation. There has never before been any difficulty at Woburn in getting nodules on the roots of soya beans, even without inoculation, but in 1950, there was little or no nodule development, in spite of inoculating material supplied from Sweden. The result was that the plants grew badly and had an unhealthy appearance, and the excessive rain made the plots very patchy. The best of the varieties gave 10 cwt. beans per acre for a full plant, as compared with 14½ cwt. per acre in 1949. Further tests will be made in 1951.

Sweet Lupins : 1950 proved an excellent year for growth and the yellow variety (Weiko) yielded 16·5 tons per acre of green stuff on August 16th, equal to 2·57 tons of cured hay per acre. When spread for grazing animals in a field, the material was not at once relished, but all, except for a few stalks, had disappeared by the following morning. Sweet lupins, however, appear to be a rather uncertain crop, for after an excellent yield of fodder in 1948 (a wet year), the yield was only small in 1949 (a dry year). The production of seed was good in 1950.

Serradella : The yield of fodder was good amounting to 11·6 tons of green fodder on August 16th equal to 2·14 tons of hay, and was greedily consumed by grazing animals. This again is a crop which is much affected by the character of the season, for while in 1949 there was a good yield of seed and little fodder, in 1950 the production of good seed was very small while there was a fair amount of fodder. There is still much to learn, however, about how to deal with this crop during growth and harvest.

Birdsfoot Trefoil : The narrow leafed type, sown at the end of April, gave 3 tons of green fodder per acre on July 7th and, without any resowing, gave 18·4 tons of green fodder per acre on August 16th. This was readily taken by stock, and contained 16·8 per cent of dry matter, making the yield of hay equivalent as 3·64 tons in 1950. The wet season of 1950 seemed to suit the crop well, and the semi-acid soil at Woburn seemed to have no adverse effect.

Irrigation Experiments : During the year it has been decided to begin irrigation experiments at Woburn, under the general control of Dr. Penman of the Physics department at Rothamsted. Before selecting the site, the suitability of the soil and the water conditions of the land had to be tested and this involved a close investigation of the soil and subsoil of the area proposed for the experiment. A close examination of the subsoil conditions in this typical greensand area, was made to a depth of six feet, in a field which has been under arable cultivation as far back as records go. It is hoped that the experiments on the use of irrigation water with grass and other field crops will be started during the coming spring. The Station is indebted to the Woburn estate for the use of their private water supply for these irrigation experiments.

POT EXPERIMENTS

Clover sickness : The study of the failure of clover when it is frequently grown on the same land has been one of the investigations of the pot culture station for the last fourteen years. The failure here studied has not been connected with any parasite, though it often causes very great reduction of the yield of clover, particularly on soils more or less deficient in lime. As stated in last year's report we have discovered interesting facts about the sickness but have not yet found the actual cause.

We have found no other method of inducing the symptoms, except by repeatedly growing clover, but there is a definite correlation between the proportion of growing clover to soil, and the development of sickness. This has suggested the idea that the sickness is caused by a toxin which might be separated by washing the soil or sand in which the clover was growing and in 1950 we have given much time and work in attempting to do this, but without success. The washings from the soil on which a heavy crop of clover was growing had no injurious effect on clover plants. A similar negative result with the washings from sand cultures makes it unlikely that soil colloids retained the supposed toxin.

Another line followed up in 1950 was to see whether the burial of large amounts of clover roots or tops would have any effect in reducing the vigour of a crop grown after their burial. With roots no such effect occurs : with tops, using a very large amount of material, there did seem to be some reduction in growth of clover. These results though inconclusive, suggest that the clover tops when buried carry with them some toxin. This suggestion will be followed up. All antiseptics tried, including formalin, have failed to improve the capacity of a sick soil to grow clover.

The nutrition of crops under very acid conditions : The work on this question, which has been one of the main enquiries at the Woburn station for a number of years, has continued in 1950, but the results obtained are still under consideration. The principal point dealt with has been whether the actual amount of calcium present has any effect on the growth of barley, either in the presence of large amounts of soluble phosphates or otherwise. It is hoped to publish the results of this enquiry in the very near future.

LABORATORY WORK

The formation of nitrates in soil following various crop rotations : It is generally recognised that land which has been under a ley crop for several years tends to be more fertile than the same soil with similar manuring under a continuous arable rotation. The reasons for this are not fully understood and in an attempt to ascertain the cause Mr. Barnes has been studying the rapidity of the formation of nitrates in soils after each of the several treatments of the ley arable experiment, continued since 1938 in Stackyard field. On the whole, as a result of eight years of soil examination, he has found very little difference in the amount of nitrate formation taking place and so it would appear that the cause must be sought elsewhere. The results have just been published in the Journal of Agricultural Science.

Changes in the sulphur content of soils under long treatment with fertilisers and manures : At Woburn we have had land under barley for nearly eighty years, which has been treated with various manures every year for at least fifty years. Samples of the soils from each treatment have been taken from time to time, and these have afforded the opportunity to see how far the changes in fertility have corresponded with variations in sulphur in the soils. The work is now complete and is awaiting publication. It may be stated here, however, that there is little sign of any correlation between any form of sulphur in the soil and the yield of barley that was obtained. The accumulation of sulphur in the form of sulphate has been very small, and any increase which has taken place has occurred chiefly in the form of organic sulphur compounds.