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Report for 1923-1924 With the Supplement to the Guide to the Experimental Plots Containing the Yields per Acre Etc.



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Green Manuring

Rothamsted Research

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GREEN MANURING.

The importance of increasing the amount of organic matter in the soil is widely recognised, and experiments have been carried out at Rothamsted for some years to determine the best ways in which this could be done. Mr. Page has been studying green manuring, and he has now been able, thanks to the intervention of the Research Council of the Royal Agricultural Society, to arrange for a number of experiments at outside centres, and thus to obtain direct information on the extent to which soil and climatic factors influence the method.

In practice two kinds of green manuring are possible, though they are not always practicable:—

1. Summer catch crops may be turned in before the winter corn.

2. Winter catch crops may be turned in before roots.

In general, the first method can be practiced only on fallow land, early ploughed seeds leys, or land that has carried a crop harvested early, such as a silage or soiling crop. The eastern counties appear to offer the best opportunities for success.

Trials of this method, using mustard as the green crop, are in progress at six centres, one in the west (Gloucestershire), and five in the east (Kent (2), Suffolk, Beds. and Northants.). The results of the test at Rothamsted give a forcible illustration of its value. Mustard was sown on the bare fallow after cleaning on 20th August, 1923. It was turned under on October 18th, and winter oats were drilled at once. The yields of oats in August, 1924, were as follows:—

Basal Manure.	Yield of Oats, bu/acre.		Increase due to Mustard.	
	After Mustard Ploughed in.	After Fallow (no mustard)	Bu.	Per cent.
None	43·3	25·0	18·3	73
5 tons town refuse	51·8	27·1	24·7	91
10 „ „ „	49·3	30·6	18·7	61
Average	48·1	27·6	20·5	74

The turning in of mustard thus added, on the average, 20 bushels per acre to the crop. The cost per acre for mustard seed and the extra operations involved in drilling and turning under amounts to 18/-, whilst the increased yield of oats was worth 79/6 per acre, without reckoning the value of the extra 9 cwts. of straw per acre.

The turning in of winter catch crops before roots is probably of even greater practical importance. Climatic factors play a great part since the green crops have to pass through the winter: if this is too cold, crops sown in the autumn do not usually make sufficient growth, by the time when the land needs to be prepared for roots, to produce any marked effect on the root yield. It is probably only within the region, with an average winter temperature exceeding 40° F. and an annual rainfall between 30 and 40 inches, that the present set of autumn sown green crops can as a rule be successfully grown for turning under

in the spring before the roots. The fact that the corn harvest is earlier in this part of the country, so that green crops can be sown earlier, also helps. Outside of this region autumn sown green crops do not in general make enough growth by the spring to be useful for green manuring purposes; this has happened at Rothamsted for three successive seasons (1921-1924).

The problem therefore arises of finding a system of green manuring for roots which is applicable to the colder northern and eastern districts.

Undersowing of green crops in the corn, and possible new crops are being tried: and at certain centres the relative economic values of folding the green crops to sheep, and of turning them in for manure, are being ascertained.

THE LEGUMINOUS CROPS.

Considerable attention has been devoted to the leguminous crops, owing to their great importance in the rotation and as stock foods. The effect of manures applied to the barley on the clover sown in is shown on pp. 114, 115. Sulphate of ammonia had no bad effect on the clover although it increased the yield of barley. We have met cases where the application of sulphate of ammonia to barley reduced the yield of the clover, but in our experience this happens only when the land badly needs lime, and it is attributable to the increased acidity which sulphate of ammonia is liable to produce on such soils. The phosphate apparently had no action while the potash exerted a distinct residual effect, giving an additional 6 cwts. of clover hay in 1924 and 12 cwts. in 1923. The results indicate that potash should be applied to the clover if the barley crop has been good, unless it has already been given to the barley.

Inoculation of leguminous crops, especially lucerne.

Ever since 1890, when Hellriegel and Wilfarth discovered that leguminous plants live in association with micro-organisms inhabiting the nodules on their roots, efforts have been made to improve the growth of leguminous crops by adding the appropriate organisms to the soil. Some successes were obtained on the Continent, but the method failed in this country; the results at Rothamsted in 1906 and 1907 were not then considered sufficiently good to justify extension to farm practice.

There is no doubt, however, that for certain crops the principle is sound; the failure of inoculation in Britain must be attributed to the lack of compliance with the conditions necessary to success. During the past three years the whole subject has been re-examined in the Bacteriological Department.

The subject affords an admirable illustration of the way in which a practical problem of great importance remains unsolved, in spite of many empirical efforts, until the underlying principles have first been studied and a solid groundwork of definitely ascertained facts has been obtained.

The failure of inoculation in many cases has been traced to the circumstance that the organisms were already present in the soil, but some condition essential to the growth of the plant