ROTHAMSTED RESEARCH

The Growing of Lucerne

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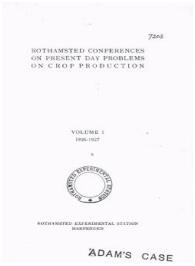

Some Scottish Experiments With Lucerne

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Inoculation should chiefly help us by enabling the area of successful growth to be extended. To do this, however, there are two limiting factors to be overcome: the cold winters of the North and the weeds due to wet weather in the West. It is possible that some of the Canadian or Scandinavian varieties of lucerne may be sufficiently cold-resistant to grow in the North, and this possibility is being tested. The weed problem, however, has always been paramount. There seem to be two possible ways of dealing with it. One is late sowing. In the course of our trials sowing has been carried out at times ranging from April till August, and the best and cleanest have been those sown in July, since it is then possible to clean out the majority of annual weeds before sowing. The second possibility is to use some cover crop. It is recognised that in the Eastern counties a cover crop is undesirable, but in the West one is often faced with the alternative of having an intentional cover crop or an unintentional cover of weeds. The weakening effect of a cover crop is largely due to its removing nitrogen from the young lucerne. Inoculation renders the plant more independent of soil nitrogen, so that the cover crop then does little harm in this way. For this reason our trials have shown that where a cover crop is used, inoculation is the more necessary.

I feel that this problem of weed suppression is vital in the extension of lucerne growing, and I hope it will be discussed by those more competent to do so.

SOME SCOTTISH EXPERIMENTS WITH LUCERNE

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The experiments with lucerne carried out by the Edinburgh and East of Scotland College of Agriculture were begun in 1920. In that year a culture for the inoculation of lucerne was received from the United States Department of Agriculture with a request that it should be tested. An experiment to test the effect of inoculation was carried out at Seton Mains, East Lothian, on land which showed a lime requirement (Hutchinson and MacLennan's method) of 1 ton calcium carbonate per acre. The inoculation was applied to the seed. The crop was a complete failure.

An endeavour was made to ascertain whether lucerne was grown satisfactorily anywhere within the College area at this time. Three small plots were discovered—one at Pathhead, Midlothian, one at Newtown St Boswells, Roxburghshire, and one at Cupar, Fife. All

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three plots carried excellent crops. The one at Cupar had been inoculated; the other two had been neither inoculated nor limed. The plot at Pathhead yielded three good cuttings annually and had been sown five years previously. The soil from the Newtown St Boswells and Pathhead plots showed no lime requirement but contained calcium carbonate.

In 1923 a small area at Scone was used to test the effect of inoculation and liming. It was divided into four equal parts, two of which received ground limestone at the rate corresponding to the lime requirement. A culture for inoculation was obtained from the United States Department of Agriculture. It was used for inoculating half of the seed, which was drilled 4 in. between the rows. The plots were arranged to give uninoculated, unlimed; uninoculated, limed; inoculated, unlimed, and inoculated, limed areas. A good crop was cut in September 1923. Inoculation increased the crop yield from 50 to 80 per cent. and nearly doubled the percentage of nitrogen in the dry matter (see Table, p. 12). Owing to the fact that the plots were small the yields have been stated as percentages of the yield of the unlimed uninoculated plot. The plots at Scone have yielded two good cuttings each year since 1923 and the inoculation has now spread to all four plots.

In 1924 a more extensive series of experiments was planned to test the effect of inoculation and liming. The general arrangement of the plots was the same as at Scone, but the whole area at each centre consisted of $\frac{1}{4}$ acre divided into four $\frac{1}{16}$-acre plots, except at Boghall, where a total area of 1 acre was sown. The lime requirement of the soil was determined by the Hutchinson and MacLennan method, and ground limestone was applied in excess of the lime requirement to two of the plots some time before the seed was sown. All four plots also received a dressing of phosphatic and potash manures. The inoculation consisted of a mixture of cultures isolated from plants obtained from the plots at Scone and cultures from the United States Department of Agriculture. The cultures were grown on mannite agar. The growth was suspended in water and the suspension was used to water the seed for the inoculated plots. The seed used was a mixture of two parts of Provence to one of South American and one of English grown. It was drilled in April and May, 8 in. between the rows, at the rate of 30 lb. per acre. Precautions were taken to prevent transfer of inoculation in sowing, and a path 3 ft. wide was left between the inoculated and uninoculated plots in order to reduce the risk of spread of inoculation.

Considerable difficulty in establishing the crop was experienced in most of these experiments. The crop failed in five of the eight centres. At the remaining three centres—Camptoun and Ballencrieff in East Lothian, and Boghall in Midlothian—the experiments

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TABLE

	Sown	Cut	Lime Requirement	Weight of Dried Crop				Nitrogen in Dry Matter per cent.			
				Limed		Unlimed		Limed		Unlimed	
				Inoc.	Uninoc.	Inoc.	Uninoc.	Inoc.	Uninoc.	Inoc.	Uninoc.
				Per cent.	Per cent.	Per cent.	Per cent.				
Scone, Perthshire . . .	May 1923	Sept. 1923	0·1 ton $CaCO_3$ per acre	152	104	184	100	2·76	1·82	3·05	1·63
Ballencrieff, East Lothian . .	April 1924	July 1925	1·2 ton $CaCO_3$ per acre	254	100	...	...	2·34	1·47	...	...
		Aug. 1925		127	40	...	...				
				cwt. lb.	cwt. lb.	cwt. lb.	cwt. lb.				
Boghall, Midlothian . .	May 1924	July 1925	0·5 ton $CaCO_3$ per acre	30 109	17 44	32 43	20 18	2·73	1·22	2·47	1·11
		Oct. 1925		22 23	...*	16 103	...*	4·53	3·43	4·27	2·36
Kildinny, Perthshire . . .	June 1925	Sept. 1925	3·2 tons $CaCO_3$ per acre	35 46	24†	11 76	4 96	3·47	1·84	...	...

* Insufficient to weigh. † Estimated.

were more successful. The plots at Camptoun gave a fair yield the first season. Unfortunately, however, they had to be ploughed up at the end of the first season for reasons which had no connection with the experiment. The experiments at Ballencrieff and Boghall gave small yields the first season, but in neither case was the crop sufficiently large to weigh.

The crop obtained in these experiments in 1925 has, as a rule, been fed green to animals. In order to secure a figure for the weight of hay a weighed sample has been taken in the field and air-dried in the laboratory. Owing to the fact that it has been found to be practically impossible to prevent inoculation from spreading to the uninoculated plots it has been difficult to obtain values which accurately represent the effect of inoculation. Generally speaking, it has been necessary to cut and weigh the crop on selected representative areas and to calculate the yield from the data so obtained. The results, however, do not truly represent the effect of inoculation, because the crop on the uninoculated areas has consisted almost entirely of weeds.

The procedure outlined sometimes necessitated the weighing of the crop from comparatively small areas, as for example at Ballencrieff. In this case, therefore, the results have been stated as percentages of the yield of the limed uninoculated plot. It should be mentioned, however, that the crop on the inoculated limed plot in this case, as well as at Scone, was decidedly superior to that on the corresponding plot at Boghall, which yielded about 30 cwt. per acre. Inoculation produced a marked effect on the yield and also on the percentage of nitrogen. The second cutting was taken about four weeks after the first, with a view to allowing of the possibility of obtaining a third cutting. This expectation, however, was not realised. The Boghall results also show the beneficial effects of inoculation on yield and percentage of nitrogen. A fair total yield has been secured. Although the second cutting gave a smaller weight than the first, it contained a higher percentage of nitrogen and a higher actual weight of nitrogen per acre than the first.

The high proportion of failures in the experiments started in 1924 was attributed to:

(1) Too early sowing and the cold wet season. As a result the crop grew slowly and was difficult to keep free from weeds.

(2) Late application of lime. The lime was applied generally less than one month before sowing, and probably therefore had not sufficient time to exert fully its beneficial effects. Thus soils with a higher lime requirement than 1·2 ton failed to produce a crop.

(3) Inadequate cleaning of the land in certain cases.

In 1925 experiments were begun at four new centres. In those cases the lime was applied three to five months before sowing. The

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seed was sown in June, and before sowing the land was harrowed from time to time to encourage weed seeds to germinate. The soil was then thoroughly cleaned and cultivated just before the crop was sown. The seed used consisted entirely of the Provence variety. Otherwise the arrangement of the experiments was the same as in 1924.

So far as one can judge, the crop at three of the four centres appears to have established itself. A cutting was obtained at all three centres at the end of the first season. In one case (at Kildinny) the yield of the inoculated limed plot was 35 cwt. per acre, which is highly satisfactory. At the other two centres the yield of the corresponding plot was under 1 ton. These results are more promising than those secured in 1924 and lend some support to the view that the modifications introduced in 1925 have had a beneficial effect. At the fourth centre the failure is attributed to the fact that the soil was too heavy for this crop.

Our experience with lucerne therefore indicates that on soils adequately provided with lime a satisfactory crop can often be grown without inoculation. On soils with a distinct lime requirement the beneficial effects of liming and inoculation have been demonstrated and promising yields have been obtained in certain cases. Late sowing with thorough preliminary cleaning and cultivation of the land seems to be of value in establishing the crop. From the practical standpoint the greatest drawback appears to be the uncertainty of obtaining a satisfactory yield the first season. The work will, therefore, be continued with a view to trying to overcome this difficulty. An attempt will also be made to obtain further data on the yield obtainable on soils adequately provided with lime.

LUCERNE FOR THE DAIRY FARM

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The value of lucerne as a forage crop has been recognised and the crop largely grown throughout the southern countries of Europe for many centuries. It appears to have been introduced into England in the seventeenth century, and its cultivation on suitable soils slowly spread throughout the South-Eastern counties. Marshall, in his *Rural Economy of the Southern Counties*, published in 1798, mentions that the cropping practice of the district of Maidstone and also of the Isle of Thanet is distinguished from that of other parts of England by the frequency with which lucerne is grown in small fields, "not, however, standing in rows with hoen intervals, as in other countries,

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