ROTHAMSTED RESEARCH

The Growing of Lucerne

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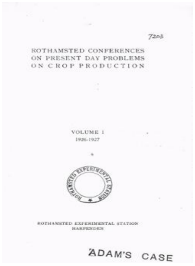

Lucerne Growing in High and Wet Districts

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On many occasions I have discussed with dairy farmers the advisability of growing a small area of lucerne, and frequently I have been met with the complaint that when they had tried it they had been able at first to get a satisfactory plant, but were very disappointed with the first year's growth. Apparently, therefore, before the acreage under lucerne can be materially increased it is essential to find out by what methods of cultivation competition from weeds can be kept down, and how a fair crop can be obtained during the first year. It may be that inoculation will aid materially in this respect, and a stronger growth in the early stages will thereby hinder weed growth. Dairy farmers and others will value greatly any assistance or advice which will increase the return during the first year of the plant's growth.

LUCERNE GROWING IN HIGH AND WET DISTRICTS

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Lucerne is grown only to a very small extent in the Western counties. In Wales, for example, it is almost entirely confined to a small area in South Glamorgan. During recent years several half-hearted attempts have been made to introduce it into other districts, but without much success. Why is lucerne, which is generally acknowledged to be the best fodder crop in the world both as regards productivity and feeding value when grown under suitable conditions, not grown to a larger extent in districts such as Wales, which are devoted mainly to stock-rearing?

There are several reasons for this: the most important are the absence of lime in the soil, high rainfall, and the fact that the growing of lucerne is often undertaken without the full appreciation of the special requirements of the crop. Thus, for example, it is not an uncommon practice to sow lucerne with a seeds mixture under oats or barley, regardless of the soil and weather conditions of the district. It has been repeatedly shown by various experiments conducted in different counties that under conditions prevailing in Wales lucerne is nearly always a complete failure when sown in this way. In an experiment conducted at Aberystwyth, in 1922-1923, lucerne was sown in a very simple mixture consisting of 5 lb. of tall oat grass, 7½ lb. of an early red clover and 15 lb. of Provence lucerne per acre. The soil was deficient in lime and phosphates. The phosphates were made good by the application of slag at the rate of 6 cwt. per acre. Though the seeds germinated quite well, lucerne

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was unable to make headway, apparently owing to the severe competition from the tall oat grass and red clover, and when cut for hay in 1923 the plants were very small—their average height being only 5 in.—and sickly in appearance. The percentage composition of the hay was as follows :—

	Per cent.
Red clover	48·7
Tall oat grass	44·5
Unsown grasses and weeds	6·4
Lucerne	0·4

In other words, the lucerne produced only 20 lb. of hay per acre —that is, the weight of hay was only 5 lb. more than the weight of seeds sown. That this was largely due to competition was shown by the results of another experiment set up in the same field on exactly similar soil, in which the lucerne had been sown alone in wide drills and therefore not in competition with other species. About 15 cwt. of hay (first cut) was obtained from the experiment.

Lucerne is far more sensitive to competition, especially during its early stages of growth, than any other forage crop grown in this country. Consequently, except perhaps on soil which is particularly suitable, it should always be sown alone and in drills, so that it can be kept free from weeds right from the very start until the crop is firmly established. The best stands at Aberystwyth have been obtained by sowing in drills about 12 in. apart. When sown at this distance the crop helps to keep the land clean by filling up the drills during the summer when the growth is too tall to send the hoes through.

Considerable care should be exercised in selecting fields for growing lucerne. It is merely a waste of time, labour and seeds to attempt to grow the crop on very exposed fields or on shallow, heavy or badly drained soils. The fields should be fairly well sheltered, preferably with a southern aspect. The soil should be fairly deep and well drained. It is a sound practice in wet districts to sow the crop after roots, as the land is then fairly clean and in good heart.

Most of the soils in the extreme west are very deficient in lime, the lime requirements being often over 2 tons per acre. The absence of lime is due partly to the fact that the soils are in the main derived from non-calcareous rocks and partly to the leaching action of the rain. The average annual rainfall in most districts in Wales is well over 40 in.—that is, practically twice as much rain as in the east of England. Lucerne, more than any other crop, except possibly sainfoin, requires a high proportion of lime in the soil, and before it can be grown with success in wet districts the soils must be heavily limed.

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The results of two experiments carried out at Aberystwyth are interesting in that they show the kind of crops often obtained when lucerne is sown on soils very deficient in lime. These were red clover trials in which a few plots of Provence lucerne—some in drills and others broadcasted—were included for comparison. The lucerne was sown at 30 lb. per acre, and red clover at an average rate of 15 lb. The lucerne germinated quite as well as the red clover, but the plants remained very small and stunted throughout the seeding year and the first harvest year, and by the second year they had died back completely. The average yields of green fodder per acre of lucerne and Montgomery red clover during the first two years were:

Experiment I

	1923	1924
Montgomery . .	158 cwt.	59 cwt.
Lucerne . . .	6½ „	...

Experiment II

	1923	1924
Montgomery . .	165 cwt.	61 cwt.
Lucerne . . .	7 „	...

In most cases where lucerne is grown for the first time the soil should be inoculated. The simplest method of doing this is to inoculate the seeds of the first crop with an artificial culture, then if the crop has been properly inoculated to use the soil from this field to inoculate the other fields. But if the soil is very deficient in lime, inoculation has practically no effect. This was shown to be the case in an experiment laid down in 1920. In this experiment a number of plots were sown with inoculated and uninoculated seeds of Provence lucerne on soil very deficient in lime. There was practically no difference between crops given the two treatments, both giving equally poor results.

A similar experiment was started last year in which inoculated and uninoculated seeds were sown on both limed and unlimed plots. Though it is rather early to draw any definite conclusions from this experiment, even now it is quite clear that the limed plots —both the inoculated and uninoculated—are better than the plots which received no lime. Of the limed plots the inoculated seemed last autumn to have a much more healthy appearance than the uninoculated plots.

On the inoculated plots, more especially on those which had been limed, the roots have already a large number of nodules, while not a single nodule could be found on the roots of the plants growing on the plots which had not been inoculated.

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Most of our soils are also lacking in phosphates. Lucerne in common with other leguminous crops if they are to be grown successfully must be supplied with phosphates. On soils very deficient in phosphates the best time of applying this manure is just before sowing, so as to give the seedlings a good start.

It is often asserted that lucerne cannot be grown profitably in districts with high rainfall. On the contrary, excellent crops of lucerne, lasting for several years, have been grown at Aberystwyth and other centres in Wales, and there is no reason why it should not be grown with equal success in other wet districts, provided the soil is well supplied with lime and phosphates, the seeds inoculated and sown in drills on well-drained sheltered fields, and the crops kept free of weeds, especially during the first year.

There is no doubt that the final take depends to quite a large extent on the time of sowing. If sown too early—say, in late March or early April—a large percentage of the seedlings may be killed off by late frost; and if the sowing is delayed until too late, winter will set in before the plants are firmly established. In an experiment on the time of sowing lucerne, conducted at Aberystwyth in 1925, seeds were sown in replicated drill plots every two weeks from 30th March to 7th August, the same number of viable seeds being sown in each case. The number of seedlings on small representative areas of each plot were counted from time to time. The results given below show the average numbers expressed as percentages of the number of viable seeds sown present on 7th September in the case of the first four sowings. The results of the later sowings are not shown, as unfortunately they are not comparable with those given by the early sowings, owing to the fact that germination was badly effected by the severe drought which occurred during June and July.

	Times of Sowing			
	30th March	*14th April*	*28th April*	*12th May*
Percentage No. of established plants on 7th September	19·0	12·7	49·3	43·0

As seen from these results the plots sown in late April and mid-May gave much better stands than those sown earlier.

Our knowledge concerning the behaviour of the different varieties of lucerne under different conditions is rather limited. The results of the few small-scale trials conducted at Aberystwyth suggest that Grimm and Canadian Variegated are more suitable for wet districts than Provence and other *sativa* varieties, not because they are necessarily more productive, but because they give heavier crops during midsummer—that is, from late June to August, the only period when it is usually possible to make hay in wet districts. There is

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also a certain amount of evidence which seems to indicate that the hybrid varieties are also able to withstand pasture conditions better than the common varieties.

As a plant breeder I am naturally more interested in the possibilities of breeding lucerne to suit different conditions than in the purely agronomic aspect of the work.

Like nearly all cross-fertile species, every variety of lucerne consists of a large number of distinct types. Many of these types show very wide differences in certain economic characters. In Provence lucerne, for instance, it is possible to select plants which start growth two to three weeks earlier in the spring than others; also plants which are able to give three to four cuts a year, others only two. Again, some plants assume the winter habit much earlier than others. They also differ in frost resistance, leafiness, seed production and many other important characters. Unlike some of the other cross-fertile species, lucerne is fairly self-fertile, if artificially self-pollinated. For example 76 per cent. of the lucerne plants which were self-pollinated by me in 1925 produced a certain amount of seed. If the plants were pure and bred true to type it would be a comparatively simple matter to breed improved strains. Unfortunately the problem is far more complicated than this, as nearly every lucerne plant is a product of a cross between two unlike plants, and will therefore segregate out in the next and subsequent generations into a large number of different types, even when self-fertilised. It is possible, however, to secure a certain degree of purity by self-fertilising the plants and their progeny for several generations. During this process the undesirable characters are being eliminated. When the necessary degree of purity is reached, the next step is to group together a number of pure lines showing the desired characters and allow these plants to intercross freely: this is necessary in order to recover the vigour which has been lost during the process of pure lining. By adopting some such method it will no doubt be possible to breed new strains of lucerne which might be more suitable to our conditions than any of the existing varieties. It must be remembered that most of the breeding work so far conducted with lucerne in America and elsewhere has been with a view to obtaining types with increased resistance to frost and to drought. For Welsh and West Country situations resistance to wet and more or less water-logged conditions is the first essential, and thus it is possible that strains with shallower, more fibrous and more branching root systems may be more suitable than those with the normal deep-growing top roots, and this is one of the points under consideration in connection with our breeding work.

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