THE ESTABLISHMENT OF LUCERNE (*Medicago sativa* L.) ON MARLBOROUGH HILL COUNTRY BY OVERSOWING

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SUMMARY

The effects of applications of lime and herbicides on the establishment of lucerne from inoculated seed oversown into unimproved danthonia swards on hill sites in Marlborough were determined. Suppression of the resident vegetation by application of the herbicides 2,2-DPA, paraquat and amitrole resulted in better establishment and survival of lucerne. Application of lime 1250 kg/ha had beneficial effects also.

INTRODUCTION

Marlborough has relatively small areas of fertile arable soils and must look to its large areas of poor hill country for substantial increases in livestock production. The Yellow-Grey Earth hill soils of the lower hill country cover some 80,000 hectares between the Wairau and Clarence rivers, are of medium fertility, weakly acid - pH 5.7 - 6.0 - and are free draining but because of the erratic spring and summer rainfalls are frequently drought striken. Under these conditions perennial clovers such as White Clover Trifolium repens L. do not persist. However, lucerne Medicago sativa L. being better suited agronomically for droughty conditions (White, 1960. and Iversen, 1964.) would probably be more productive and persistent on Marlborough hill country and if established may result in higher stock carrying capacities. This has been the experience where lucerne has been established on shallow droughty soils in some low rainfall districts (Flay, 1962; Iversen, 1964 and Lynch, 1967).

The successful establishment of grasses and clovers in the eroded Wither Hill soils was achieved first in 1957 by oversowing seed of pasture species after the danthonia Notodanthonia spp dominant sward had been treated with 2,2-DPA. Follow-up work included lucerne in the oversown seed mixtures.

Although lucerne seed germinated satisfactorily, establishing lucerne seedlings failed to survive, not withstanding the successful establishment and survival of other pasture species.

In view of its presumed potential as a forage species on droughty soils in low rainfall environments, it was decided to investigate the causes of the failure of lucerne to establish from oversown seed.

METHODS AND MATERIALS

1966 Experiments

In the winter of 1966 similar experiments were commenced in five hillside sites in the Wairau and Awatere Valleys to test the effect of applications of lime and herbicides on the establishment and survival of lucerne. On the experimental sites the unimproved swards were dominantly danthonia (Notodanthonia spp) together with some browntop, Agrostis tenuis Sibth.; red fescue Festuca rubra; suckling clover, Trifolium dubium Sibth.; Jersey cudweed, Gnaphalum lutea-album L. and catsear, Hypochaeris radicata L.

Applications of 2,2 -DPA nil, 2.7 kg and 4.5 kg/ha in water were made to the danthonia swards in the middle of July and some two months later applications of paraquat nil, 0.28 kg and 0.56 kg/ha in water were made alone and in all factorial combinations with the 2,2-DPA treatments. At the time paraquat was applied, lime 1250 kg/ha was applied to sub plots in the herbicide plots, and the trial areas were oversown with inoculated Wairau lucerne seed 11.2 kg/ha and topdressed with molybdic super phosphate 375 kg/ha.

Six weeks after the applications of inoculated lucerne seed counts were made of the numbers of lucerne seedlings and in the following autumn counts were made of the numbers of lucerne plants that had survived the summer.

1969 Experiment

In the winter of 1969 an experiment was put down on a site near Hauwai, Grassmere to test the effects of herbicides on the suppression of resident vegetation and the establishment of lucerne from oversown seed. Applications of 2,2-DPA 4.5 kg/ha and 2,2-DPA 4.5 kg + amitrole 1.1 kg/ha were made to a danthonia dominant sward which also contained some perennial ryegrass Lolium perenne L., goose grass Bromus mollis L., subterranean clover Trifolium subterraneum L. and some weed species. Inoculated Wairau lucerne seed 6.7 kg/ha was oversown

on to the trial area in mid September together with lime 1250 kg.ha and molybdic super phosphate 375 kg/ha.

Counts of lucerne seedlings and surviving lucerne plants were made subsequently.

RESULTS

1966 Experiments

Satisfactory numbers of lucerne seeds germinated on all sites but seedlings persisted for more than a few weeks in only three sites. Two sites were on a Haldon soil in the Wairau Valley, and the third in a Wither Hill soil. Establishment of lucerne at this site was sparse.

The failure of seedlings to survive on the two sites is almost certainly due to the failure of the lucerne seedlings to nodulate satisfactorily.

On the adjacent East Face and North Face sites in the Wairau Valley, where seedlings survived, rain 16.5 mm fell two days after the inoculated seed had been oversown. During the following months of October, November and December 43 mm, 137 mm and 51 mm respectively were recorded. Drought conditions were experienced in January and February.

On areas treated with 2,2-DPA, initial grass control was good, but Jersey cudweed and catsear grew more vigorously than on untreated areas. Paraquat had no prolonged effect on the grasses, which recovered and grew strongly. Where 2,2-DPA and paraquat were applied together growth of both grasses and weeds was effectively suppressed.

The efficiency of the herbicides in suppressing growth of resident vegetation was reflected in the numbers of lucerne plants which established and survived. On bothEast Face and North Face sites the combination of herbicides improved the control of resident vegetation. Lime also caused higher numbers of lucerne plants to survive.

TABLE 1: Number of Lucerne Plants/930 cm^2 Established on Herbicide and LimeTreated Areas on East Face and North Face Sites, Wairau Valley 1966.

	East Face 22.2.67		North Face 14.4.67	
	Lime Nil	Lime	Lime Nil	Lime
Treatment				
Control	0.0	1.6	0.0	0.0
2,2-DPA 2.7 kg/ha	0.5	2.7	0.2	0.7
2,2-DPA 4.5 kg/ha	0.6	4.4	0.4	1.1
Paraquat*	1.4	4.3	0.4	0.7
2,2-DPA 2.7 kg/ha + Paraquat*	3.0	7.4	0.9	2.1
2,2-DPA 4.5 kg/ha + Paraquat*	1.3	6.4	1.7	2.4

* Mean values of Paraquat 0.28 kg/ha and Paraquat 0.56 kg/ha treatments.

1969 Experiment

In 1969 rain 22 mm fell some fourteen days after the inoculated lucerne seed had been oversown in mid September. Drought conditions were experienced through the following months of October and November.

Satisfactory numbers of lucerne seeds germinated.

On 2,2-DPA 4.5 kg/ha treated areas grasses were almost completely suppressed but Subterranean clover made strong regrowth. On areas treated with 2,2-DPA 4.5 kg + amitrole 1.1 kg/ha neither grasses nor clovers made much regrowth.

By the end of November lucerne seedlings on the 2,2-DPA 4.5 kg/ha treated areas were some 2.5 cm tall but on the 2,2-DPA 4.5 kg amitrole 1.1 kg/ha treated areas lucerne seedlings were taller up to 10 cm, and had produced three to four stems.

Counts of surviving plants made in the following January showed greater numbers of plants on the most effective herbicide treated areas.

TABLE 2: Numbers of Lucerne Plants Surviving at Grassmere 1969

Treatment	Plants per m^2	Plant Height (cms)	Stems per plant
Control	0	-	-
2,2-DPA 4.5 kg/ha	39	10	1.8
2,2-DPA 4.5 kg amitrole 1.1 kg/ha	59	23	5.0

DISCUSSION

In the experiments described in this paper only one feature affecting the establishment of lucerne from oversown seed was investigated. Results showed that under the conditions of the experiments successful establishment of lucerne from oversown seed is largely a matter of reducing competition from resident vegetation. However, where resident vegetation is sparse and plant competition for soil moisture less intense, lucerne may be established without any preliminary treatment of the site other than the correction of plant nutrient deficiencies. This has been shown by Douglas (1970) on recovering scabweed country in North Otago. However, elsewhere under less favourable conditions Campbell (1968) and White (1970), have shown that the use of herbicides to suppress resident vegetation results in better establishment of lucerne from oversown seed.

Poor germination of lucerne seed, high losses of seedlings, and nodulation failures have been common experiences in local field work. It is suggested therefore that factors other than the use of herbicides to reduce competition by resident vegetation need further investigation.

Local climatic conditions generally do not aid successful lucerne establishment from oversown seed. Dessicating nor-west winds are common in the spring and early summer months and monthly rainfalls fluctuate widely. Even in the early spring month of August when falls of rain average 63 mm, evaporation which averages 48 mm, not infrequently exceeds rainfall. Germination of seeds lying on the soil surface have been shown by McWillian and Dowling (1970) to be markedly affected by soil moisture status and the degree of contact between the seed and soil surface during imbibition.

Campbell (1968) has shown that the establishment of the seedling on the soil surface is markedly affected by rainfall and evaporation between the time that the radicle emerges and the time that it penetrates the soil. In view of the dependance of the establishing seedlings on a readily available supply of moisture in the soil surface, it is not surprising that it is difficult to achieve success in local climatic conditions.

Oversowing is a much less certain method of establishing lucerne than drilling seed into a cultivated seed bed. Time of oversowing seed relative to climatic conditions is critical. The relative importance of each phase in the technique required for the successful establishment of lucerne plants from oversown inoculated seed had not been fully determined and will, no doubt, vary according to local circumstances. Nevertheless the work undertaken in the field since 1966 has shown promise in developing methods for the introduction of lucerne into Marlborough hill country swards.

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