

OVERSOWING GRASSES AND CLOVERS

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Summary

The effects of time of sowing, lime and fertilizer, ground cover, grazing and use of paraquat on the establishment of oversown grasses and clovers were investigated in a series of trials located throughout Otago. Competition from existing herbage had a marked effect on grass establishment, and hence on dense swards those treatments which reduced competition, namely, close grazing and use of paraquat, aided survival. Lime increased grass survival but high phosphate and nitrogen failed to improve establishment in most cases; clover establishment was generally aided by high phosphate but not by lime or nitrogen.

INTRODUCTION

DURING the past eight years, more than twenty trials involving the individual sowing and counting of more than 100,000 grass and clover seeds have been laid down at Hindon, Berwick, Te Anau, Tara Hills High Country Research Station near Omarama, and Invermay Research Station. The trials have been conducted on a variety of pasture types — e.g., dense browntop at Invermay, sparse fescue tussock with browntop and native grasses at Hindon and Berwick, and bracken fern country near Te Anau — and have investigated such aspects as the effect of time of sowing, application of lime and fertilizer, use of paraquat, effect of grazing intensity, and need for clover inoculation. In this paper an endeavour has been made to summarize some of the main results and recommendations.

RESULTS

TIME OF SOWING

Late winter and early spring have generally proved the best time for sowing clovers (During *et al.*, 1963; Lobb, 1958) probably because the cool, damp soil favours clover germination and inoculation and there is minimum competition from existing herbage.

However, results from this series of trials indicated that weather and soil conditions at sowing influenced greatly the per-

centage germination and survival of both clovers and grasses and that establishment could be successful from winter, spring, summer or autumn sowing.

Competition from the existing herbage appeared to be the main reason for poor grass survival and by use of paraquat cocksfoot was successfully established in two trials whether sown in August, December or March. Ryegrass establishment in several cases proved superior when sown in autumn — perhaps, because of its rapid establishment, it was able to compete successfully with the native vegetation at that time of the year.

EFFECT OF LIME AND FERTILIZER

Although lime is often associated with good clover establishment, in most of the trials cited in this paper it had a greater effect on grasses than on clovers except on very acid soil (pH less than 5.0) where at least 5 cwt of lime was necessary for clover inoculation. Using lime-pelleted clover seed did not overcome this need (Cullen and Ludecke, 1966).

In several trials on low-fertility soils, lime aided grass survival to a greater extent than nitrogenous fertilizer. Ryegrass tended to respond to lime more than cocksfoot (Table 1). The use of high rates of phosphate improved clover but not grass establishment. Nitrolime tended to depress germination and seldom aided survival although it usually improved grass vigour in the early stages.

GROUND COVER

Some ground cover generally increased germination and survival. In particular, cover is important in the late spring when clover mortality may be high because of inoculation failure as a result of sowing on hot, dry ground (Table 2). Thin fern or tussock, such as that obtained where the area has been burnt about a year previously, is recommended.

EFFECT OF GRAZING

Where vegetation was dense, close grazing both before and after sowing aided grass and clover establishment, particularly where paraquat was not used (Table 3). Close set stocking is recommended in preference to mob grazing to check existing vegetation. Spelling after sowing or in the first year is not recommended as this favours the existing herbage more than the young

TABLE 1: EFFECT OF LIME AND FERTILIZER ON GRASS GERMINATION AND SURVIVAL
(Trials sown August, 1963. Survival counts taken September, 1964)

	Germination %				Survival %†			
	Trial 1		Trial 2		Trial 1		Trial 2	
	Ryegrass	Cocksfoot	Ryegrass	Cocksfoot	Ryegrass	Cocksfoot	Ryegrass	Cocksfoot
No phosphate	43	34	29	21	52	69	24	44
Super-phosphate 6 cwt	37 - 6	35 + 1	29 - 0	17 - 4	46 - 6	77 + 8	18 - 6	35 - 9
No lime	33	33	27	20	38	66	14	38
Lime 1 ton	47 + 14**	36 + 3	32 + 5*	18 - 2	59 + 21**	79 + 13*	29 + 15*	41-j-3
No nitrogen	37	31	27	19	50	76	13	41
Nitrolime 2 cwt	43 + 6	38 + 7	33 + 6**	19 - 0	48 - 2	70 - 6	30 + 17'	39-2
c v	12.2%		20.1%		13.7%		26.5%	

Trial 1 = Sparse browntop, native sward on Taieri foothills.

Trial 2 = Dense browntop-dominant sward at Invermay.

Note: Survival data for Trial 1 are means of paraquat 1 lb and no paraquat treatments; for Trial 2 paraquat treatments only are shown because of very low survival in the no paraquat treatments.

†Survival % = Percentage surviving of those which germinated.

sown seedlings. Few clovers will set seed in the first year and if spelling to allow seeding is desired it should be left until the second year.

EFFECTS OF PARAQUAT

Paraquat proved of benefit for grass establishment, especially on dense browntop, but was seldom necessary for good clover establishment (Table 3).

Results from two trials with various rates of paraquat up to 2 lb/acre suggested that $\frac{1}{2}$ lb was sufficient for satisfactory grass establishment, and in some cases — e.g., under very dry conditions — higher rates gave poorer results. In the paraquat treatments, there was some indication that cocksfoot survival was highest from sowings made in late spring, and, where it is desired to introduce grass into pastures sown with clovers some years previously, late spring or early autumn may be the best time of sowing. This has not yet been tested fully.

WHEN TO SOW GRASSES

It is advocated frequently that the initial sowing on undeveloped country should be with clover only and that grasses should be introduced at a later stage after soil fertility has been built up. Trials at Te Anau indicated that best results were obtained by including grasses in the initial seed mixtures when competition from existing herbage was at a minimum. Despite low fertility and low nitrogen status, grasses will establish without artificial nitrogen although growth may be very slow and the sown grasses are seldom noticed for two or three years. It is extremely difficult to introduce grasses successfully into vigorous grass and clover swards unless paraquat or very intensive grazing is used, because of the strong competition from existing vegetation.

This point cannot be emphasized too strongly. It is not that the seed lies on the dry ground surface and does not germinate — in most trials germination is quite fair — it is the low number of plants surviving which causes the poor grass establishment. Hence any method which cuts down this competition will help appreciably, whether it is surface cultivation, burning, hard grazing, or use of chemicals such as paraquat. This explains why grass (and clover) establishment is often much better on burnt fern and tussock country than on dense browntop, despite the soil being less fertile.

TABLE 2: EFFECT OF COVER ON GRASS AND CLOVER PERCENTAGE SURVIVAL

<i>Time of Sowing</i>	<i>Open — No Cover</i>				<i>Some Fern Cover</i>		
	<i>Jul.</i>	<i>Sep.</i>	<i>Nov.</i>	<i>Nov.</i>	<i>Jul.</i>	<i>Sep.</i>	<i>Nov.</i>
White clover	70	33	0	65	78	30	
Red clover	38	73	0	77	95	38	
Subterranean clover	100	50	0	79	62	32	
Ryegrass	10	0	0	10	12	21	
Cocksfoot	44	23	4	3	62	35	56

TABLE 3: EFFECT OF GRAZING ON GRASS AND CLOVER GERMINATION AND SURVIVAL (DENSE SWARD)
(Trial sown August, 1965. Survival counts taken Jan., 1967)

	<i>Germination %</i>				<i>Survival %</i>			
	<i>Paraquat 1 lb</i>		<i>No Paraquat</i>		<i>Paraquat 1 lb</i>		<i>No Paraquat</i>	
	<i>Close Grazed</i>	<i>Infrequently Grazed</i>	<i>Close Grazed</i>	<i>Infrequently Grazed</i>	<i>Close Grazed</i>	<i>Infrequently Grazed</i>	<i>Close Grazed</i>	<i>Infrequently Grazed</i>
Ryegrass	17	13	7	3	54	30	27	17
Cocksfoot	19	13	15	12	42	59	10	8
White clover	17	17	21	16	29	32	26	17

SEED MIXTURE

This depends on the area, climate, fertility and a host of other factors. White clover should always be sown and red clover is normally included although it can be a problem in wet areas because of its prolific summer growth. Alsike is recommended in the South Island high country and subterranean clover and possibly lucerne may be included in dry areas.

The inclusion of ryegrass and cocksfoot in all mixtures is advocated even if low seeding rates are used. Little may be seen of these for several years but they provide a nucleus of grasses which will become more important constituents of the sward once fertility builds up. Examples of two mixtures are as follows:

- (1) Lowland browntup hill country capable of carrying 4 to 5 sheep per acre with development: Perennial ryegrass 10 lb, cocksfoot 3 lb, timothy $\frac{1}{2}$ lb, dogstail $\frac{1}{2}$ lb, white clover 3 to 4 lb, Montgomery red clover 3 lb.
- (2) High-altitude tussock country in low rainfall area with a potential of 2 to 3 sheep per acre — e.g., Tara Hills, North Otago: Perennial ryegrass 5 lb, cocksfoot 3 lb, white clover 3 lb, Montgomery red clover 2 to 3 lb, alsike 2 lb.

METHOD OF SOWING

The seed is best sown separately from the fertilizer, using an aircraft fitted with a spreader. This results in a much wider swath and less segregation of the seed (R. S. Scott, pers. comm.) . This method also avoids damage to the clover inoculum through being mixed with acid fertilizer.

CLOVER INOCULATION

On most areas of hill and high country in Otago, inoculation of the clovers is recommended, especially where few clovers are naturally present. This applies to the low-altitude tussock country in the Berwick and Hindon areas bordering the Taieri plain, the bracken fern country near Te Anau, and the high-altitude tussock country throughout central and north Otago.

Recent trials have indicated that a high *Rhizobia* count in the inoculum is necessary and best results have been obtained where the inoculum has been used at several times the recommended commercial rate (Cullen *et al.*, 1969) . Pelleted inoculated seed which is available commercially and has a high *Rhizobia* count

has generally given good results. Recent work has also shown that strain of *Rhizobia* is important and several new strains are proving superior to those formerly in commercial use. Some of these promising strains are now being used in commercial inocula.

CONCLUSION

It is obvious that many factors have to be taken into consideration to ensure successful results from oversowing but, with attention to the points mentioned, particularly realization of the importance of overcoming competition from existing vegetation, good establishment of grasses and clovers can be obtained.

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DISCUSSION

Asked to comment on the need for pelleting because so many factors are outside the farmers' control, Cullen replied that pelleting had not proved of any great merit, except perhaps from the ballistics angle. The important aim should be to ensure that high nodulation took place. This meant inoculating with very high rates of bacteria. To a suggestion that autumn sowings were better than spring, Cullen stated that it depended entirely on weather conditions. What he did prefer to see was close grazing before, during and after establishment.

He agreed that the lack of response to nitrogen could be due to increased growth of resident vegetation and hence more competition for the establishing species.

Asked if he could offer any explanation for the response to lime which he obtained, Cullen said that he had noticed in several trials that certain grasses, particularly ryegrass, had responded to lime. He had assumed that it was due to mineralization of nitrogen over a period of time, in contrast to fertilizer nitrogen actually applied.

To a question as to the necessity for applying nitrogen where seed was sown on bare ground following the use of paraquat, Cullen replied that it had often been stated that there would be a nitrogen deficiency, but it had not shown in his trials.