EFFECTS OF WINTER APPLICATION OF PHENOXY HERBICIDES ON WHITE CLOVER AND PASTURE PRODUCTION IN LOWER NORTHLAND

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Summary

Three phenoxy herbicides 2,4-D, MCPA and MCPB were applied to pastures containing white clover (*Trifolium repens*) during three successive winters and their effects were measured over the following season. MCPA and 2,4-D at 1 kg/ha depressed both clover and total dry matter production in the following 4 - 5 months but the early to mid-winter applications were less severe than the late winter treatments. MCPB at 2 kg/ha had little effect on clover or total dry matter yields from the early application but the late winter treatment caused a significant reduction in the total dry matter production.

INTRODUCTION

The role of white clover in New Zealand pastures is of undisputed importance both for the food value of its herbage and for its part in nitrogen fixation. Consequently, any reduction in clover growth, even temporarily, results in production losses at the time and reduced nitrogen fixation can also lead to lowered grass production later on. Many experiments have shown the importance of clover in pasture production (Lewis 1956; Meeklah 1958) and Lynch (1954) has cited a reduction of up to 73% in the total dry matter yield in the absence of clovers. Lewis (1957) also emphasised the importance of the clover component in increasing the nutritive value of the pasture for fat lamb production.

Concern by farm advisory officers over poor spring clover growth in the area north of Auckland led to a survey of 200 farms. Results indicated some low potash levels and some clover pathogens which could be responsible but another common factor was the aerial application of hormone herbicides for control of thistles and other annual weeds. The quantity of 2,4-D and MCPA sold in Northland provides enough evidence for assuming that thousands of hectares of pastures are sprayed each season.

Because less material is required to kill weeds when they are small (Blomfield 1956; Matthews 1956) and because it is considered that the least clover damage occurs during a period of clover dormancy, such as during winter in Canterbury and Otago (McLean 1956; Meeklah 1958), most of the spraying is done between May and September. Temperatures below -5°C are rare in Northland so that true clover dormancy does not occur. A rate of growth trial at Otakanini near Helensville between 1964 and 1974 showed that 14% of the annual production of clover occurred in the months of June, July and August (Piggot *et al* 1978). This situation prompted an investigation into the effects of three phenoxy herbicides on pasture production in the milder winters of Northland.

MATERIALS AND METHODS

This study included three trials conducted between 1976 and 1978. The herbicides were applied to short, white clover based pastures with an Oxford Precision sprayer in 500 - 600 litres/ha water. Plot size was 5 x 1.5 m and treatments were arranged in a randomised block design with 4 to 6 replicates. The trial areas were fenced to exclude stock and mown for dry matter production at intervals of about 28 days. Clippings were returned on most occasions but were discarded when growth was

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very strong. Herbage dissections were done on a bulked treatment basis at every cut dividing the sample into grasses, clovers and weeds which comprised mainly narrow-leaved plantain (*Plantago lanceolata*), broad-leaved dock (*Rumex obtusifolius*), daisy (*Bellis perennis*), creeping buttercup (*Ranunculus repens*) and Scotch thistle (*Cirsium vulgare*).

The rates of application and herbicides used were similar to those used by both McLean (1957) and Meeklah (1958). Ethyl ester of 2,4-D and potassium salt of MCPA were applied at 1 kg/ha and sodium salt of MCPB was used at 2 kg/ha. These rates were rather low with regard to label recommendations for pasture weeds but would be expected to be quite sufficient under good conditions. The details of trial sites and application dates of herbicides are given in Table 1.

TABLE 1: Details of trial sites and herbicide application dates

Trial No.	Trial location	Year	Pasture type	Clover %	Application dates	
					Early	Late
1	Silverdale	1976	Cattle	25-30	24 June	not applied
2	Waimauku	1977	Cattle	20-25	31 May	1 August
3	Otakanini	1978	Sheep	8-10	23 June	7 August

RESULTS AND DISCUSSION

The effects of the treatments on clover DM production were averaged over corresponding cuts on different trials, there being three trials investigating early winter application and two trials involving late winter application.

With early application (Fig. 1) MCPB had little effect on clover production until late spring when there appeared to emerge some residual effects in Trials 1 and 2 which had higher clover levels than Trial 3. By contrast MCPA and 2,4-D showed a substantial early effect in all trials, reducing clover growth by about 70%. A residual effect was also shown in the same two trials as for MCPB.

The effects of late applications were much more pronounced for MCPA and 2,4-D (Fig. 2). Treatments were applied part way through an active growth period and the two chemicals not only restricted the clover production but also killed some of the clover foliage present at the time of application. Both trials (2 and 3) showed residual effects from all treatments.

The total DM production data (including weeds, where present) are given in Table 2. The analysis of the mean of treatment effects over the trials showed that the reductions in the total dry matter production from MCPA and 2,4-D were significant at least at the 5% level for each time of application and that even the late application of MCPB caused a significant depression in dry matter production.

TABLE 2: Total pasture production (kg/ha DM) from the time of application until the following January

Treatment Trial	Early sprayed				Late sprayed		
	1	2	3	Mean	2	3	Mean
Control	7700	6340	5240	6490	5840	4590	5210
2,4-D	7070	5470	4890	5810*	4230	3840	4030**
MCPA	7070	5530	5070	5890*	5090	3720	4400*
MCPB	7520	5760	5510	6260	5120	3970	4540*

*, ** Significantly lower than the control at 5% and 1% respectively.

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Fig 1 Effect of *early* applied herbicide treatments on clover production (average of 3 trials)

Fig 2 Effect of *late* applied herbicide treatments on clover production (average of 2 trials)

There is a suggested relationship between the extent of initial weed infestation and the replacement by grasses of the eliminated weeds. Thus in Trial 3 with weeds comprising only 3% of DM produced in the controls, grass production averaged over chemical treatments was reduced by 2% from early application and by 10% from late application compared with control. On the other hand, in Trial 2 with about 30% weed infestation grass production was increased by about 30% from early application and 20% from the late application, compared with the control. Trial 1, early application, showed a 12% increase associated with 8% weed DM presence. In weedy pastures, therefore, the effect of spraying may be to remove most weed growth, reduce the clover growth and to increase the grass growth by removal of the competing species. Nevertheless the total DM yields compared with the control were reduced by 250 - 400 kg/ha more than the loss in clover production *per se* in these trials.

CONCLUSIONS

In the relatively mild winters of Northland there is apparently no 'safe' time for applying phenoxy herbicides. Early to mid winter applications caused less damage to clovers than the late winter sprayings. Total pasture dry matter losses from MCPA and 2,4-D ranged from 400 - 900 kg/ha in the 7 months following early application while with the MCPB in the same period the losses were insignificant. All three chemicals caused significant reductions ranging from 600 - 1600 kg/ha from the late application.

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The risk of pasture production losses in early spring when feed is at a premium would dictate that the application of phenoxy herbicides should be restricted to the early winter. Management practices which will strengthen the pasture and encourage the smothering of annual weeds during the winter could well be considered as an alternative to the overall application of hormone type herbicides.

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