WHITE CLOVER SEED CROP: PARAQUAT AND CARBETAMIDE MIXTURES FOR WEED CONTROL

I. C. LOGAN and R. N. ARNST
ICI New Zealand Ltd, Christchurch.

Summary

The advantages of early control of grass weeds in the white clover (*Trifolium repens*) seed crop were confirmed. The trials showed that a combination of paraquat and carbetamide extended the period of weed control of grasses and wild oats (*Avena fatua*), over that effected by either constituent alone. Indications were that a mixture of paraquat 0.3 kg/ha and carbetamide 1.25 kg/ha would be satisfactory for weed control and yield.

INTRODUCTION

Paraquat has been extensively used to control ryegrass (*Lolium perenne*) in white clover (*Trifolium repens*) seed crops and thereby increase seed yields as outlined by Leonard (1965). More recently carbetamide and propyzamide have been shown to produce increased clover seed yields (Allen *et al* 1972; Wasmuth and Miles 1972). During the past few seasons there has been some regrowth of 'Grasslands Paroa' Italian Ryegrass and 'Grasslands Manawa' ryegrass following paraquat application. Increasing the rate to 0.6 kg/ha has been practised and has solved the problem but, if followed by dry conditions, this can accentuate crop retardation as discussed by the above authors.

Carbetamide and propyzamide are essentially grass killers thus if a range of flatweeds is present competition from this source may reduce clover yields, as experienced by Allen *et al* (1972).

Also the time of application, for maximum yields, of propyzamide and carbetamide, does not always suit the farmer's management, even if he is a specialist grower.

It was considered that a combination of paraquat and either propyzamide or carbetamide might add flexibility of timing of application whilst increasing the weed spectrum controlled and the period of control. Previous experience with paraquat-carbetamide mixtures demonstrated their compatibility and indicated that carbetamide, in mixture, was still effective when applied in the spring (Logan and Arnst 1972; Wasmuth and Miles 1972).

Work in 1971 indicated some benefits for mixtures. Further trials were considered necessary to test the postulated and partially established advantages of mixtures of paraquat and carbetamide.

EXPERIMENTAL METHOD

1972 Plot Scale :

Three fully replicated and randomised trials were set down next to each other, comparing the same range of chemical treatments but having different application times.

The trials were situated in a two year old clover stand on a Templeton plus Wakanui soil type near Lincoln in Canterbury. Plots were 30 m x 5 m and treatments were applied, by boom sprayer, in 330 litres of water/ha.

Small Seed Crops

At the time of the August application the vegetation was short (up to 3 cm) but by September the ryegrass was up to 15 cm high, clover 10 cm and poa annua 7.5 cm. Hairgrass (*Vulpia* spp) was also present. Before the October application it was necessary to graze the area to be sprayed and at treatment the ryegrass was 12 cm and the clover 8 cm high. Closing up a paddock for spraying in August or September results in rank growth and "topping" is practised to allow flower development. This operation was done in mid-October and clover was left 10 cm high.

Propyzamide was not applied in October following observations of the September application and apparent lack of activity of the chemical.

In mid November the whole trial area received 2.5 cm water through an overhead irrigation system.

Visual assessments were made at intervals and scores from these appear in Table 1. Seed yields, Table 2, were obtained by heading (following windrowing) individual plots, collecting seed and dressing to commercial requirements.

1973 Large Scale :

On 25th August 1973, in a paddock adjacent and similar to that used in the 1972 trial, one acre blocks with control strips between, were sprayed with propyzamide, carbetamide, paraquat and a carbetamide-paraquat mixture.

At harvest measured strips, randomly selected from each block, were headed and seed collected to be dressed and weighed, Table 3.

RESULTS
TABLE 1: GRASS WEED CONTROL 1972 TRIAL

Application Date	16-18 August 1972	19 Sept. 1972
Assessment Date	12/9/72	15/11/72
Treatment kg/ha		
untreated control	0	0
paraquat 0.6	9	10
paraquat 0.3 + carbetamide 0.8	9	10
paraquat 0.3 + carbetamide 1.25	9	10
paraquat 0.3 + carbetamide 1.70	9	10
paraquat 0.3 + carbetamide 2.50	9	10
carbetamide 2.50	0	2.5
propyzamide 0.75	1.5	3.0

0 = No control 10 = Full control
Figures are means from at least two observers

1972 Trials

August treatments which included paraquat quickly desiccated the vegetation present and clover slowly recovered over the following weeks, stooling out to give full even ground cover. It was nearly a month before visual effects were noted following treatment by propyzamide and carbetamide on their own.

September applications of propyzamide confirmed that at this stage its effectiveness for weed control is seriously reduced but carbetamide was still acceptably effective although not as good as paraquat alone

or paraquat-carbetamide mixtures. October-applied carbetamide had only a slight effect on grasses and its addition to paraquat did not appear to have any advantage. During December the benefit of adding carbetamide to paraquat for August and September applications became apparent when ryegrass development was prevented and a clean clover stand was maintained.

1973 Trial

The major weed problem was wild oats (*Avena fatua*). These were immediately desiccated by paraquat but it was nearly four weeks before carbetamide effects were apparent and a week to ten days longer before propyzamide control was obvious.

Carbetamide also had an effect on seedling wire-weed (*Polygonum aviculare*) which remained stunted until swamped by clover growth.

At harvest an assessment on wild oats which had developed to seed head showed that the paraquat-carbetamide mixture was superior to paraquat, carbetamide and propyzamide alone.

TABLE 2: YIELD (kg/ha) OF DRESSED CLOVER SEED —
1972 TRIAL

Application Date	16-18 Aug.	19 Sept.	21 Oct.
<i>Treatment kg/ha</i>			
untreated control	85	90	85
paraquat 0.6	242 bc	112	109
paraquat 0.3 + carbetamide 0.8	269 abc	121	79
paraquat 0.3 + carbetamide 1.25	292 ab	148	87
paraquat 0.3 + carbetamide 1.70	228 c	119	94
paraquat 0.3 + carbetamide 2.50	242 bc	76	88
carbetamide 2.50	294 ab	107	82
propyzamide 0.75	322 a	126	—
CV%	13.7		

Duncan's multiple range test analysis does not include control which was clearly significantly different from all other treatments.

TABLE 3: WILD OAT CONTROL AND CLOVER YIELD
— 1973 TRIAL

<i>Treatment kg/ha</i>	Wild Oats % control	Yield, dressed seed kg/ha
untreated control	0	111
paraquat 0.6	60	594
paraquat 0.3 + carbetamide 1.25	90	688
carbetamide 2.50	70	510
propyzamide 0.75	67.5	578

DISCUSSION

The trials reported have confirmed previous work which showed that the control of weeds, particularly grass weeds, increases clover seed yields. The actual yields from the 1972 trial were disappointing and this was attributed to the light soil type and a dry period beginning in October.

All August 1972 treatments substantially increased yield but despite rapid knockdown by the paraquat mixtures there was no increase in yield over that of carbetamide on its own. The reduction in yield

Small Seed Crops

by the mixture applying 1.7 kg carbetamide/ha cannot be explained unless the addition of paraquat does reduce clover tolerance, although this is not substantiated by the yields following application of the higher rate of chemical.

In August 1973 the paraquat-carbetamide combination was superior to either chemical on its own. Desiccation of the wild oat population was very fast and some of the wild oat germination which occurred following spraying of the mixture was controlled by the carbetamide.

The September application resulted in very much lower yield increases but did indicate an advantage for a mixture of paraquat and carbetamide for weed control. Yield was reduced by paraquat plus the high rate of carbetamide. October treatments correspond with a dry period and responses were not anticipated but paraquat alone did tend to show an increase. The 1972 trials conclusively indicated the advisability of early weed control and showed that all chemicals are effective if growth conditions are slow and they have time to act. If growth is more vigorous as in 1973, immediate desiccation is advantageous but under such conditions some competitive weeds may recover so the presence of a residual is beneficial. If applications are to be made in September the lower rate of paraquat plus carbetamide should allow quicker clover recovery, in case of early dry spells, whilst maintaining control of grasses.

The chance grower who applies chemicals after mid-October, a common practice, should continue to use paraquat alone until combinations have been further evaluated.

It is to be hoped that the combined properties of paraquat and carbetamide can help overcome the managerial problems, of the specialist grower, which arise from: July or early August applications not being practicable, the variable activity of chemicals according to season or the possible regrowth or late germination of grasses which may follow August-September applications of paraquat. Whilst propyzamide was not included in mixture with paraquat in the experiments reported, this material could be as effective in mixture as carbetamide.

CONCLUSIONS

The combination of paraquat and carbetamide resulted in a period of weed control of greater duration than can be achieved by either chemical alone.

A mixture of paraquat 0.3 kg/ha and carbetamide 1.25 kg/ha could offer the grower managerial flexibility if further work confirms yield advantages.

ACKNOWLEDGEMENTS

The authors wish to record their gratitude to Brian Payne for his co-operation and forbearance, particularly during a difficult harvest.

REFERENCES

- Allen, F. C., Smallridge, T. J., Walker, I., 1972. Grass Weed and Sheep's Sorrel control in clover seed crops. *Proc. 25th N.Z. Weed and Pest Control Conf.*: 214-19.
- Leonard, W. F., 1964. Grass suppression in clover seed crops. *Proc. 17th N.Z. Weed and Pest Control Conf.*: 49-52.
- Logan, I. C., Arnst, R. N., 1972. Barley grass control: Evaluation of initial and sequential applications of herbicide mixtures. *Proc. 25th N.Z. Weed and Pest Control Conf.*: 34-40.
- Wasmuth, A. G., Miles, K. B., 1972. The suppression of grass weeds in white clover seed crops with carbetamide. *Proc. 25th N.Z. Weed and Pest Control Conf.*: 210-213.

Proc. 27th N.Z. Weed and Pest Control Conf.