PRELIMINARY EVALUATION OF PRE- AND POST- EMERGENCE HERBICIDES IN 'MAKU' LOTUS

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Summary

In an experiment on *Lotus pedunculatus* cv. 'Grasslands Maku' sown in November 1974, dinoseb was the most effective of 6 pre-emergence herbicides tested and 2,4-DB the best of 5 post-emergence herbicides. The crop showed no tolerance towards atrazine, cyanazine, metribuzin or bentazone. Carbetamide, propyzamide, and possibly methabenzthiazuron, caused little crop injury and, although not effective in controlling a predominantly dicotyledonous weed population, would be worth further testing for control of grass weeds.

INTRODUCTION

The tetraploid, 'Grasslands Maku' lotus (*Lotus pedunculatus*) has considerable potential as a perennial pasture legume for large areas of damp, infertile hill grazing land, where it performs better and persists longer than white clover (*Trifolium repens*). It is, however, a difficult crop to establish. The seed germinates slowly and growth of the young seedlings is also slow, so that weed competition in the early stages of establishment is a frequent cause of failure to produce successful seed crops.

Herbicide work in New Zealand has been restricted to the testing of trifluralin as a pre-sowing, incorporated treatment, and carbetamide as pre-sowing and post-emergence treatments on autumn sown crops. Both chemicals showed promise against grasses but not dicotyledons and the degree of selectivity appeared to be somewhat less with lotus than with three clovers (Brock 1972). More information is available on *L. corniculatus* (bird's-foot trefoil), grown extensively in the northern USA which is equally slow to establish and for which EPTC or benfluralin are recommended as pre-sowing, incorporated treatments and 2,4-DB as an early post-emergence treatment (Burr 1974).

The present investigation was undertaken as a field screening experiment to obtain information on the effectiveness and selectivity in a spring sown lotus crop of pre- and post-emergence herbicides showing promise, or in commercial use, on other small-seeded legumes.

EXPERIMENTAL METHODS

The experiment was conducted on a Tokomaru silt loam soil on the Massey University farm. The area had been ploughed out of permanent pasture two months prior to sowing. Inoculated seed of lotus was sown in 15 cm rows with a Connor-Shea disc drill on 15 November, 1974. Pre-emergence sprays were applied with a propane sprayer at a volume of 560 litres/ha on 28 November, at which time neither crop nor weeds had emerged. Post-emergence sprays were applied on 2 January 1975 when the crop was 1 to 7 cm and the weeds up to 30 cm high.

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The major weeds present were fathen (*Chenopodium album* agg.), black nightshade (*Solanum nigrum* complex), twincress (*Coronopus didymus*) and redroot (*Amaranthus hybridus*, *A. retroflexus*), with smaller numbers of hawkbit (*Leontodon taraxacoides*), sowthistle (*Sonchus oleraceus*) and willow weed (*Polygonum persicaria*).

Six herbicides were tested as pre-emergence and five as post-emergence sprays, each at three doses as detailed in Tables 1 and 2. The experiment was of randomised block design with three replicates and the plot size was 4 x 3 m. The effects of the treatments were assessed by scoring at intervals and by measuring the dry weights of crop and weeds from a 3 x 1 m cut made with an autoscylthe on 5 February, by which time the crop had grown to a height of up to 20 cm and was flowering.

RESULTS

Table 1 shows the results of the pre-emergence treatments as assessed by visual estimation 5 weeks and by dry weight measurement 10 weeks after spraying. The figures given are means for the three replicates. The stand of both crop and weeds was variable, as is indicated by the high coefficients of variation. Despite this, there are clear differences between treatments. Atrazine and cyanazine were entirely non-selective and killed most of the crop and weeds at all doses. With dinoseb, however, although the effects were less persistent, weeds were effectively controlled for the first 5 weeks. At the higher

TABLE 1: EFFECTS ON WEEDS AND CROP,
PRE-EMERGENCE TREATMENTS

Treatment	Weeds			Crop	
	Rate kg/ha	Estimated % Kill 3/1/75	% reduction dry weight 5/2/75	Estimated growth reduction 3/1/75	Dry weight as % control 5/2/75
dinoseb (acetate)	2.2	87	45	3	209
	3.4	92	82*	40	149
	4.5	87	53	50	299*
methabenzthia- zuron	0.8	67	23	30	173
	1.4	70	10	67	118
	2.2	88	80*	73	69
propyzamide	0.8	43	19	43	134
	1.4	40	21	17	203
	2.2	47	3	40	86
carbetamide	1.1	47	4	18	101
	2.2	50	58	33	89
	3.4	63	30	53	128
atrazine	0.6	90	85*	100	0*
	1.1	99	84*	100	0*
	1.7	100	100*	100	0*
cyanazine	0.6	83	70	93	0*
	1.1	95	93*	100	0*
	1.7	98	96*	100	0*
control		Ground cover	kg/ha	—	kg/ha
		20-40%	892	—	196
CV %			34		40

* Significantly more or less than control ($P = 0.05$).

Calculated from analysis of transformed data ($\sqrt{x + 0.5}$).

doses, the crop was checked temporarily, but no plants were killed and the benefit of early weed control was reflected in a significantly increased yield with the highest dose. Methabenzthiazuron also gave good control of weeds at 2.2 kg/ha but appeared to be more damaging to the crop than dinoseb.

Table 2 gives the assessments of the post-emergence treatments 4 and 5 weeks after application and indicates good agreement between visual estimates and dry weight measurement. Metribuzin and bentazon were very damaging to the crop, dinoseb was less effective than when applied before emergence, while 2,4-DB and MCPB provided good weed control with little crop damage. At the two higher doses of MCPB marked deformity of the base of the lotus stems was observed so that, although yields were little affected, 2,4-DB appeared to be the more selective herbicide.

TABLE 2: EFFECTS ON WEEDS AND CROP,
POST-EMERGENCE TREATMENTS

Treatment	Rate kg/ha	Weeds		Crop	
		Estimated % Kill 28/1/75	% reduction dry weight 5/2/75	Estimated growth reduction 28/1/75	Dry weight as % control 5/2/75
2,4-DB	1.1	88	91*	7	82
	2.2	87	91*	0	220
	3.4	92	96*	13	150
MCPB	1.1	83	82*	0	132
	2.2	87	82*	0	154
	3.4	87	80*	22	72
dinoseb	2.2	33	2	10	70
	3.4	27	24	23	136
	4.5	70	65	23	61
metribuzin	0.6	63	35	90	1*
	1.1	57	42	87	1*
	2.2	77	81*	98	1*
bentazone	1.1	33	17	95	1*
	2.2	68	32	98	0*
	3.4	85	89*	100	0*
control		Ground cover	kg/ha	—	kg/ha
		60-100%	892	—	196
CV %			34		40

* Significantly less than control ($P = 0.05$).

Calculated from analysis of transformed data ($\sqrt{x + 0.5}$).

DISCUSSION

The most promising of the chemicals tested were dinoseb as a pre-emergence and 2,4-DB as a post-emergence treatment. Both gave satisfactory control of the four major weeds present (fathen, black nightshade, twincress and red root) without causing more than temporary injury to lotus. The crop appeared to benefit more from effective pre-emergence than post-emergence treatment, but it is probable that 2,4-DB could have been applied at an earlier growth stage without causing injury; in which case the crop would have been expected to make better growth through earlier release from competition. There were no clear dosage differences but the degree of control given by

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the lowest and the lack of injury from the highest doses suggest an adequate margin of safety with the two chemicals. Further testing will be needed on different weed populations and on crops growing under different conditions and at a wider range of growth stages before dinoseb or 2,4-DB could be recommended for use on a field scale.

Of the other herbicides, neither atrazine nor cyanazine showed any promise as pre-emergence treatments. Metribuzin and bentazon were equally unpromising as post-emergence sprays. Propyzamide and carbetamide, however, caused no obvious crop injury and, although they killed few weeds in this experiment, could still be of value where grass weeds are more important.

Brock (1972) found trifluralin promising as a pre-sowing, incorporated treatment on *L. pedunculatus*. Incorporated treatments were not included in the present experiment but, on nearby plots sown earlier than the main area, trifluralin and benfluralin applied at 1.7 kg/ha and incorporated with a Dutch harrow gave successful control of fathen without injuring the crop. Black nightshade and hawkbit were unaffected, however, and rapidly dominated the plots. Such incorporated treatments are worth further investigation for grass control.

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