THE EFFECT OF HERBICIDES ON WHITE LUPINS FOR SEED PRODUCTION

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Summary

A number of pre-plant, pre-emergence and post-emergence materials were evaluated for weed control in white lupins (*Lupinus angustifolius*). Atrazine and cyanazine treatments resulted in the highest seed yield of lupins, heavier than yields following treatment by a selection of dinitroaniline herbicides. Generally, lupin tolerance to pre-plant and pre-emergence treatments appeared acceptable but severe lupin damage resulted from the use of post-emergence materials. The weed population was dominated by cruciferous weeds, thus atrazine and cyanazine gave the most comprehensive weed control.

INTRODUCTION

White lupins (*Lupinus angustifolius*) of low alkaloid content have received publicity of late as an alternative high protein meal supplement for non-ruminant animals. Very little experimental work has been reported on this crop in the lower half of the South Island. To determine both associated weed and crop response to herbicides, some candidate materials were evaluated in three experiments laid down in conjunction with Crop Research Division, DSIR, on their research area at Gore. The findings from these trials are described in the following report.

MATERIALS AND METHODS

Three field trials were laid down using Uniharvest lupins sown with a Stanhay precision seeder at 145 kg/ha in rows 25 m long, 18 cm apart and spaced at 5 cm within the row. All materials were applied with an experimental plot sprayer in 250 litres/ha. Pre-plant incorporated materials were rotary hoed into the seed-bed to an approximate depth of 7.5 cm immediately following application.

Herbicides used are shown in Tables 1 and 2.

Lupins were sown on 2.10.74 and emergence commenced 11.10.74 and 80% of the crop had emerged by 16.10.74. Each experiment included two initially untreated controls, but in Experiment A and B weeds were removed by hand hoeing (18.11.74) from one control to simulate precision inter-row hoeing which was being carried out at that time on the remainder of the paddock. Assessments for percent weed cover and lupin vigour were taken on 15.11.74 and 10.12.74.

Lupin vigour ratings were from 0 = dead to 5 = unaffected and the figures for percent cover weed assessments and lupin vigour are the mean of three assessors.

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Experiments A and B were direct headed on 2.4.75 but experiment C was not headed due to severe lupin damage from herbicides. Seed samples were taken at harvest for moisture determination and treatment yields were corrected to 15% moisture. Soil analyses taken at laying down showed pH 5.8 and organic matter at 6%.

Accumulated rainfall figures in mm as recorded by DSIR, Gore prior to and after herbicide application were as follows:

Application date		Before treatment	After treatment
2.10.74 (ppi)	1 Day	Nil	0.5
	1 Week	6.6	12.9
	1 Month	12.6	75.0
11.10.74 (Pre-emergence)	1 Day	Tr	2.4
	1 Week	12.4	2.4
	1 Month	23.8	70.1

Rainfall over the spraying times appeared adequate for pre-plant soil incorporated and pre-emergent materials.

RESULTS

The main weeds present were volunteer oil seed rape (*Brassica napus*) cv. Oro shepherd's purse (*Capsella bursa-pastoris*); Californian thistle (*Cirsium arvense*) and fathen (*Chenopodium album* agg.).

For experiments A and B assessments of percent cover of volunteer oil seed rape, lupin vigour and yields are shown in Tables 1 and 2 respectively.

TABLE 1: VOLUNTEER RAPE COVER, LUPIN VIGOUR AND SEED YIELD

Treatment	Rate kg/ha	% Volunteer rape 10.12.74	Lupin vigour 10.12.74	Seed yield % of untreated control
nitralin	1.0 ppsi	27.49 abcAB	4.2 abcAB	130 bcdB
	1.5 ppsi	22.24 bcAB	4.0 bcABC	113 cdB
dinitramine	1.0 ppsi	16.25 bcB	3.7 cdBC	190 bAB
	1.5 ppsi	10.58 cB	3.2 dC	184 bcAB
penoxalin	1.0 ppsi	21.66 bcAB	4.2 abcAB	156 bcdB
	1.5 ppsi	29.99 abAB	4.3 abAB	130 bcdB
trifluralin	1.0 ppsi	32.49 abAB	4.3 abAB	152 bcdB
	1.5 ppsi	46.66 aA	4.4 abAB	118 bcdB
penoxalin	1.0 pre-emergence	17.08 bcB	4.2 abcAB	185 bcAB
	1.5 pre-emergence	27.08 abcAB	4.2 abcAB	181 bcAB
hand-hoed control		0.11 dC	4.0 abcAB	278 aA
untreated control		21.83 bcAB	4.6 aA	100 dB
actual yield kg/ha				650
CV %		30.5	9.16	33.6

ppi treatment applied 2.10.7, pre-emergence treatment applied 11.10.75. Duncan's letters for % volunteer rape refer to transformed data as the square root transformation was used as a variance stabilizing technique.

TABLE 2: VOLUNTEER RAPE COVER, LUPIN VIGOUR, AND SEED YIELD

Treatment	Rate kg/ha	% Volunteer rape 15.11.74	% Volunteer rape 10.12.74	Lupin vigour 10.12.74	Seed yield % of untreated control
atrazine	1.0 pre-emergence	0.34 bB	3.48 cdBCD	4.2 abA	224 abAB
	1.5 pre-emergence	0.06 bB	1.85 dCD	4.1 bA	272 aA
cyanazine	1.0 pre-emergence	0.77 bB	10.26 bB	4.3 abA	178 bcABC
	1.5 pre-emergence	0.79 bB	6.93 bcBC	4.3 abA	193 bcABC
MCPB	1.0 post-emergence	0.71 bB	1.35 dCD	3.0 cB	141 cdBC
	1.5 post-emergence	0.70 bB	0.85 dD	2.7 cB	95 dC
hand-hoed control		11.79 aA	0.12 dD	4.4 abA	233 abAB
untreated control		6.46 aA	32.66 aA	4.6 aA	100 dC
actual yield kg/ha					944
CV %		58.9	47.4	7.9	31.4

Pre-emergence treatment applied 11.10.74, post-emergence treatment applied 4.11.74 at 4 to 6 true leaf stage.

Duncan's letters for % volunteer rape refer to transformed data, as the square root transformation was used as a variance stabilizing technique.

Treatments in experiment C were applied on 4.11.74 after crop emergence (4 to 6 true leaf stage); lupins were marginally tolerant to methabenzthiazuron 0.5 and 0.75 kg/ha, but metribuzin 0.5 and 0.75 kg/ha, bentazon 1.0 and 1.5 $\pm$ MCPB 1.0 and 1.5 kg/ha caused severe crop damage and the trial was abandoned.

DISCUSSION

Crop response: In experiments A and B, visual assessments showed that lupin tolerance to all materials except MCPB and dinitramine appeared satisfactory. Vigour ratings for dinitramine were low but the rates used in this experiment were higher than would be considered necessary due to its greater activity when compared with other dinitroanilines (Naish *et al* 1974). The four materials used in experiment C caused severe crop damage and could not be recommended for post emergence weed control in white lupins.

Weed response: Broad spectrum weed control as shown by atrazine resulted in maximum seed yields and comparable yields from the hand hoed treatment suggest that this cultivar of white lupins may possess adequate tolerance to atrazine but as treated plots were still weed free after harvest this could cause possible residue problems. Cyanazine gave very good weed control but volunteer rape cover increased rapidly after 15.11.74, suggesting a fairly short residual life. Only dinitramine, of the materials used in experiment A, reduced volunteer rape to a level below that of untreated control plots but this reduction was not significant. The pre-emergence application of penoxalin gave slightly better control of shepherd's purse than the same material applied pre-plant but control of volunteer rape was similar. The cover of fathen in experiments A and B was only 5% in untreated controls at 10.12.74 but all treatments reduced cover below 1% with the exception of cyanazine 1.0 kg.

Effect on crop yield: lupin response to herbicides as measured by seed yield, largely reflected the degree of control of the most troublesome weed, i.e. volunteer rape. This plant is leafier but otherwise could be considered similar to wild turnip (*Brassica campestris*). The high yield from the hand hoed treatment indicates that inadequate control of cruciferous weeds

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will prevent white lupins from reaching their maximum yield potential. Despite the fact that hoeing was not carried out until rape ceased to emerge about 48 days after crop drilling, hand hoed plots significantly outyielded all other treatments with the exception of atrazine and cyanazine (Table 2). Dinitramine, while significantly reducing lupin vigour did not cause an associated decrease in seed yield. Although there was no apparent reduction in lupin vigour (except for dinitramine), it may be that high rates of dinitroanilines have an adverse effect on white lupins since better control of volunteer rape from the higher rates was not reflected in higher seed yields.

In conclusion, although no treatment in experiments A and B was detrimental to the crop, only dinitramine, penoxalin pre-emergence, atrazine and cyanazine caused a significant yield increase over that from untreated controls. Furthermore, seed yields following atrazine treatment were equivalent to those from the hand hoed treatment and as both gave equivalent reductions in weeds, this may indicate that the white lupin cultivar Uniharvest has sufficient tolerance to atrazine to warrant testing under a wider range of conditions.

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