FATHEN CONTROL IN LUPINS IN CANTERBURY

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Summary

Atrazine, simazine and chloroxuron were evaluated for fathen (*Chenopodium album*) control in lupins (*Lupinus angustifolius*) cv Uniharvest. Chloroxuron was applied post-emergence at three rates with four rates of surfactant 'Citowett' and compared with pre-emergence applied atrazine and simazine. Chloroxuron at 0.5 kg/ha plus 0.5% v/v surfactant gave higher seed yields and better fathen control than the higher rates of chloroxuron, atrazine or simazine. The addition of surfactant to low rates of chloroxuron appears to give adequate fathen control in spring sown lupins.

INTRODUCTION

Fathen is the main problem weed in spring sown lupins in Canterbury. Atrazine 1 kg/ha applied pre-emergence is the accepted chemical for weed control (Betts 1975; Lucas *et al* 1976; Rhodes 1975) but may give poor results (Lucas pers comm).

As with most surface applied pre-emergence herbicides, rainfall or a moist surface is required to activate the atrazine. The performance of atrazine is affected by different soil types and it can persist in the soil for 6 months or longer (Fryer and Makepeace 1977).

Several situations arise where post-emergence control of fathen or other weeds would be more suitable. These include; when soil conditions are too wet for herbicide application, when conditions are too dry for herbicide activity, when pre-emergence herbicides appear to have failed or when the residual effects of the herbicide interfere with crop rotations.

Betts (1975) showed that lupins had good tolerance to chloroxuron at 0.75 kg/ha but fathen control was not reliable at this rate. Label claims for weed control in soyabeans (*Glycine max*) indicated increase in activity through addition of a suitable surfactant.

This paper reports results of trials undertaken in the Lincoln district to evaluate rates of chloroxuron and effect of surfactant and rates of atrazine and simazine in sites where fathen was known to occur.

METHOD

The lupins cv Uniharvest were sown at the rate of 130 kg/ha using a hoe coulter drill.

Fertiliser was not applied to any of the trial areas since soil tests showed there were no deficiencies of the main elements. All treatments were applied by a bicycle wheel mounted, hand pushed, compressed air operated spray boom delivering 200 litres/ha. A non-ionic surfactant 'Citowett' was used.

Experiment A

Plots 15 x 2 m were arranged in a five replicate randomised block

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design on Wakanui silt loam. Treatments as set out in Table 1 were applied on the 20th December, 4 weeks after sowing. On the 8th March 1978, two 1.5 m² samples per plot were harvested for lupin yield and weed measurements.

Experiment B

This experiment was located on Templeton silt loam and compared chloroxuron post-emergence at 0.5, 1.0 and 1.5 kg/ha both without surfactant and with surfactant at 0.5, 1.5 and 2.5% v/v, atrazine 1.0 kg/ha pre-emergence and untreated.

Plots 20 x 2 m were arranged in a four replicate randomised block design. Lupins were sown on the 5th October 1978 and atrazine pre-emergence was applied 4 days after sowing. Post emergence treatments were applied 6 weeks after sowing. At this time lupin plants were 14 - 16 cm tall and the fathen plants 8 cm tall.

Weed and plant counts were taken prior to application of the post-emergence treatments, at 13 days after treatment and at harvest, 22 weeks after sowing.

The area was desiccated with diquat 0.6 kg/ha on the 9th March to allow machine harvesting of all plots on the 19th March 1979.

Experiment C

This trial adjoined experiment B and investigated the treatments atrazine 1.0, 1.5, 2.0 kg/ha, simazine 1.0, 1.5, 2.0 kg/ha and untreated. The trial was arranged in a randomised block design with four replicates. Plots were 10 x 2 m.

The area was sown in lupins on the 5th October 1978 and treatments were applied 7 days after sowing on 12th October 1978.

Fathen and lupin counts were taken 8 and 21 weeks after sowing. Whole plots were threshed on the 12th March 1979.

RESULTS

Experiment A

A summary of results is presented in Table 1. There were no weeds of importance other than fathen in this experiment.

Table 1. Effects of post-emergence treatments on fathen and lupins.

Chemical	Rate kg/ha	Plants/m ²	Pods/m ²	Seed yield g/m ²	Fathen plants/m ²	Fathen DM g/m ²
chloroxuron	1.0	47 b	159 b	75 b	64 a	516 a
chloroxuron	1.5	53 ab	179 b	95 b	43 a	495 a
chloroxuron	2.25	58 a	182 b	93 b	41 a	453 a
chloroxuron	1.0 +	53 ab	286 a	161 a	11 b	64 b
surfactant	1.5% v/v					
untreated		51 ab	174 b	77 b	54 a	657 a
S.E.		2.8	15.7	11.1	8.7	76.7

The chloroxuron plus surfactant treatment significantly reduced the dry matter (DM) of fathen and increased the seed yield when compared with other treatments. The fathen competition appears to have reduced the numbers of pods per plant but little else.

Experiment B

Reduction of fathen plants by chloroxuron and surfactant is shown in Fig. 1. Other weeds growing in the trial were unevenly distributed and of low incidence. There was no increased control of fathen plant numbers

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with the addition of more than 0.5% v/v surfactant to chloroxuron 0.5 kg/ha, or by increasing chloroxuron to 1.5 kg/ha with surfactant.

Fig. 1: Effect of chloroxuron plus or minus surfactant on % reduction of fathen plants in lupins.

Fig. 2: Effects of atrazine and simazine on weed dry matter production and seed yield of lupins.

Weed weights and lupin seed yields are shown in Table 2 and 3. There was a reduction in fathen weight, and an increase in lupin seed yield following addition of surfactant. For a given rate of chloroxuron there was a significant trend for reduction in weed weight and increase in yield but no additional reduction in plant numbers (Fig. 1) Chloroxuron 0.5 kg/ha plus surfactant 0.5% v/v increased seed yield compared to untreated (Table 3, (<0.01)). This was due to an increase in plant survival (58 vs 52/m²) and more pods per plant (7.5 vs 6.5).

Table 2. Total weed weight g/m²

Surfactant	chloroxuron				atrazine	untreated
% v/v	rate kg/ha	0.5	1.0	1.5	1.0	
0	1	340	460	280	330	620
0.5		140	140	220		
1.5		130	160	170		
2.5		110	130	130		
S.E. = 54						
CV% = 44						

Table 3. Lupin seed yields (whole plot harvest) g/m²

Surfactant	chloroxuron				atrazine	untreated
	rate kg/ha	0.5	1.0	1.5		
% v/v					1.0	
0		170	187	227	193	205
0.5		233	237	254		
1.5		242	248	263		
2.5		254	253	258		
S.E. = 9.4						
CV% = 8						

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Analysis by partitioning treatments shows atrazine 1.0 kg/ha was less effective ($P < 0.01$) than chloroxuron plus surfactant in terms of reduced weed dry weight (330 vs 150 g/m²) and in less pods (460 vs 550/m²). Atrazine was more effective than chloroxuron without surfactant in reducing weed weight (330 vs 360 g/m²).

Damage to lupins increased as the surfactant rate rose for all chloroxuron rates ($P < 0.05$, unpublished data). Symptoms of damage were leaflet curling, wilted leaflet tips and at high chloroxuron and high surfactant rates wilting of the lupin plants for 2 or 3 days. This damage was not serious enough to prevent associated yield increases.

Experiment C

Weed control and seed yield results are graphed in Fig. 2. Main plot analysis showed atrazine was superior to simazine ($P < 0.01$) in reducing weed DM, and increasing seed yield, but both were better than untreated ($P < 0.01$). These results in Fig. 2 and the main plot analysis confirm the work of Ivens and Withers (1977), that atrazine has an advantage over simazine for weed control.

It should be noted that lupin seed yields were not different at the commercially accepted field rate of 1.0 kg/ha, but that weed control was more effective with atrazine.

DISCUSSION

Seed yields in experiments B and C were very similar although the degree of control of fathen was very different (330 g/m² vs 100 g/m²). This variability of weed control by atrazine was associated with different soil surface moisture levels at application and soon after. The atrazine in experiment B was applied 4 days after sowing date while experiment C was sprayed 7 days after sowing. It rained 5 days after experiment B was sprayed and 1 day after C was sprayed. This illustrates how critical soil surface moisture is for activation of pre-emergence chemicals and the consequent variability of weed control.

The activity of chloroxuron was markedly increased by the addition of surfactant.

In Experiment B increasing surfactant from 0.5%-2.5% v/v tended to decrease weed DM and to raise yields but did not alter weed numbers. Increasing chloroxuron rate from 0.5-1.5 kg/ha did not give any yield increase nor improve weed control.

It is possible that the chloroxuron rate, the surfactant rate or both could be further reduced without losing efficiency in weed control.

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