PENDIMETHALIN: A HERBICIDE WITH POTENTIAL FOR USE IN FOREST NURSERIES.

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SUMMARY

The tolerance of nursery seedlings of several tree species to the herbicide pendimethalin at 0.99 kg/ha or 1.32 kg/ha was evaluated over two seasons. *Pinus radiata*, *Acacia dealbata*, *Cupressus macrocarpa*, and five species of *Eucalyptus* were all tolerant to pre-emergence applications. Post-emergence applications caused a reduction in height growth of *A. dealbata*, and *C. macrocarpa* which also developed a high incidence of double leadering. Tolerance of *Eucalyptus* species to post-emergence applications was rate dependent.

Keywords: forest nurseries, pendimethalin, seedling tolerance.

INTRODUCTION

Weed control is essential to maximise seedling growth in forest nurseries. Herbicides are the most cost-effective method of controlling the wide range of weeds which commonly occur. Nitrofen, propazine, or a mixture of propazine plus chlorthal dimethyl, and more recently, oxyfluorfen have been used.

Continued herbicide screening is necessary due to the withdrawal or pending withdrawal of some herbicides from sale, the marginal tolerance of several tree species, and the invasion of herbicide tolerant weed species such as Jersey cudweed (*Gnaphalium luteo-album*) into some nurseries. This study was undertaken over 2 consecutive years to evaluate pendimethalin for use in forest nurseries.

METHODS

Trials were carried out in the Forest Research Institute nursery in Rotorua during the 1990-91 and 1991-92 growing seasons. Species evaluated included *Pinus radiata* (radiata pine), *Eucalyptus botryoides* (southern mahogany), *E. fastigata* (brown barrel) and *E. saligna* (Sydney blue gum). Additionally, *Cupressus macrocarpa* (macrocarpa), *E. globulus* (southern blue gum), *E. nitens* (shining gum), and *Acacia dealbata* (silver wattle) were included in the 1991-92 trial. The same trial methods were followed in both seasons.

Seed of different genera were sown on the dates listed in Table 1, in different nursery beds. *Eucalyptus* species were sown in separate rows in the same bed. Plots 6 x 1 m were laid out in the beds immediately after sowing, in a randomised split plot design, with four replicates of each treatment. Apart from herbicide applications, standard nursery practices were followed.

Pre-emergence applications of pendimethalin (Stomp) were made within 7 days of sowing at 0.99 or 1.32 kg/ha to all species, except to *A. dealbata*, where plots were treated with the lower rate only. In pre- plus post-emergence treatments pendimethalin was applied between 6 and 10 weeks after emergence over a 3 m length of each 6 m plot treated previously with a pre-emergence application. The tolerance of *P. radiata* to 1.32 kg/ha applied either 2 or 4 weeks after emergence was also assessed.

Standard control treatments consisted of plots sprayed as above with propazine (Gesamil) plus chlorthal dimethyl (Dacthal) at 0.5+5.0 kg/ha on *P. radiata*, nitrofen (Tok E) at 5.5 kg/ha on *Eucalyptus* species and *A. dealbata* and oxyfluorfen (Goal) at 0.48 kg/ha on *C. macrocarpa*. Dates of treatment applications and measurements are shown in Table 1.

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TABLE 1: Trial timetable

Operation	<i>Pinus radiata</i>		<i>Eucalyptus</i> species		<i>Acacia dealbata</i>	<i>Cupressus macrocarpa</i>
	1990	1991	1990	1991	1990	1990
Sowing	25.10.90	18.10.91	01.12.90	01.11.91	01.11.90	03.10.90
Pre-emergence application	29.10.90	21.10.91	05.12.90	02.11.91	02.11.90	10.10.90
7 day rainfall (mm)	6	17	14	21	4	83
Emergence	12.11.90	04.11.91	19.12.90	18.11.91	21.11.90	23.10.90
Post-emergence application	14.12.90	19.11.91 03.12.91 31.12.91	12.02.91	21.01.92	01.02.91	14.12.90
7 day rainfall (mm)	12	4 35 9	63	3	0	12
Height measurement	27.03.91	12.03.92	10.04.91	10.03.92	09.04.91	25.03.91

All herbicide treatments were applied using a CO₂ pressurised handsprayer with two 80015 (Spraying Systems) nozzles, in a volume of 450 litres/ha. Rainfall was recorded for 7 days after each spray application (Table 1).

Tolerance to pendimethalin was assessed by visually inspecting seedlings for damage and by measuring the heights of 50 seedlings in each plot (all seedlings in *Eucalyptus* plots where sowing density was much lower). Weed control was assessed by counting the number of weeds in each treatment plot. Differences in treatment means were analysed using analysis of variance and LSD tests.

RESULTS AND DISCUSSION

All tree species evaluated were tolerant to a pre-emergence application of pendimethalin as there was no difference in height growth compared with that of seedlings treated with the standard treatments (Table 2).

Heights of seedlings treated with pre- plus post-emergence applications of pendimethalin are listed in Table 3. The effect of the herbicide on emerging *P. radiata* seedlings was not evaluated but 1.32 kg/ha applied 2 or more weeks after emergence did not affect subsequent growth. The growth of *C. macrocarpa* was significantly reduced by both rates of pendimethalin compared with the standard oxyfluorfen treatment. Seedlings also showed a significant incidence of double leadering (60% and 54% at 0.99 and 1.32 kg/ha respectively) compared with seedlings treated with only a pre-emergence application of pendimethalin (4% and 6% respectively). Post-emergence treatment of *C. macrocarpa* would not be recommended. *Acacia dealbata* growth was reduced by 14% following a post-emergence application of 0.99 kg/ha of pendimethalin. Of the *Eucalyptus* species evaluated, growth of only *E. nitens* was affected by pre- plus post-emergence applications of pendimethalin at a rate 0.99 kg/ha when compared with the standard treatment of nitrofen. Tolerance of *Eucalyptus* species to 1.32 kg/ha of pendimethalin varied between species and season. Seedlings of *E. botryoides*, and *E. saligna* were tolerant to pre- plus post-emergence applications at the higher rate only in the 1991-92 season, possibly because the seed was sown a month earlier, resulting in faster initial growth.

Statistical comparison between heights of seedlings treated pre-emergence and pre- plus post-emergence (Tables 2 and 3) show that the growth of *C. macrocarpa*, *A. dealbata* and *E. fastigata* was significantly suppressed by a post-emergence application of pendimethalin at both rates. No foliar scorching or distortion was observed on any species treated with pendimethalin.

Except for groundsel (*Senecio vulgaris*), pendimethalin effectively controlled weeds, including Jersey cudweed, at both rates tested, when applications were made prior to weed emergence.

TABLE 2: Mean seedling height (cm) in plots treated with a pre-emergence application

Herbicide		pendimethalin		propazine + chlorthal dimethyl	oxyfluorfen	nitrofen
Rate (kg ai/ha)		0.99	1.32	0.5 + 5.0	0.48	5.5
<i>P. radiata</i>	1990	23.9a	22.8a	24.3a		
	1991	26.4b	28.8b	27.0b		
<i>C. macrocarpa</i>	1990	32.5a	34.3a		31.8a	
<i>A. dealbata</i>	1990	49.0a				53.5a
<i>E. botryoides</i>	1990	26.4a	28.8a			38.9a
	1991	29.4b	29.6b			26.0b
<i>E. fastigata</i>	1990	11.4a	13.0a			16.1a
	1991	26.4b	27.2b			28.4b
<i>E. saligna</i>	1990	27.9a	25.8a			27.2a
	1991	54.2b	54.6b			54.4b
<i>E. globulus</i>	1990	23.4a	21.3a			26.7a
<i>E. nitens</i>	1990	21.7a	18.0a			24.9a

Within any one species, treatments joined by the letter do not differ significantly (P= 0.05).

TABLE 3: Mean seedling height (cm) in plots treated with pre-plus post-emergence applications

Herbicide		Pendimethalin		Propazine + chlorthal dimethyl	Oxyfluorfen	Nitrofen
Rate (kg/ha)		0.99	1.32	0.5 + 5.0	0.48	5.5
<i>P. radiata</i>	1990	23.4a	22.8a	24.7a		
	1991	26.1b ¹	25.8b ¹ 27.8b ² 25.4b ³	26.4b ¹		
<i>C. macrocarpa</i>	1990	23.0a	22.5a		28.7b	
<i>A. dealbata</i>	1990	42.3a				53.5b
<i>E. botryoides</i>	1990	29.3a	20.4b			28.3a
	1991	22.5c	26.3c			20.5c
<i>E. fastigata</i>	1990	15.7a	16.9a			21.8a
	1991	17.3b	20.8b			17.3b
<i>E. saligna</i>	1990	27.8a	21.0b			27.0a
	1991	46.9c	47.5c			42.7c
<i>E. globulus</i>	1990	24.5a	26.0a			28.0a
<i>E. nitens</i>	1990	20.1a	16.3a			28.0b

Within any one species, treatments joined by the same letter do not differ significantly (P= 0.05).

¹ sprayed 8 weeks after emergence

² sprayed 4 weeks after emergence

³ sprayed 2 weeks after emergence

Results of these trials suggest that pendimethalin has potential for use in forest nurseries, particularly as a pre-emergence herbicide.

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