

TOLERANCE OF SEVERAL SPECIES OF TREE SEEDLINGS TO OXYFLUORFEN

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SUMMARY

Oxyfluorfen was applied either pre- or post-emergence to tree seedlings. Pre-emergence application at a rate of 0.96 kg/ha did not reduce the growth of *Pinus radiata*, *Cupressus lusitanica* or *C. macrocarpa*. The growth of *Eucalyptus fraxinoides* was reduced by a pre-emergence application of 0.96 kg/ha of oxyfluorfen and *E. botryoides* and *E. saligna* by 0.48 kg/ha. Growth of *E. fastigata*, *E. nitens*, *E. regnans*, *Racosperma dealbata* and *R. melanoxylon* was reduced by a rate of 0.24 kg/ha. Oxyfluorfen applied post-emergence at rates up to 0.72 kg/ha killed all the foliage of both *Racosperma* species. Other species suffered some foliar damage, but growth was not affected.

Keywords: forest nurseries, oxyfluorfen, seedling tolerance

INTRODUCTION

Weeds can severely limit the production of tree seedlings in forest nurseries. Nitrofen or propazine + chlorthal dimethyl have commonly been used for their control. Nitrofen is no longer available in New Zealand, and some tree species have a low tolerance to propazine.

Oxyfluorfen has been used overseas for controlling weeds in forest nurseries (Mason 1988; Kuhns 1988), and was considered to be a potential alternative to these herbicides. A trial was established to evaluate the tolerance of several tree species to either pre- or post-emergence applications of this herbicide at a range of rates.

METHODS

Seeds of 11 tree species commonly grown in forest nurseries were sown in the Forest Research Institute (FRI) nursery at Rotorua. The species evaluated were *Eucalyptus botryoides* (southern mahogany), *E. fastigata* (brown barrel), *E. fraxinoides* (white ash), *E. nitens* (shining gum), *E. regnans* (mountain ash), *E. saligna* (Sydney bluegum), *Racosperma dealbata* (silver wattle), *R. melanoxylon* (Australian blackwood), *Cupressus lusitanica* (Mexican cypress), *C. macrocarpa* (macrocarpa) and *Pinus radiata* (radiata pine). All species of a given genus were sown in the same bed. The sowing dates are listed in Table 1.

Plots 5.5 x 1.0 m were laid out in the nursery beds, immediately after sowing, in a randomised block design with three replicates of each treatment. Pre-emergence applications of oxyfluorfen (Goal) were applied after sowing at rates of 0.24, 0.48 or 0.96 kg/ha. Control treatments consisted of untreated plots, and plots sprayed with the current pre-emergence treatments: nitrofen (Tok E25) at 7.0 kg/ha on *Eucalyptus* plots and 5.5 kg/ha on *Racosperma* plots or a mixture of propazine (Gesamil) + chlorthal dimethyl (Dacthal) at 0.5 + 5.0 kg/ha on *Cupressus* plots and at 1.0 + 5.0 kg/ha to *P. radiata* plots. Application dates are listed in Table 1. Herbicide treatments were applied to *Cupressus*, *Pinus* and *Racosperma* species using a CO₂ pressurised hand sprayer fitted with three 730154 nozzles (Spraying Systems), in a total spray volume of 450 litres/ha. *Eucalyptus* species were sprayed with a tractor-mounted plot sprayer fitted with four 8002 LP nozzles applying 450 litres/ha. Rainfall of 51 and 55 mm was recorded within 7 days of spraying the *Cupressus* and *Racosperma*, and the *P. radiata* plots respectively. Rainfall of 8 mm was recorded within 7 days of spraying the *Eucalyptus* species.

Proc. 44th N.Z. Weed and Pest Control Conf. 1991: 17-20

TABLE 1: Treatment and assessment timetable.

Species	Sowing date	Date of first emergence	Date of spray application		Date of height measurement	
			pre-emergence	post-emergence	pre-emergence	post-emergence
<i>Eucalyptus</i> spp.	09.11.89	20.11.89	16.11.89	24.01.90	28.02.90	21.03.90
<i>Racosperma</i> spp.	10.10.89	27.10.89	16.10.89	13.12.89	28.02.90	
<i>Cupressus</i> spp.	11.10.89	26.10.89	16.10.89	13.12.89	30.03.90	30.03.90
<i>Pinus radiata</i>	19.10.89	04.11.89	20.10.89	17.11.89	02.04.90	03.04.90
	19.10.89	04.11.89		30.11.89		03.04.90
	19.10.89	04.11.89		28.12.89		03.04.90
	26.10.89	09.11.89		17.11.89		03.04.90
	26.10.89	09.11.89		30.11.89		03.04.90
	26.10.89	09.11.89		28.12.89		03.04.90
	26.10.89	09.11.89		24.01.90		03.04.90

Post-emergence applications of oxyfluorfen were made at 0.24, 0.48 or 0.72 kg/ha. Application dates are listed in Table 1. To prevent seedlings in the post-emergence plots from being over-run with weeds prior to spraying, they were treated with the current pre-emergence herbicide treatment after sowing. The same application methods were used for the post-emergence treatments except that the *P. radiata* plots were sprayed with the tractor-mounted plot sprayer. Post-emergence applications were made 6 to 11 weeks after emergence in a total spray volume of 450 litres/ha. Between 45 and 53 mm of rain fell within 7 days of spraying all species. In addition, post-emergence applications of oxyfluorfen were made to plots of *P. radiata*, 8, 13, 21, 26, 49 and 54 days after emergence to assess the tolerance of young seedlings. Applications were made at a rate of 0.48 kg/ha in a total spray volume of 450 litres/ha using the handsprayer.

Herbicide tolerance was assessed by measuring heights of 50 seedlings of each species in each plot, and by visually recording seedling damage. Plot means of seedling height were subjected to analysis of variance. Differences between treatments were determined using an LSD test.

RESULTS AND DISCUSSION

Seedling tolerance to pre-emergence herbicide applications

The mean heights of seedlings (as a percentage of the standard treatment) treated with pre-emergence applications of oxyfluorfen are listed in Table 2.

The tolerance of *Eucalyptus* species to pre-emergence applications of oxyfluorfen varied according to species. A rate of 0.48 kg/ha or less did not significantly reduce the growth of *E. fraxinoides* compared with the standard treatment. Rates of oxyfluorfen greater than 0.24 kg/ha significantly reduced the growth of *E. botryoides* and *E. saligna*. All rates of oxyfluorfen significantly reduced the growth of *E. fastigata*, *E. nitens* and *E. regnans* compared with the standard nursery treatment of 7.0 kg/ha of nitrofen. Growth rates were reduced by between 29% and 32% by an application of 0.24 kg/ha to the latter three species. The question remaining for the nurseryman is whether these reductions in growth are of significance in the production of a crop. In the 1989-90 season, growth rates in the FRI nursery were such that some *Eucalyptus* seedlings had to be topped by more than 30% to keep them to a manageable size at lifting time.

All pre-emergence rates of oxyfluorfen significantly reduced the growth of *Racosperma* species, compared with the standard treatment of 5.5 kg/ha of nitrofen.

TABLE 2: Seedling heights expressed as a percentage of the standard pre-emergence treatments (nitrofen or chlorthal dimethyl + propazine) for pre-emergence applications of oxyfluorfen.

Tree species	Oxyfluorfen rates (kg ai/ha)			Unsprayed
	0.24	0.48	0.96	
<i>E. botryoides</i>	90*	67	66	42
<i>E. fastigata</i>	68	49	42	29
<i>E. fraxinoides</i>	94*	82*	62	66
<i>E. nitens</i>	70	58	38	49
<i>E. regnans</i>	71	46	40	38
<i>E. saligna</i>	79*	66	43	42
<i>R. dealbata</i>	58	—†	68	47
<i>R. melanoxylon</i>	69	—†	74	57
<i>C. lusitanica</i>	82*	108*	111*	40
<i>C. macrocarpa</i>	84*	113*	121*	40
<i>P. radiata</i>	106*	116	107*	87

* Not significantly different to the standard treatment (100%) at the 0.05 level using an LSD test

† Plots lost.

The growth of *C. lusitanica*, *C. macrocarpa* and *P. radiata* was not suppressed by pre-emergence applications of oxyfluorfen at rates up to 0.96 kg/ha, when compared with the standard pre-emergence applications of propazine + chlorthal dimethyl.

A significant reduction in seedling growth was recorded in the unsprayed control treatment, due to competition from weeds.

Seedling tolerance to post-emergence applications

The sizes of seedlings treated with post-emergence applications of oxyfluorfen (as a percentage of the standard treatment) are shown in Table 3.

Foliage of the two *Racosperma* species died back, almost to ground level, when treated with a post-emergence application of oxyfluorfen. Height growth of *Eucalyptus* species, *Cupressus* species and *P. radiata* was not significantly reduced, although there was some damage to the foliage.

TABLE 3: Seedling heights expressed as a percentage of the standard pre-emergence treatments (nitrofen or chlorthal dimethyl + propazine) for post-emergence applications of oxyfluorfen.

Tree species	Oxyfluorfen application rates (kg ai/ha)		
	0.24	0.48	0.72
<i>E. botryoides</i>	123	103	95
<i>E. fastigata</i>	109	84	72
<i>E. fraxinoides</i>	115	103	90
<i>E. nitens</i>	155†	130	127
<i>E. regnans</i>	108	107	88
<i>E. saligna</i>	115	92	87
<i>R. dealbata</i>	0*	0*	0*
<i>R. melanoxylon</i>	0*	0*	0*
<i>C. lusitanica</i>	103	106	101
<i>C. macrocarpa</i>	115	113	111
<i>P. radiata</i>	96	89	93

* Treatment resulted in death of all the foliage.

† Treatment showed a significant increase in growth over standard treatment (5% level of confidence).

Pinus radiata seedlings sprayed with oxyfluorfen at a rate of 0.48 kg/ha 8, 13, 21, 26, 49 or 54 days after emergence, all showed signs of scorch, but seedling heights were not significantly reduced.

ACKNOWLEDGEMENTS

The technical support of J. Ray, N. Davenport, S. Bodle and F. Fields is gratefully acknowledged, as is the financial support of Rohm and Haas New Zealand Ltd, NZFP Forests Ltd and Forest and Farm Nurseries Ltd.

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