

**FIELD EVALUATION OF *PINUS RADIATA* TOLERANCE TO TRICLOPYR**

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The tolerance of seedling *Pinus radiata* transplants to broadcast applications of triclopyr was assessed in two trials conducted under dormant and active tree growth conditions. During tree dormancy 1.8 kg/ha triclopyr had no significant effect on tree wood volume growth or tree malformation. Application during maximum active tree growth resulted in significant suppression of wood volume at 0.6 kg/ha triclopyr and unacceptable malformation at 0.9 kg/ha. Triclopyr may be applied as a broadcast spray release treatment over seedling *Pinus radiata* transplants less than 1 year old up to 1.8 kg/ha provided the application is made before the onset of spring tree growth. Under active tree growth conditions a maximum of 0.6 kg/ha should be used.

**INTRODUCTION**

Radiata pine (*Pinus radiata*) is a widely planted exotic coniferous tree species which dominates the commercial forestry industry in New Zealand. Forest establishment often includes application of a herbicide to control competing broadleaf weed species after tree planting. Typically 2,4,5-T or picloram + 2,4,5-T have been used in the past.

Seedling radiata pine plantings must be able to adequately tolerate any such herbicide application. Significant tree damage can be caused in two ways: (1) tree growth suppression reducing wood volume growth, or (2) tree malformation through apical damage resulting in multileading, or trunk twisting, both of which will produce an unacceptable saw log in the mature tree.

Products containing 2,4,5-T were withdrawn from sale in New Zealand during 1988. This left foresters without a suitable herbicide for the release of radiata pine from some post-plant weed problems. However in the same year triclopyr was introduced as a replacement for 2,4,5-T. Triclopyr is a substituted pyridine derivative herbicide manufactured by The Dow Chemical Co., U.S.A. It is highly translocated within the vascular tissue of treated plants and has herbicidal activity on dicotyledonous species. The tolerance of radiata pine to triclopyr had to be established before it could be used with confidence for tree releasing. This paper describes two trials assessing the tolerance of radiata pine to broadcast applications of triclopyr.

**METHOD**

Trials were conducted at Elders-New Zealand Forest Products Ltd, Kinleith forest during 1987-88. Applications were made under dormant (September) and active growth (January) conditions to a commercial line of genetically improved radiata pine seedling trees (2680P) transplanted during June 1987. Trials were of randomised complete block design with four replicates. Plots were 14 m<sup>2</sup> and containing five seedling trees. Treatments were applied with a precision back pack spray unit and hand held boom operating at 200 kPa through teejet 730-154 flat fan nozzles to give a water rate of 200 litres/ha as a broadcast treatment over the trees.

Triclopyr butoxy ethyl ester (Grazon) was applied at 0.6 — 1.8 kg/ha. Picloram + 2,4,5-T (Tordon Brushkiller DS) at 0.15 + 0.60 kg/ha was used as the standard commercial treatment. To eliminate the effects of weed competition on tree growth the site was maintained weed free with applications of 0.5 kg/ha haloxyfop (Gallant) + 7.5 kg/ha atrazine (Actazine 5A) throughout the term of the trial.

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Tree tolerance was assessed using two methods:

(1) Visual evaluation, 12 months after treatment, of tree malformation attributed to herbicide damage. Trees were individually assessed for multileading (two or more main stems) or trunk twisting, and ranked as acceptable or unacceptable (cull trees). Results were recorded as percentage of trees ranked as unacceptable. Tree form classification guides (Anon., undated) used commercially by Elders-NZFP Ltd were used as a reference for tree assessment.

(2) Tree wood volume growth 8 months after treatment (one growth season). Stem basal diameter and tree height were individually measured during September and again during April. Increase in diameter<sup>2</sup> x height was calculated as a measure of tree wood volume growth. Tree growth data was statistically analysed using Duncan's Multiple Range Test for mean separation.

### RESULTS AND DISCUSSION

Table 1 summarises mean percent of trees ranked as unacceptable because of multileading or trunk twisting, and growth in tree wood volume after treatment with triclopyr.

An incidence of 30-40% unacceptable (cull trees) was expected from the tree stock (2680P) used in this trial (D. Macfarlane, Elders-NZFP Ltd. pers. comm.), and is demonstrated by the untreated result (Table 1).

When applied prior to the onset of spring growth, triclopyr had no significant effect on either wood volume growth or tree malformation in the rate range tested (0.6-1.8 kg/ha). Similarly, the standard treatment of picloram + 2,4,5-T did not suppress tree wood volume growth or increase the percentage of unacceptable trees outside the expected naturally occurring range.

Applications of triclopyr during active tree growth (January) resulted in significant suppression of tree growth throughout the rate range tested. A significant dose response was observed with wood volume growth decreasing sharply as triclopyr rate was increased above 0.9 kg/ha. At the highest rate (1.8 kg/ha) the wood growth was less than half of the untreated control.

Tree malformation was significantly increased by application of triclopyr during active tree growth. Trees treated with 0.9-1.8 kg/ha exhibited a level of unacceptable malformation (60-70% cull trees), markedly higher than the expected naturally occurring level (30-40%). Multileading resulting from apical damage caused by the herbicide was principally responsible for the increased incidence of unacceptable trees. During active tree growth the apical cambium is a strong nutrient sink. Translocation of triclopyr through the vascular tissue of the plant and subsequent concentration at the apex is the most probable cause of the observed damage.

**TABLE 1: Radiata pine wood volume growth 8 months after treatment and percent trees rated unacceptable due to malformation (% cull) 12 months after treatment.**

Chemical	Rate (kg ai/ha)	% Cull	Time of Application		Wood Volume Growth*
			Dormant Wood Volume Growth*	Active Growth % Cull	
triclopyr	0.6	25	412.3	40	243.8 bc
triclopyr	0.9	27	440.3	65	246.0 bc
triclopyr	1.2	33	461.8	60	188.0 cd
triclopyr	1.8	40	372.5	70	148.8 d
pic/245-T	.15/.60	40	460.0	25	311.8 b
untreated	—	27	463.3	35	421.0 a
			N.S. CV = 19.6%		CV = 16.7%

\* Wood volume growth = diameter<sup>2</sup> x height

Triclopyr at 0.6 kg/ha and the standard treatment applied during active growth caused moderate suppression of tree growth but did not increase the incidence of tree malformation. Although incidence of tree growth suppression and malformation caused by herbicide application is commercially undesirable, minor damage is acceptable where no safer alternative treatment is available and the competing weed problem is likely to cause significant tree suppression.

#### CONCLUSION

Results presented here indicate that triclopyr may be used at up to 1.8 kg/ha as a blanket broadcast spray over first year radiata pine transplants provided the application is made before the onset of spring tree growth. Under these conditions the herbicide will not significantly affect tree growth or the incidence of tree malformation. If triclopyr is applied during the period of active tree growth significant growth suppression results from 0.6 kg/ha while rates of 0.9 kg/ha and above may cause an unacceptable incidence of tree malformation.

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#### REFERENCES

Anon., undated. Tree Form Classification. unpublished. Source: Elders-New Zealand Forest Products Ltd., Forest Investigation Dept., Kinleith, New Zealand.