GROWTH RESPONSE OF RADIATA PINE TO AREA OF HERBACEOUS WEED CONTROL

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SUMMARY

The effect of herbaceous weed control, using spot, strip or blanket applications of hexazinone, on growth of radiata pine seedlings was assessed and compared to untreated and regularly mown controls. Increasing spot size from 0.5 and 0.75 m radius to 1 m radius increased growth of seedlings for 2 years after planting. Strip spraying in a 2 m wide band and a blanket spray application gave the greatest growth response. Mowing the weeds monthly increased diameter growth, but not height growth, compared with the unsprayed control. The most economic option was spot spraying (0.5 m radius), but strip spraying at a slightly higher cost may be the best option where it is mechanically feasible.

INTRODUCTION

Hexazinone is a useful herbicide for releasing radiata pine seedlings from herbaceous weed competition. Recent field testing (Gaskin and Zabkiewicz 1986) has shown that the three formulations, liquid, soluble powder, and granular, were equally effective. Tolerance of radiata pine seedlings to the three formulations of hexazinone was similar at rates of <10 kg ai/ha (Prest 1986). At higher rates (14 kg ai/ha) the liquid formulation was the least damaging to newly planted seedlings.

METHOD

The trial was established on an uncultivated, weedy (predominantly cocksfoot (*Dactylis glomerata*)) silt loam at Rangiora Nursery, North Canterbury. Seedlings of 1/0 radiata pine (*Pinus radiata*) were planted at a 5 x 5 m spacing in July 1984. A randomised block design was used, with five replications of nine trees. The tree seedlings were healthy and had resumed growth before being sprayed for weeds (October 1984).

Hexazinone was sprayed at the recommended rate of 3.6 kg/ha. A calibrated knapsack sprayer was used to spray predetermined spots of 0.5, 0.75 and 1.0 m radius. Strip (2 m width) and blanket spray treatments were applied with a tractor-mounted boom with 730077 nozzles, at a water rate of 400 litres/ha. As an alternative to using herbicides, the grass was mown at monthly intervals for the 2 year period, using a heavy duty lawn mower. An unsprayed control was monitored throughout the trial.

Tree survival, stem diameter (10 cm above ground level), and shoot height were measured at planting and again at 12 and 24 months after planting. These measures of tree response were tested by analysis of variance (ANOVA) and the means were compared by Duncan's Multiple Range Test.

The weather during the 1984-85 growing season was very dry (335 mm rainfall), and the 1985-86 season was wet (635 mm rainfall).

RESULTS AND DISCUSSION

In the sprayed treatments total weed control was achieved for the first growing season. In September/October 1985 Californian thistles (*Cirsium arvense*), dock (*Rumex obtusifolius*) and plantain (*Plantago lanceolata*) were the first plant species to colonise the sprayed areas. Timothy (*Phleum pratense*), Yorkshire fog (*Holcus lanatus*), red clover (*Trifolium pratense*) and cocksfoot had re-established by the end of December 1985 and quickly formed a dense sward around the trees.

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Tree survival exceeded 95% in all treatments, despite low rainfall during the 1984-85 growing season. This reflected the good quality of seedling stock used and the care in planting.

Tree diameter growth

Diameter growth response (Fig. 1) differed markedly with intensity of weed control ($P \leq 0.001$). Generally, diameter growth after one growing season was 2-3 times greater in the sprayed treatments than in the unsprayed control or in the 'regularly mown' option. By the end of the second growth season (1986) the difference had increased, and strip or blanket-sprayed trees had diameters 4 times greater than those in the unsprayed control. There was no difference in growth response between spot sizes of 0.5 and 0.75 m radii, but growth response increased when the radius of the spot was increased to 1 m ($P \leq 0.001$).

Regular mowing significantly improved growth response compared with the unsprayed control, but was less effective than any of the spraying treatments.

Fig. 1: Radiata pine growth response to area of weed control (planted 1984). All LSD tests at 1% level. Values for diameter and height increment with the same letter are not significantly different.

Tree height growth

Tree height increment in the strip and blanket spray treatments was more than twice ($P \leq 0.001$) that in the unsprayed control (Fig. 1). Increasing the spot application from 0.5 to 0.75 m to 1.0 m radius had given a marked improvement in height growth by the end of the second season.

Shoot extension in the regularly mown treatment was no greater than in the unsprayed control, suggesting that root competition was reducing height growth.

Cost-efficiency

Although blanket and strip spraying gave the greatest growth gains, these need to be related to cost of treatment (Table 1). The small growth increases gained from increasing the size of the spot application do not warrant the extra cost of the herbicide. However, the cost of herbicide for strip spraying is only marginally more than for spot spraying (\$0.77 compared with \$0.67), and with its greater gains in growth, may prove to be the best option depending on application costs. Blanket spraying was no more

TABLE 1: Chemical cost and percent height growth increase for spraying options¹.

Treatment	Quantity hexazinone ² (kg product/ha)	Cost (includes application cost) ³ (\$/ha)	% Growth gain	Cost/1% gain in growth (\$)
untreated	—	—	—	—
spot 0.5 m radius	0.25	41	61	0.67
spot 0.75 m radius	0.56	67	71	0.94
spot 1.0 m radius	1.00	104	99	1.05
strip (2 m width)	1.14	109	141	0.77
blanket	4.00	384	141	2.72

¹ Assuming initial tree stocking of 800 seedlings/ha planted in rows 7 m apart.

² Velpar 90 wsp

³ Spot spraying cost \$20/ha. Strip spraying \$13/ha. Blanket application by helicopter applying 330 litres TSV/ha \$50. These costs were based on operational programmes at Ashley Forest (North Canterbury) and Selwyn Plantation Board as at October/November 1986. It does not include supervisory, quality control, or fleet hire charges.

effective than strip spraying but considerably more expensive.

On easier terrain such as the Canterbury Plains forests, Balneaves (1984) showed that the cost of strip spraying with a tractor-mounted boom was cheaper than spot spraying (0.5 m radius) with a spot-gun applicator. However, on hill country, the cost of herbicides coupled with cost of aerial application means that spot application is still the preferred option.

This trial will continue until the trees are 5 years old to confirm these early growth trends and a formal cost/benefit analysis will then be made.

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