RATES OF DIURON FOR WEED CONTROL IN POPLAR AND WILLOW BEDS

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SUMMARY

In a nursery trial, rates of up to 5.6 kg ai/ha of diuron were applied to cuttings of a hybrid Matsudana willow, 'Flevo' poplar, and purple osier. After one growing season there was a very highly significant height response overall, but no significant differences in height response between species. The optimum rate was 2.6 kg ai/ha. It is concluded that the label rate for grapes, 2.4 kg ai/ha (3 kg/ha of 80% formulations) is suitable also for poplars and willows.

INTRODUCTION

New Zealand's poplar and willow production in 1984 consisted of almost 1,350,000 rooted trees of which 90% were produced by trade nurseries, largely for horticultural shelter (van Kraayenoord 1984); and over 1 million poles, wands and stakes produced from almost a million stools of which 80% were grown in catchment authority nurseries or by growers contracted to supply catchment authorities, largely for soil conservation and river control plantings (A.G. Wilkinson pers. comm.). Both rooted trees and stools are grown from stem cuttings that are often produced in cutting beds by bulking up cutting material received in limited quantities from the Soil Conservation Centre, Aokautere.

In previous trials at Aokautere, Manawatu, (Gilchrist 1981) and Waerenga-o-kuri, Poverty Bay, (Gilchrist unpublished) using three rates of diuron, the highest rates gave the greatest height responses. However the lowest rates in each case gave slightly higher responses than the intermediate rates (Table 1). This puzzling depression in the response curve of 'Flevo' hybrid black poplar (*Populus x euramericana* cl. Flevo), 'Aokautere' hybrid tree willow (*Salix matsudana x alba* cl. Aokautere), and 'Irette' purple osier (*S. purpurea* cl. Irette) to label rates for woody plants such as grapes was the reason for the present study. The significance of the depression was not clear using multiple comparison procedures in the previous trials. The present study was planned with a wider range of rates to enable response curves to be built up from trend comparisons.

TABLE 1: Height responses (cm) of three poplar and willow clones to rates of diuron in previous trials.

Rate (kg ai/ha)	'Flevo' poplar	'Aokautere' willow	'Irette' willow
Aokautere, 1978-79			
4.5	149 a	228 a	140 a
2.2	120 b	220 a	97 b
1.1	132 ab	224 a	99 b
Waerenga-o-kuri, 1980-81			
4.8	203 a	337 a	not
2.4	158 a	274 c	tested
1.2	185 a	282 bc	

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METHOD

In 1984-85, at the Soil Conservation Centre, Aokautere, the responses of 'Flevo' hybrid black poplar, 'Aokautere' hybrid tree willow, and 'Irette' purple osier to diuron (Dyron 80 WP) were tested at application rates of 0, 1.4, 2.8, 4.2, and 5.6 kg ai/ha. A split block design with four replicates was used. Cuttings 25 cm long were planted at 25 cm spacing in rows 1 m apart in late July 1984. There were two adjacent rows of each species in each replicate. The diuron strips were 1.5 m wide and 6 m long. Thus individual plots measured 2 m x 1.5 m, most containing 12 cuttings of which the inner eight (four per row) were measured. Diuron was applied using an "Algen" precision sprayer on 24 August 1984. The soil type was Manawatu fine sandy loam with 8% organic matter.

The height of the tallest leader of each tree was measured at the end of the growing season, in late April 1985. Analyses of variance were performed on the data and response curves were fitted to those parameters that gave significant trend comparisons ($P < 0.05$) as measured by F tests. By using regression analysis, effects of all treatments, including intermediate ones not used in the trial, would be significantly different when the regression was significant (Chew 1976).

RESULTS AND DISCUSSION

Mean height, survival, and weed control are shown in Table 2. Because survival in *P. 'Flevo'* was treatment related and yield is dependent on both height and survival, mean height was re-calculated using zero or the measured height of dead trees instead of calculating the mean height of survivors only as in Table 2. Analysis of variance showed a significant main effect response to rate of application ($P < 0.001$) but a non-significant clone x rate interaction. The recalculated heights as means of all three clones combined are shown in Fig. 1. The response curve was best represented ($r^2 = 0.9998$) by the cubic equation

$$Y = 1.23 + 1.04 X - 0.31 X^2 + 0.03 X^3$$

where Y is the height in metres and X is the rate in kg ai/ha.

TABLE 2: Effect of diuron on (a) survival (per cent), (b) mean end-of-season height of surviving trees (metres), and (c) weed control rating on 0-10 scale (10 = complete weed control).

Clone (c:date)	Rate of application (kg ai/ha)				
	0	1.4	2.8	4.2	5.6
(a) Aokautere	97	100	100	100	100
Flevo	85	97	97	91	68
Irette	94	97	100	100	91
(b) Aokautere	1.80	2.72	2.88	2.61	3.13
Flevo	1.33	2.11	2.16	2.02	2.29
Irette	0.78	1.92	1.99	2.10	2.22
(c) 5/10/84	0	9	9	9	10
12/11/84	0	5	7	8	8

This empirical equation predicts the optimum rate to be 2.6 kg ai/ha, giving a mean height of 2.32 m. This height is predicted over the range 2.3-2.8 kg ai/ha. The common label recommendation for grapes, 2.4 kg ai/ha, is within this range.

Although the clone x rate interaction was not statistically significant, inspection of the data used to plot Fig. 1 suggests that only *S. 'Aokautere'* has a height response curve which is cubic in form. Both *P. 'Flevo'* and *S. 'Irette'* appear to have parabolic response curves which would be described by quadratic equations.

Height data from individual clones were therefore examined. 'Aokautere' willow's response curve was cubic ($r^2 = 0.9908$) with the initial peak at 2.1 kg ai/ha. There was a barely significant difference between rates on 'Flevo' height ($P = 0.06$), yet 95.6% of the variation was accounted for by a quadratic equation whose curve peaked at a rate of

Fig. 1: Mean response of three representative poplar and willow clones to application rates of diuron.

3.1 kg ai/ha. 'Irette' osier's response was very highly significant and 94% of the variation was accounted for by a quadratic equation whose parabola peaked at 3.9 kg ai/ha.

Why there should be a small though significant depression in height at about the 4.2 kg ai rate in 'Aokautere' willows is not clear. Weed control assessments in mid November showed that weed control at this rate was as good as the 5.6 kg ai rate. The effect of the chemical independent of weed competition (by keeping all plots weed free) was not investigated but there was no deleterious effect on this clone at 5.6 kg ai/ha. There was little or no evidence that, at the lower rate, phytotoxicity was beginning to have an effect while at the higher rate it was masked by a response to the elimination of weed competition.

CONCLUSIONS

1. The trend for a depression in height at application rates of 2.2-2.4 kg ai/ha diuron found in earlier trials was not confirmed.
2. Predicted optimum rates of diuron application varied from approximately 2 to 4 kg ai/ha according to clone, the average being 2.6. To the nearest 0.5 kg of product per hectare this is approximated by the 2.4 kg ai/ha (3 kg 80% product/ha) recommended as an upper limit for grapes grown on light soils and as a lower limit for grapes grown on soils high in clay or organic matter.

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