COST EFFECTIVE HERBICIDES FOR YORKSHIRE FOG (*HOLCUS LANATUS*) CONTROL

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SUMMARY

A replicated trial was established in Kaingaroa Nursery to evaluate the effectiveness of various herbicides for Yorkshire fog control, either as single products or as mixtures. Herbicide application was either before or after tree planting. Grass control was assessed visually as percentage cover. The most cost effective treatment was a post-plant application of 5.5 kg/ha terbuthylazine plus 1.0 kg/ha amitrole. The addition of amitrole to this rate of terbuthylazine significantly increased its effectiveness. The effectiveness of terbuthylazine was not increased significantly by the addition of glyphosate. Tree growth was correlated with percent grass cover, particularly 1 year after planting. The data have been used to predict tree growth based on grass cover.

INTRODUCTION

Weed control is necessary for the successful establishment of *Pinus radiata* on the harder, frost-prone cutover sites in Kaingaroa Forest. Poor weed control increases the risk of severe seedling mortality caused by out-of-season frosts within 2 years of planting. One of the most difficult weeds to control is Yorkshire fog (*Holcus lanatus*). Its tolerance to herbicides appears to increase with the age and size of the clumps.

Two broadcast spray options are available, pre-plant or post-plant. The former offers the use of a wider range of herbicides as tree crop tolerance is not an immediate consideration. However, because the treatment is applied in winter, residual action must extend into the spring and summer to prevent weeds from becoming re-established before the onset of autumn frosts. A post-plant treatment limits the range of herbicides, but as it is applied about 3 months later than a pre-plant spray, can offer protection later into the growing season, provided initial kill of weeds is satisfactory.

This trial compared the herbicidal effectiveness and duration of control of pre-and post-plant applications of triazine herbicides, applied alone or in combination with other herbicides, on a sward of Yorkshire fog. The effect on tree growth was also evaluated.

METHODS

Yorkshire fog seed was collected locally and sown during autumn 1986 in the Kaingaroa Nursery. Germination was variable, with some areas producing a dense sward whereas in others the strike was much poorer.

In May 1987 60 plots (4 x 5 m) were established and visually assessed for Yorkshire fog cover. Four plots were assigned as replicates to each treatment, such that each contained one plot of dense grass, one of light grass and two with an intermediate density of grass cover.

Treatments

Sprays were applied with a hand-held, 4 m swath width, CO₂ pressurised boom sprayer fitted with Lurmark 01-F80 nozzles and pressurised to 275 kPa. Applications were in two passes each at 150 litres/ha.

Herbicide rates are listed in Table 1 together with their approximate cost per hectare. All treatments were applied in 1987; Treatments 2-7, 9, 10, 12 and 13 on June 23, 1 and 8 on September 21, and 11 and 14 on November 13.

Assessment of grass cover

Percentage grass cover on the centre section of each plot was estimated visually by two independent observers on June 28, 1988. Estimates were made in 5% steps. Where

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there were only one or two plants (less than 5% cover) a score of 1 was given. Only one plot was free of grass. Repeat assessments were made in November 1988 and February 1989. Fisher's protected LSD test was used to test the statistical significance of difference among treatments with mean percent grass cover as the dependent variable.

Seedling growth

Eight 1 year old radiata pine seedlings from Kaingaroa Nursery were planted at 1 m centres in each plot on July 15, 1987. Root collar diameters and heights were measured after planting, in April 1988, and in March 1989.

Statistical analysis

Seedling volume increment data was analysed by transforming to natural logarithms to stabilise variances. A LSD test was carried out to compare the means of treatments.

Regression analysis, was used to estimate the competitive effect of grass on tree growth. Plot means were used to improve the precision of the estimate of the independent variable, percentage grass cover, which is assumed to be measured without error. A natural log transformation of the dependent variable, tree volume, was used to stabilise the variance.

TABLE 1: Treatments, their cost per ha and the effect on grass cover and resultant tree growth. All the figures in a column with the same letter are not significantly different at the 5% level

Treatment	kg ai/ha	Cost \$/ha	% grass cover			Seedling volume increment	
			June 1988	Nov. 1988	Feb. 1989	April 1988	March 1989
1* terbuthylazine amitrole	5.5 1.0	114	1.0 a	3.8 a	4.9 a	7.6 ab	90.7 ab
2 terbuthylazine glyphosate	10.0 1.08	213	2.2 ab	4.3 ab	10.6 ab	7.1 ab	93.2 ab
3 terbuthylazine	10.0	163	3.3 abcd	11.7 cd	12.9 b	6.3 ab	90.5 ab
4 terbuthylazine glyphosate	10.0 0.72	196	4.9 bcd	19.4 cde	16.1 bc	7.0 ab	82.8 ab
5 terbuthylazine glyphosate	8.0 0.72	162	6.9 bcdef	11.6 cd	17.3 bc	8.8 a	118.1 a
6 terbuthylazine glyphosate	8.0 1.08	181	8.4 cdef	9.6 bc	19.6 bcd	7.0 ab	87.0 ab
7 simazine dalapon atrazine	15.5	180	2.7 abc	10.8 cd	21.6 bcd	6.8 ab	89.9 ab
8* atrazine simazine amitrole	4.0 1.5 1.0	112	11.0 def	11.5 cd	22.4 bcd	5.8 ab	79.2 ab
9 terbuthylazine	8.0	130	8.8 cdef	16.1 cd	33.1 cd	7.3 ab	93.8 ab
10 terbuthylazine glyphosate	5.5 1.08	140	14.1 ef	24.5 de	34.7 cd	6.2 ab	72.0 ab
11* hexazinone	1.8	108	24.5 ef	20.3 cde	39.2 cde	4.5 b	52.1 b
12 terbuthylazine	5.5	89	13.2 ef	14.1 cd	40.5 cde	5.8 ab	74.2 ab
13 terbuthylazine glyphosate	5.5 0.72	123	15.7 efg	15.8 cd	46.3 de	6.9 ab	80.5 ab
14* hexazinone	2.7	216	51.4 fg	39.9 ef	49.4 de	4.8 ab	56.7 b
15 untreated	—	—	100.0 g	80.2 f	87.4 e	2.1 c	11.0 c

*Post-plant applications

RESULTS AND DISCUSSION

With the exception of a few larger clumps (one in one plot of each of treatments 10 and 8), and several clumps in the plots treated with hexazinone (Velpar P) all treatments killed the original grass cover. By March 1988 new grass had appeared on all plots. The even growth suggested that germination had occurred over a short time interval. Weather conditions would have been suitable for grass growth during November, December, February and March. It is therefore assumed that earlier germination of grass was prevented by the presence of residual quantities of herbicides in the soil, including treatments applied prior to tree planting.

The percentage of grass cover in June 1988 is shown in Table 1. With the exception of the lowest rate of terbuthylazine (Gardoprim 500 FW) plus glyphosate (Roundup) and hexazinone, all treatments significantly reduced the percentage grass cover. The amount of grass increased during the period to February 1989 when the final assessment was made (Table 1). Terbuthylazine at 10 kg/ha was more effective than 8 kg/ha which was more effective than 5.5 kg/ha. The addition of glyphosate to terbuthylazine had no significant effect on the level of grass control. Adding amitrole (Chemagro Amitrole 40AC) at 1 kg/ha to terbuthylazine at 5.5 kg/ha applied post-plant significantly increased the effectiveness of the terbuthylazine. The other post-plant treatments, atrazine:simazine:amitrole and the two rates of hexazinone were all significantly less effective than the combination of terbuthylazine and amitrole. All trees survived in the herbicide treated plots.

All herbicide treatments significantly increased tree growth. Similar results have been reported by West (1984), Balneaves (1984), Glass (1985) and Balneaves and Christie (1988) but none related this to grass cover. Tree growth in this trial is expressed as volume increment, [height increase (m)] multiplied by [diameter increase (cm)²]. Whilst there is no statistically significant difference in tree volume increment between the herbicide treatments, regression analysis reveals that volume increment is highly dependent on the mean percentage grass cover. Ninety one percent of the variation in total tree volume increment over the whole trial period could be explained by the mean percentage grass cover, measured in June 1988.

$$\text{Increment (total volume)} = 4.574 - 0.0195 (\% \text{ grass cover}) R^2 = 0.91$$

Volume increment for the first year also correlated well with percent grass cover in June 1988.

$$\text{Increment (1st year volume)} = 2.009 - 0.0121 (\% \text{ grass cover}) R^2 = 0.84$$

Tree volume increment predicted from these equations plotted against the percentage of grass cover 1 year after planting the trees is shown in Figure 1.

Fig. 1: Seedling volume increment 1 and 2 years after planting, as predicted from the percentage grass cover on the plots 1 year after planting the trees. Units for seedling volume increment are cm² (dia) x m (height).

CONCLUSIONS

The most cost effective treatment was the post-plant application of terbuthylazine 5.5 kg/ha plus amitrole 1.0 kg/ha.

The combination of terbuthylazine 5.5 kg/ha with amitrole 1 kg/ha consistently ranked as the best grass control treatment. The level of grass control at the last assessment was significantly better than all other treatments with the exception of terbuthylazine 10 kg/ha plus glyphosate 1.07 kg/ha. The addition of glyphosate did not increase the long-term effectiveness of pre-plant applications of terbuthylazine.

To gain maximum tree growth it is essential that planting sites be kept free of grass for at least 1 year after tree establishment.

Tree growth was highly dependent on the amount of grass on the plots. The best fit obtained by regression analysis was for percent grass cover 1 year after planting with the total tree volume increment over the period of the trial ($R^2 = 0.91$).

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