ACHIEVING SPECIFIC SPOT SIZES FOR WEED CONTROL IN FORESTRY

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A large proportion of the land area being planted with radiata pine is fertile pasture or oversown cut-over sites. Spot weed control, where only the area around individual trees is treated, is popular partly because of the reduction in herbicide used and the associated environmental and economic benefits. With variations in herbaceous species, climate, soil type and fertility, the optimum spot size generally lies between 1 and 2 m in diameter. Although there are a number of different devices used for spot applications, little information is available on techniques for achieving different spot diameters. Consequently, studies were undertaken using both liquid and granular herbicide formulations, to provide practical recommendations on how to achieve weed free spots with diameters between 1 and 2 m.

For liquid herbicide application, seven nozzle types¹ were initially screened by spraying a single 40 ml spot onto a paper strip, using a Target Master attached to a standard knapsack sprayer operating at a pressure of 2 bar. Release heights required to achieve spot diameters of 1, 1.5 and 2.0 m were derived from the relationship between application height and diameter achieved using a constant pressure and nozzle angle. The data were quantified using standard colourimetric techniques (Richardson *et al.* 1989).

The spot diameters from granular herbicide applications were estimated from measurements of inert granule deposition (averaged over 40 replicates using a #2 trigger) for a range of release heights (trigger height) between 0.5 and 1.5 m using a Weed-a-Metre fitted with the newly designed 28 cm cone. The granules were applied over a 12 x 12 grid of 10 cm square boxes, and their distribution pattern determined by weighing. Subsequently, field applications (five replicates) of hexazinone (Velpar 20G) were used to examine the relationship between herbicide rate and diameter of weed control at two release heights, 0.9 and 1.3 m. Weed control was assessed 7 weeks after treatment.

Nozzle types and release height

From a practical viewpoint, a nozzle producing a uniform, circular deposit distribution is most desirable. Of the nozzles tested, the FullJet produced the best pattern. In addition to producing a circular spot, spray distribution was almost even within the spot. Minor peaks occurred toward the edge of the spot at the lower heights tested. This characteristic is an improvement on the deposit pattern of the modified drench gun reported by Davenport *et al.* (1991) where a large peak of herbicide was concentrated in the centre of the spot around the seedling stem.

With both the FullJet nozzle and the Weed-a-Metre, spot diameter increased approximately linearly with increased release height. Using the Weed-a-Metre, it was estimated that release heights of 0.9 and 1.3 m were required to give effective weed control with spot diameters between 1.1 and 1.5 m. It was also estimated from the colourimetric analysis that to achieve spot diameters of 1, 1.5 and 2 m from the FullJet nozzle, release heights of 0.35, 0.65 and 0.95 m were required. Using the correct release height is essential, because a 0.05 m increase in nozzle height gave a 0.10 m increase in the total diameter for a 1 m diameter spot, which increased the spot area

¹FullJet GG4.3W, FL-VS8, TK-VS3, TF-VS3, DG11005-VS, TQ15006SS and OC-06

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by 21%. Errors in release height have a large effect on application rate, which in turn may have important implications in terms of biological effect.

Biological effect and herbicide rate

Predicting the area of weed control derived from measurements of deposit distribution requires knowledge of the dose-response relationship between the specific herbicide and the target species. Without this information, an arbitrary decision must be made on what level of deposition defines the outer edge of the spot (no observable effect level). In most cases the level of deposition slowly decreases to zero with distance from the centre. With the FullJet nozzle and the Weed-a-Metre, the edge of the spot was defined as where the dose fell to 50% of the average spray deposition rate.

Fifteen nominal 1 m and 1.5 m spot diameters were sprayed with a mixture of 1.35% atrazine plus 0.9% Agpro Blue Marker dye using a FullJet nozzle at 35 cm above the vegetation. Spot diameters, based on the distribution of the dye, were measured immediately after spraying and the diameter of actual weed control was assessed three weeks later. The diameter of weed control was significantly larger (paired t test; $P < 0.01$) than the diameter assessed using dye deposition measurements by 14% and 3% respectively. Using the 50% deposit criterion to define the spot edge provided a good approximation of spot size, although some slight effect was observable beyond this level. The importance of understanding dose-response relationships, and the dangers of using arbitrary levels of deposition to define the spot edge were further illustrated using data from the Weed-a-Metre. Increasing the rate of herbicide, while maintaining the same release height increased spot size (Fig.1).

FIGURE 1: The effect of doubling herbicide dose rate on the “no observable effect level” and consequently, spot diameter.

For liquid applications, a FullJet FL-8VC nozzle is suitable for producing weed-free spots of 1, 1.5 and 2 m when the nozzle is slightly below 0.35, 0.65 and 0.95 m from the vegetation surface. Using the Weed-a-Metre to apply hexazinone granules, spot sizes of 1.2 and 1.4 m were achieved at release heights of 0.9 and 1.3 m. The diameter of weed control may vary with different herbicides and target weeds, depending on the application rate and the no effect level. Small variations in release height have a marked effect on spot size and herbicide rate.

REFERENCES

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