DEVELOPMENT AND USE OF AN INVERTED CONE TREE RELEASING SPRAYER

A. BOWERS

N.Z. Forest Products Ltd., Kinleith

J. M. HAWTHORN

Ivon Watkins-Dow Ltd., Otorohanga

Summary

Grass weeds in young radiata pine (*Pinus radiata*) plantations may cause heavy losses. Possible release methods are reviewed and the need for a new technique established. The inverted cone sprayer, its development and operational use are described.

INTRODUCTION

A MAJOR factor in the successful establishment of trees is the control of weed competition. Weeds compete for light, space above and below the surface, water and nutrients, and the competition is most serious during the year following planting.

In 1968, the planting programme at N.Z. Forest Products Ltd. moved into areas where grasses, particularly Yorkshire fog (*Holcus lanatus*), were the major weed problem. Without release from competition, losses could amount to 50% during the first year.

Release cutting improves survival but can still result in reduced growth.

REQUIREMENTS OF RELEASE METHOD

It was therefore necessary to devise a method to deal with the problem. The method had to fulfil certain requirements:

- (1) Competition had to be removed for a full growing season.
- (2) Because the physical collapse of the mature grass could smother the trees, a minimum distance of 18 in. for the tree must be cleared.
- (3) Release must be effected in a single operation.
- (4) To be effective in rough terrain, a fully portable unit was necessary.
- (5) The method must be simple, for use by semi-skilled labour.
- (6) There should be no tree damage.
- (7) The method must be cost-efficient.
- (8) The method should be quick, so that the weeds could be removed before strong competition occurred.

EXISTING RELEASE METHODS

- (1) *Release Cutting*—the physical removal of the aerial parts of the weeds using slashers. This method has many disadvantages:
 - (a) It is slow, and therefore costly.
 - (b) Removal of the weeds is incomplete.
 - (c) There is a strong possibility of damage.
 - (d) The effect on grass is short term, and repeat treatments are necessary.
- (2) *Screefing*—the removal of the vegetation and surface layer of the soil. This method suffers from similar disadvantages to release cutting. It is slower and therefore more costly, and there is a greater possibility of tree damage. At least one repeat treatment would be necessary.
- (3) *Chemical Control*—this was the obvious answer. A mixture of amitrole, 2,2-DPA and simazine was known to be effective in controlling grass, but caused tree damage. It was therefore necessary to protect the trees. For large-scale chemical application, it was considered necessary to have a regulated dose to prevent tree damage and reduce costs.

SHIELDING METHODS

Shielding methods already in use had obvious disadvantages. The cone with the base on the ground and the cylinder leave a circle of grass around the base of the tree. Shielding the tree from one side only meant a double application and excessive movement. As none of these appeared suitable, it became apparent that a new type of applicator was needed to meet the requirements.

DEVELOPMENT

The cone-shaped shield was thought to be ideal if inverted. The circle round the base of the tree was reduced to a minimum and the tree was fully protected. The spray nozzles could be mounted around the outside perimeter of the cone. A slot allowed the cone to be placed around the tree. A prototype cone was made and tested attached to an ordinary knapsack spray unit. The problems of this system quickly became apparent.

- (1) It was difficult to obtain sufficient pressure to make the nozzles deliver a full pattern.
- (2) It was impossible to use this equipment for long periods, owing to operator fatigue.
- (3) It was not possible to regulate the chemical dose accurately.

It was therefore necessary to devise a metering device that would deliver the correct amount of chemical at the required pressure and that could be easily operated without excessive fatigue. The design chosen allowed the unit to be charged with the predetermined dosage by a lever as the operator walked from one tree to the next. The chemical would be released under pressure by pushing a button which activated a quick-release valve when the machine was in position. This system allowed

both hands for accurate placing of the unit over the tree and the operator had one hand free to assist in movement over rough terrain.

The chemical reservoir was required to hold sufficient of the mixture to allow for spraying up to quarter of a mile away from the supply point and back again. Nozzles were selected to give a 3 ft diameter spray pattern at the chosen application rate of 50 gal/acre.

A circle of 3 ft diameter has an area of 7.0686 sq.ft.

The dose rate per tree is therefore:

$$\frac{50 \times 160 \times 7.0686}{43,560} = 1.298 \text{ fluid oz}$$

With trees planted 8 ft apart, a distance of half a mile covers 330 trees. The amount used in this distance is 2.67 gal. A reserve must be carried to prevent air leaking into the pressure system, and it was decided that the reservoir should contain 4 gal.

DESCRIPTION OF SPRAY UNIT

(see Fig. 1)

The shield is an inverted cone of aluminium sheet, with a top diameter of 18 in., a bottom diameter of 2½ in., and a height of 14½ in. The front of the cone has a slot, 1¾ in. wide at the bottom and 3¾ in. wide at the top, to allow the cone to be placed over the tree. A handle which carries the metering device and charging lever is fitted to the back of the cone. The metering device is a stainless steel cylinder, with a piston which is pulled back against a double spring by the charging lever. The volume of liquid is controlled by the stroke of the piston. The stroke is governed by a slot in the pump mounting plate. The liquid is held under a pressure of 90 lb/sq.in. in the cylinder by a non-return valve and is released by pushing a button. The chemical is delivered via plastic tubing to a ½ in. copper tube running round the outside perimeter of the cone and thence to four Monarch 14.5 solid cone nozzles, spaced to give overlapping spray patterns. Air leaks and drips are prevented by Spraying Systems check strainers.

The reservoir is a plastic container mounted on a back-pack frame.

OPERATIONAL USE

On easy terrain a man can cover up to five acres of trees a day but the average is about three acres a day depending on slash density and terrain.

Spraying early in the growing season has great advantages:

- (1) Better spray coverage is possible if the grass is short.
- (2) The trees do not suffer from competition.
- (3) The operation is quicker, as the trees are visible and movement is easier.

To date N.Z. Forest Products Ltd. has sprayed 3,500 acres using these units.

FIG. 1: Inverted cone chemical tree releaser.

LIMITATIONS OF HAND SPRAYING

- (1) To spray large acreages in the time available, labour requirements are high. Labour is difficult to obtain and is necessary for other operations during the same period. The use of the unit for long periods is arduous.
- (2) The main limitation on the use of this unit is that large areas cannot be treated before competition occurs. Spray coverage is poor on long grass, leading to reduced control. Overall aerial release spraying has now largely superseded hand spraying on extensive areas planted with radiata pine.

ADVANTAGES OF HAND SPRAYING

- (1) Difficult weed species may be controlled with non-selective herbicides.
- (2) Where aerial spraying on steep country could lead to erosion, the use of this unit is preferable.
- (3) The unit is most useful in the treatment of small areas, for species which may be damaged by overall treatments, or for weed species which are tolerant to present aerially applied chemicals.

CONCLUSION

In spite of the development of aerial release spraying, there is still a place in forestry for manual release spraying. This unit has proved to be the most efficient manual method to date of controlling grass species in young pine plantations. It is quicker and gives more efficient control than traditional manual release methods.

ACKNOWLEDGEMENTS

The authors would like to thank the N.Z. Forest Products Ltd. Plumbing Section for their work on the prototype; N.Z. Forest Products Ltd. New Projects Department and Robert Stone (Tokoroa) for the development of the units, and D. Gooding of the N.Z. Forest Products Ltd. Forestry Department for his assistance in the field evaluation of the units.

The authors would also like to thank N.Z. Forest Products Ltd. for permission to publish this paper.