

TECHNIQUES FOR APPLICATION OF HERBICIDES BY A.C.T. FORESTS

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Summary. The application of herbicides by helicopters is used as routine practice within A.C.T. Forests, radiata pine, *Pinus radiata* plantations. Emphasis has been on accuracy of application particularly flow rates, nozzle distribution and guidance of the aircraft. Helicopters are economic, cover large areas quickly, and treat areas impassable to ground units.

INTRODUCTION

A.C.T. Forests is responsible for the management of 14,200 ha of radiata pine plantations with a projected target of 16,200 ha by 1989. Plantations within the Cotter Reservoir water catchment contribute 20% of this area. The Cotter Reservoir is used as a back-up for Canberra's water supply, and consequently preserving water quality is an important issue when considering the use of herbicides.

The current level of wood to supply to industry is 180,000 m³ p.a., requiring an annual harvest of 360 ha of mature plantation and thinning of a further 1000 ha. This commitment is equivalent to the maximum sustainable cut. To maintain this level of harvest, all forest establishment processes for first, second, and subsequent rotations, must be of the highest order.

Rainfall in the A.C.T. varies from 1140 mm p.a. in the west to 610 mm p.a. in the east. Annual rainfall distribution is irregular, compounding moisture supply problems especially on those ex-grazing sites which are already in the lower part of the mean annual rainfall range.

Forest establishment is that stage of development up to canopy closure, where the plantation enters a phase of transitional competition. Weed control is important especially in the early growth of a plantation before canopy closure. Helicopter application of herbicides for early weed control in radiata pine plantations now occurs on most A.C.T. plantations.

METHODS OF APPLICATION OF HERBICIDES BY HELICOPTER

Accurate application of herbicides by helicopter produces results equivalent to ground spraying techniques if suitable equipment is used and the helicopter is flown properly. In order to ensure uniformity of herbicide application rates and droplet size, all nozzles and diaphragm check valves are supplied by A.C.T. Forests. A twin turbine flowmeter interfaced with a computer system is used for monitoring and recording output. The system provides print-outs of application rates, volume sprayed, and area covered.

There are two types of aerial spraying in use in the A.C.T. Firstly, strip spraying is used along ripped planting lines (generally before planting), to provide a 1.5 m wide weed-free zone for the radiata pine seedlings. Secondly, broadcast spraying is used for second rotation crops where there are no obvious rows, and in areas where weed regeneration (native or exotic) is competing with the current crop. More details are provided below.

Strip spraying. Strip spraying was developed for protection of potentially erodible sites and to minimise chemical costs. Two strips 3 m apart are treated simultaneously. Four nozzles at 32 cm spacing are assigned to each

row. To maximise air to ground penetration Raindrop^R disc nozzles are used, producing large droplets. Experimentation is continuing with various nozzles for better control of spray distribution and drift.

Chemicals and rates. Three chemicals are used for grasses and broad-leaved weeds: glyphosate, hexazinone and atrazine.

In areas where sorrel is a problem 2.25 kg a.i./ha hexazinone is applied in a total spray volume of 50 L. Most other areas receive the standard prescription of 6-7 kg a.i./ha atrazine in a total volume of 50 L. Both applications provide a weed-free zone for at least three growing seasons.

Glyphosate is the only herbicide used by A.C.T. Forests in the Cotter Reservoir water catchment. Rates of 3.5 kg a.i./ha in a total volume of 100 L have been effective on most weed species including blackberry.

Broadcast spraying. Heavy infestations of woody weeds and grasses, especially on second rotation sites, are treated by broadcast spraying.

The same basic spraying equipment is used as for strip spraying, but nozzle number and boom lengths are modified. It is possible to achieve up to a 12 m swath, however due to mountainous terrain 9 m is optimum. Nozzle spacing (16 or 32 cm) depends on the desired spray volume. Positioning of the aircraft is achieved using a microwave electronic guidance system. This system provides the pilot with information so that he can guide his aircraft along a straight track in the air. It allows precise spray coverage by indicating start and stop points and guidance for parallel ground tracks to allow constant swath widths.

Chemicals and rates. The choice between glyphosate and hexazinone depends on whether the area is inside or outside the Reservoir catchment.

In the catchment glyphosate 3.5 kg/ha is used in 100 L water. A droplet size of 350 μ m is required for best distribution on the leaf surface. Double overlap of spray from nozzles within the swath width minimises shading effects from vegetation and residual slash.

Out of the catchment hexazinone is used at 2.5 kg/ha in 50 L water. Droplet size is not as critical due to combined foliar and root uptake of this chemical. This is a broad spectrum herbicide and is effective on eucalypt regrowth and blackberry.

TIMING, MONITORING AND SAFETY

Knockdown herbicides are applied at times of active growth of target plants. Glyphosate for general weed control in the catchment is applied in the narrow "window" in the autumn prior to pine planting. Hexazinone can be applied to pine sites pre or post-planting, preferably during a period of active growth of weeds. Residual effects can be achieved by application during dormancy, but knockdown of problem species is best attained by spraying in spring or autumn.

Spray drift and coverage is monitored using sensitive paper. The paper cards (26x500 mm) are located around target boundaries and within spray areas. An estimate of spray coverage is made by measuring droplet area and distribution on the cards. Low wind speed is critical to control spray drift and an operational cut off at 5 kg/h wind speed is enforced.

The Code of Practice for the Safe Use of Agricultural Chemicals by Aerial Application, developed by a working party of the national Health and Medical Research Council, provides the guidelines for aerial application of agricultural chemicals. A.C.T. Forests follows these guidelines.

The use of chemicals and in particular their aerial application for weed control has drawn criticism from various lobby groups. In many instances, concern has been warranted because of a disregard for the potential hazards of the chemicals used and a less than professional approach to their application.

Development and use of precise metering and application equipment, electronic guidance systems and a high regard for spray equipment maintenance will minimise problems such as errors in application which leads to the criticism. The provision of print-outs of application details and flight maps for chemical application operations can provide credible evidence of compliance with legislation and guidelines regarding application of chemicals by aircraft.