



# Memo

January 1 1991

 MINISTRY OF FORESTS LIBRARY  
 PO BOX 9523 STN PROV GOVT No.175  
 VICTORIA BC V8W 9C2

## Evaluation of Target and Crop Tree Response to Glyphosate Injection and Manual Cutting - FRDA # INT-13

Although the use of chainsaws is the common method of juvenile spacing, herbicide treatments such as "hack and squirt" are also used in some situations. Herbicide treatments have certain advantages over the use of chainsaws, including reduced slash accumulations following treatment and more elementary training requirements for the workers. One disadvantage with herbicide techniques, however, is the potential exposure of workers to the chemical.

In 1978, Brian Dillistone began developing a herbicide injection system that would reduce the exposure of both workers and the environment to the herbicide. The injection system (first called the "Wee-Do" system, and now renamed the "Ez-Jet" system) involved pushing the end of a lance against the stem of the target tree and inserting a used .22 bullet cartridge containing herbicide. In a trial of the herbicide injection system (EP 867), glyphosate<sup>1</sup> was applied in the cartridges (0.23 grams a.i./cartridge) to Douglas-fir (*Pseudotsuga menziesii*), western hemlock (*Tsuga heterophylla*) and lodgepole pine (*Pinus contorta*). Effectiveness was examined according to number and arrangement (horizontally and vertically) of cartridges and timing of treatment period (winter, spring, summer and fall). Three growing seasons after treatment, up to 100% mortality of target trees was achieved. Operational use showed the system to be effective in controlling red alder (*Alnus rubra*), spruce species (*Picea* spp.), lodgepole pine (*Pinus contorta*), and yellow pine (*Pinus ponderosa*).

The trial reported here was initiated in 1985 to gain additional experience with this stem injection technique for spacing coniferous stands. The objectives of this trial were:

1. to evaluate the effectiveness of glyphosate injection at a rate of one cartridge (each cartridge containing 0.23 g a.i. of glyphosate) per 5 cm diameter at breast height (dbh) on the growth of target trees of three conifer species: western hemlock, western redcedar and amabilis fir; and
2. to quantify and compare the growth response of crop trees to herbicide injection spacing, chainsaw spacing, and no spacing treatment.

This memo summarizes the survival of target trees and stem diameter growth of crop trees three growing seasons after treatment.

### METHODS

The trial area was located in the Norrish Creek drainage, approximately 20 km northwest of Chilliwack. The stand established naturally after the site was logged in 1962. It had a

TABLE 1. Pretreatment stand density in stems per hectare (sph), mean height and dbh by species of (i) dominant/co-dominant trees and (ii) intermediate/suppressed trees by species. N = sample size. Standard deviation in brackets.

Species	sph	Dominant/Co-dominant				sph	Intermed./Suppressed			
		Ht. (m)		dbh (cm)			Ht. (m)		dbh (cm)	
		Mean	N	Mean	N		Mean	N	Mean	N
Western redcedar	75	13.1 (3.1)	30	23.8 (9.4)	36	235	12.3 (2.0)	23	10.4 (4.0)	113
Amabilis fir	225	17.8 (3.0)	55	22.4 (5.1)	109	410	15.8 (3.4)	21	13.7 (4.8)	197
Western hemlock	263	17.5 (2.2)	56	21.8 (5.7)	134	753	17.3 (2.7)	23	12.6 (5.1)	363
<b>Total</b>	<b>563</b>					<b>1398</b>				

<sup>1</sup> Reference to specific compounds or trade names neither constitutes recommendation for their use nor excludes the possibility that other products or treatments may be more or equally effective.

634.909  
 711  
 BCMF  
 RES  
 FRM  
 No.  
 175  
 C.2

ECONOMIC &amp; REGIONAL DEVELOPMENT

ENVIRONMENTAL AGREEMENT

pretreatment density of 1960 stems per hectare (sph), composed of western hemlock, amabilis fir, and western redcedar in decreasing order of abundance (Table 1). A randomized block design was used, with each treatment replicated four times. Treatments were randomly assigned to plots 40 x 40 m in size. Pretreatment and post-treatment measurements included tree species, height, dbh, pathological remarks, crown position, foliage condition, crown diameter and height to lowest live branch. District preference for crop trees species was, in the following order: amabilis fir, western redcedar and western hemlock. Crop tree spacing was targeted to be 4 x 4 m square spacing (625 sph). Glyphosate injection was completed in mid-November of 1985. Cartridges were generally arranged on one side of the stem, although some of the larger trees were deliberately treated around the bole. Manual cutting was completed in late April 1986.

**RESULTS**

Total third-year mortality rates of target trees following glyphosate injection were similar for the three species, ranging from 91 to 93% (Figure 1). Mortality rate was higher and occurred sooner among the trees with smaller dbh. Trees which survived the glyphosate injection treatment displayed between 75 and 99% needle loss during the first year, and showed no diameter growth after treatment. Mortality of small diameter stems in the control plots was attributed to inter-specific competition. Tree mortality did not differ significantly between species ( $p=0.0921$ ) and survival increased with increasing tree dbh.

Stem diameter growth of crop trees was not significantly different between treatments in the first or third year after treatment (Figure 2). In the second year after treatment, both the manual and glyphosate injection treatments showed significantly better diameter growth than the control group, although the difference was relatively small (0.8 - 1.5 mm/year). In the second year, crop trees in the manual treatment showed significantly better diameter growth than did trees in the stem injection treatment.

**DISCUSSION**

Both the manual chainsaw and glyphosate injection treatments reduced stand density of a naturally established mixed conifer stand, but within different time periods. The injection system provided a more gradual reduction in density and lower slash accumulation than did the manual cutting, as mortality in larger trees (>15 cm dbh) continued to occur in the third growing season following treatment. Since the injected cartridges are difficult to see, however, the stem injection technique lacks an efficient method for indicating treated stems. Although there were few untreated target trees in this trial, operational treatments might experience higher levels of missed stems, especially in higher density stands. Regardless of the marking method, however, chainsaw or brush saw methods are generally more appropriate in higher density conditions.

Lack of stem diameter growth response in crop trees may be due to several reasons: brief time since treatment; the allocation of tree growth to canopy development; the low "thinning character" of the spacing treatments which removed stems principally from the lower crown classes; and the shade-tolerant nature of the remaining conifer species.

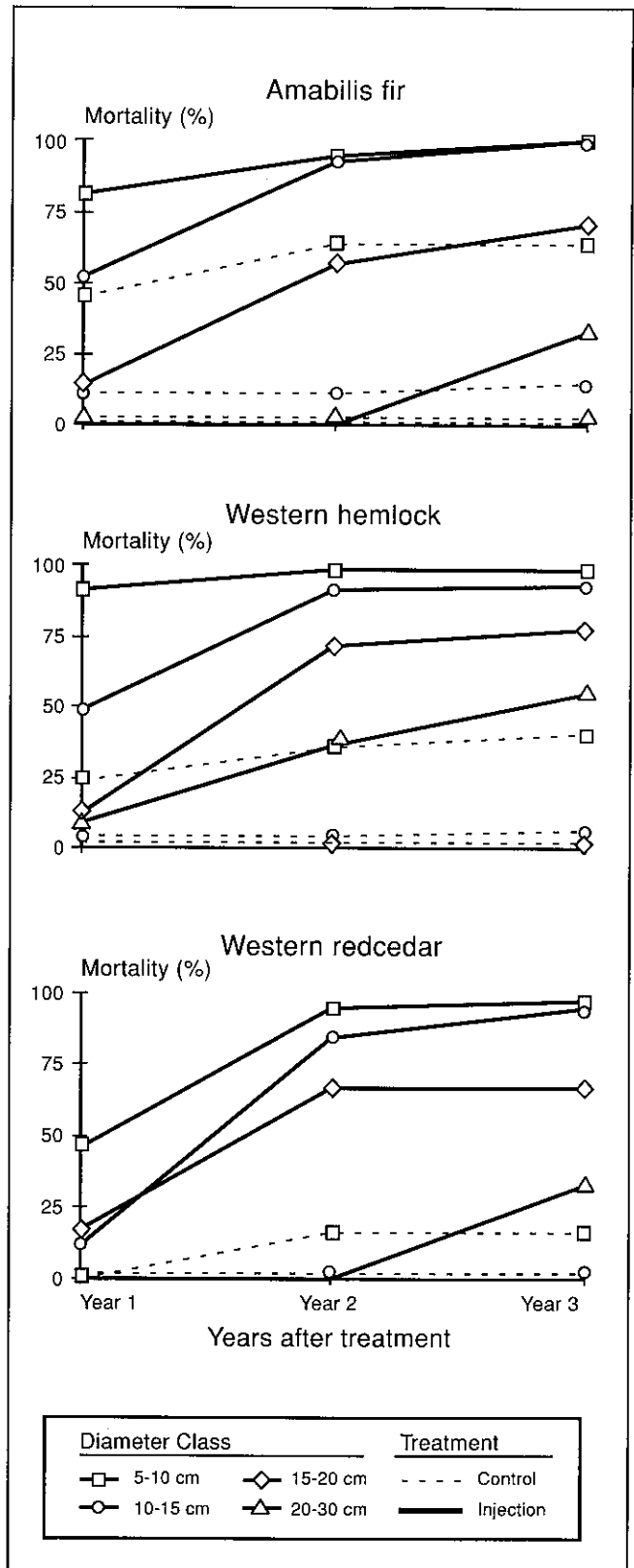


FIGURE 1. Percent mortality of target trees by species, diameter class, and time.

## CONCLUSIONS

1. The injection of cartridges containing 0.23 g a.i. of glyphosate at a rate of one cartridge for each 5 cm of stem dbh effectively controls western hemlock, amabilis fir and western redcedar up to 20 cm dbh.
2. Mortality rates following herbicide injection decline with increasing stem diameter. Although some injected trees took three growing seasons before being classified as dead, they did not display any diameter growth since treatment.
3. Crop trees in the mixed stand of western hemlock, amabilis fir and western redcedar did not show a significant increase in stem diameter growth during two of the three growing seasons following treatment.

For more information contact:

*Brian D'Anjou or Frank Pendl*  
 Forest Sciences Section  
 Vancouver Forest Region  
 4595 Canada Way  
 Burnaby, B.C.  
 (604) 660-7531  
 (604) 660-7538

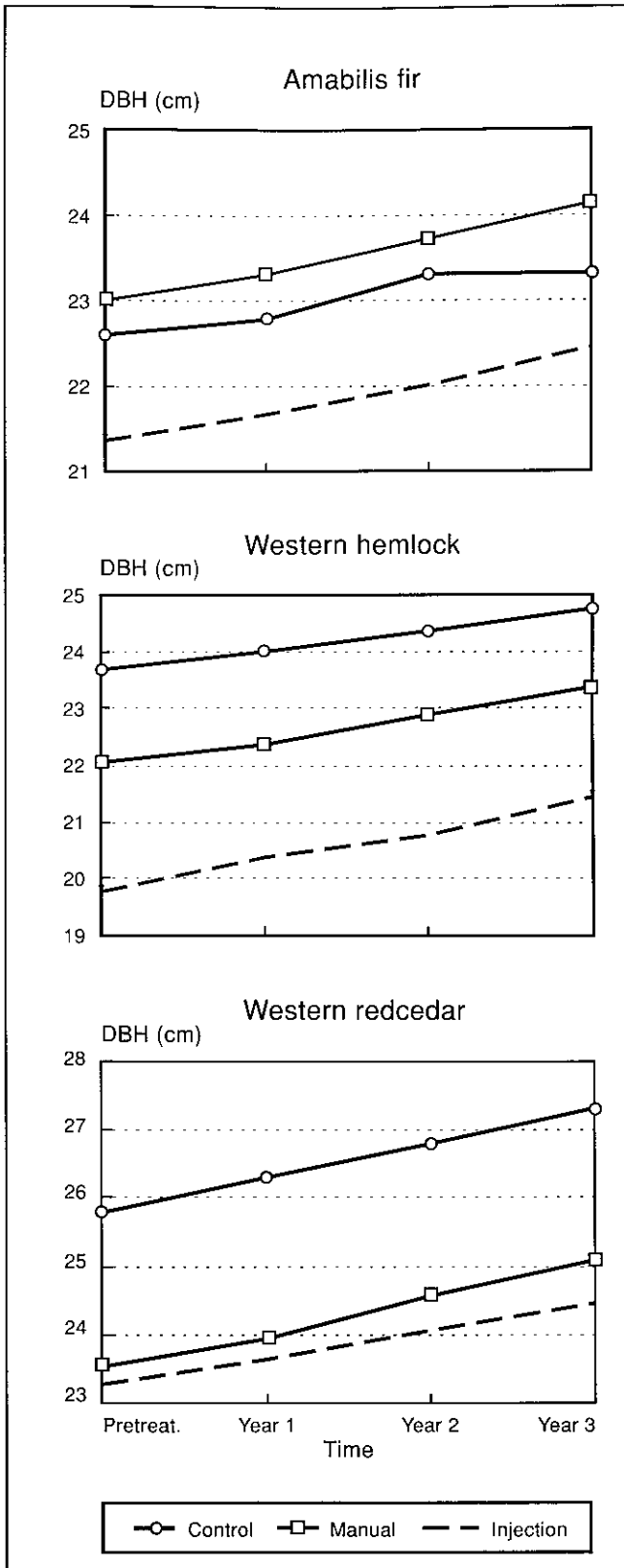


FIGURE 2. Stem diameter of crop trees by species, treatment and time.