FOREST RESEARCH REPORT

NOVA SCOTIA DEPARTMENT OF LANDS AND FORESTS
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CONIFER SUSCEPTIBILITY TO GLYPHOSATE IN NOVA SCOTIA

INTRODUCTION

Vision® is currently registered in Canada for both site preparation and conifer release (CPPA, 1986). Ideally, herbicides used to release planted seedlings or natural regeneration from competing weed species should not impair the growth of crop trees. However, conifer seedlings can be susceptible to herbicide damage depending on when the herbicide is applied and the rate of application (Newton and Knight, 1981; Radosevich et al., 1980; Sutton, 1978). Radosevich et al. (1980) states that conifers are most susceptible to glyphosate applications during the period of active growth and shoot elongation.

This report summarizes the results of experimental trials established by the N.S. Department of Lands and Forests during 1985 to determine the susceptibility of four commercial conifer species to injury by Vision®. The species tested were black spruce *(Picea mariana* (Mill B.S.P.), red pine *(Pinus resinosa* Ait.), red spruce *(Picea rubens* Sarg.), and balsam fir *(Abies balsamea* (L.) Mill.)

METHODS

Five sites were selected to evaluate the effect of Vision®: 4 were planted with conifers and 1 was naturally regenerated. The location and history of each site is summarized in Table 1.

In 1985, Vision® was applied, at weekly intervals, at each of the above sites on 16 dates beginning July 2 and ending October 22. These dates were chosen to span the period from cessation of active height growth to complete dormancy of the crop seedlings. Application of Vision® was by a carbon dioxide pressurized backpack sprayer with eight 800067 Tee-Jet flat fan nozzles on a 3.2 m boom. The total solution applied was 112 l/ha. Two different rates of herbicide were applied: 3.2 and 4.7 litres of product/ha.

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Nova Scotia Department of Lands and Forests

Forestry Canada Forêts Canada

Each treatment was assigned randomly to three blocks at Barren Brook and Cox Brook and one block at each of the other sites. The blocks were 6 x 10 metres except for two replications at Barren Brook where they were 6 x 15 metres.

The week prior to treatment all blocks were manually cleared of over-topping competition (except for the control blocks). This weeding was done to ensure that the crop trees would receive the full rate of herbicide.

Table 1. Location and history of the experimental sites.

Site	County	Stand History	Site Prep.	Regeneration
Barren Brook	Pictou	Softwood Clearcut 1983	Brush raked and burned 1984	Black Spruce Multipot 1985
Cox Brook	Pictou	Softwood Clearcut 1982	Wild fire 1984	Red Pine Multipot 1985
Duck Lake I	Pictou	Wild fire Salvage 1980	-	Red Pine Multipot 1984
Duck Lake II	Pictou	Wild fire Salvage 1980	-	Red Spruce Multipot 1984
Riversdale	Colchester	Softwood Clearcut	-	Balsam Fir Natural Regeneration

The treated sites were assessed in the fall of 1986 and 1987. Total seedling height, leader length, and stem diameter were measured and the overall seedling condition was recorded.

A comparison of the height and diameter data for all sites indicated very little difference between treatment rates. For this reason the heights and diameters were averaged for the two rates at all sites.

RESULTS AND DISCUSSION

BLACK SPRUCE — BARREN BROOK

The time of treatment did not have a pronounced effect on the diameters and heights of black spruce at Barren Brook. The maximum height difference in 1987, over all spray dates, was 0.11 m and the maximum difference in diameter was 0.44 cm. Seedlings treated on or after September 4 generally had higher average heights and diameters (Figures 1 and 2).

Some seedlings sprayed early in the season showed slight burning of the shoot tips in the year of treatment. This damage was evident in fewer seedlings toward the end of July and by August most seedlings exhibited no damage. One year later the damaged seedlings set normal buds.

BALSAM FIR — RIVERSDALE

In contrast to black spruce, the date of treatment had a pronounced effect on height and diameter growth of naturally regenerated balsam fir. The lowest average heights and diameters occurred on blocks sprayed in late July. Trees treated after July 29 showed a generally increasing trend in average height and stem diameter until the September 23 treatment date when height was double that on July 29 (1.60 m vs. 0.84 m for the 1987 assessment). The maximum difference in diameter was 1.40 cm. (Figures 3 and 4).

Compared to the other species, balsam fir sustained the greatest amount of foliage damage. This is possibly due to their greater height and

foliage mass at the time of treatment, resulting in more Vision® being absorbed. Foliar damage was detected until the end of the first week in August.

For trees sprayed in July, needle loss was extensive, sometimes defoliating shoots up to three years old.

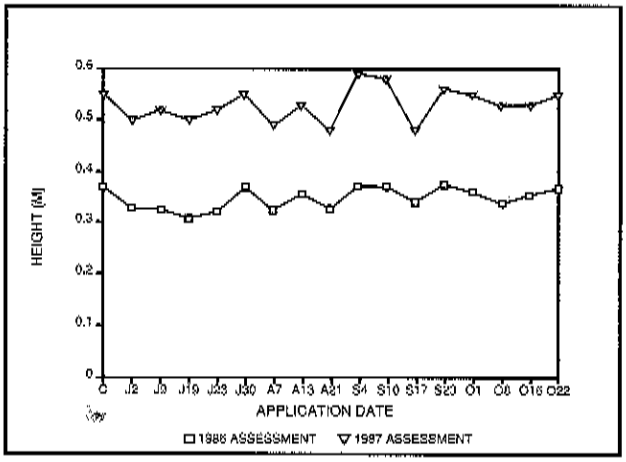

Figure 1. Average height of black spruce seedlings by date of application at Barren Brook. (C=control)

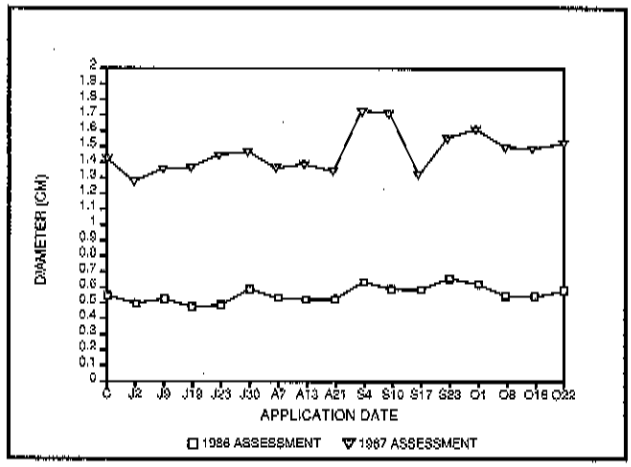

Figure 2. Average diameter of black spruce seedlings by date of application at Barren Brook. (C=control)

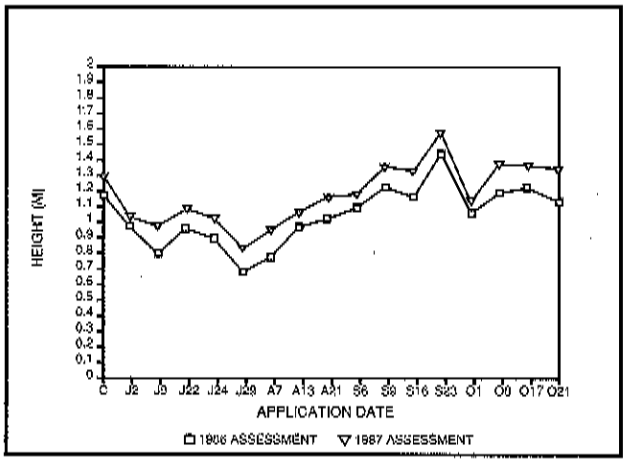

Figure 3. Average height of balsam fir by date of application at Riversdale. (C=control)

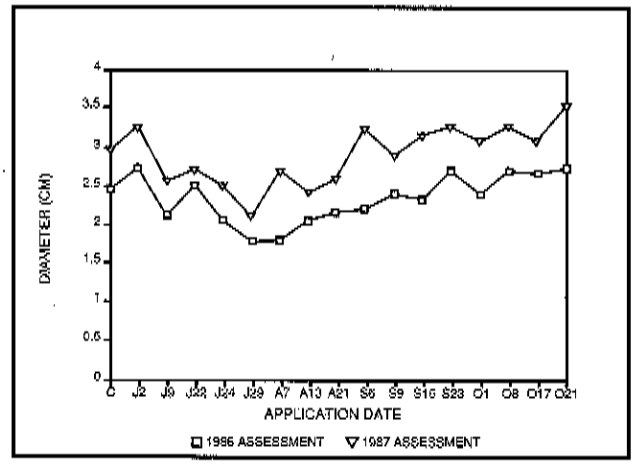

Figure 4. Average diameter of balsam fir by date of application at Riversdale. (C=control)

RED SPRUCE — DUCK LAKE ROAD

For red spruce at Duck Lake, heights two years after treatment were generally greatest for trees sprayed in September (up to 0.45 m) and lowest for July treatment dates (as low as 0.24 m) (Figure 5). Stem diameters (1987) were generally lower for the July, August and October applications (Figure 6).

Minor damage to red spruce foliage was noted in the year of treatment for the July application dates. No damage was noted on trees sprayed in August, September and October. By the second spring, damage caused to the July treated trees was no longer visible.

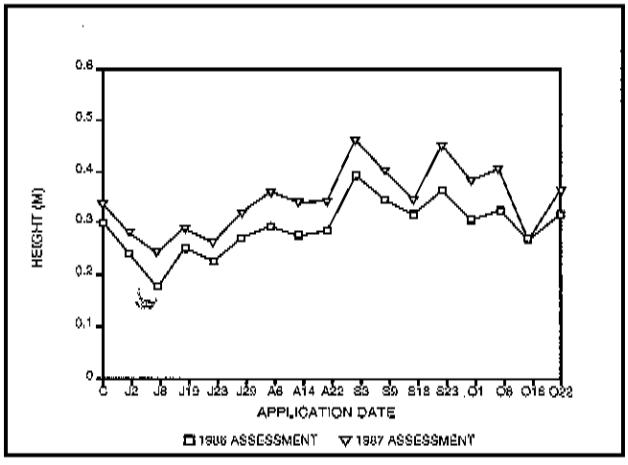

Figure 5. Average height of red spruce seedlings by date of application at Duck Lake. (C=control)

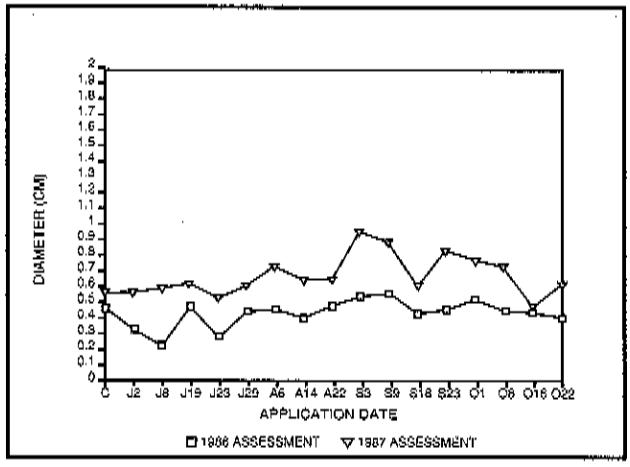

Figure 6. Average diameter of red spruce seedlings by date of application at Duck Lake. (C=control)

RED PINE — COX BROOK AND DUCK LAKE ROAD

For red pine, height and diameter growth were not related to the timing of the herbicide treatment at either the Cox Brook or Duck Lake locations (Figures 7,8,9 and 10). The low mean diameter one year after treatment for the seedlings treated on July 8 at Cox Brook is attributed to their low initial stem diameter of 4.5 mm compared to a range of 5.5 mm to 6.7 mm for the other spray dates.

The leaders of some seedlings were damaged when sprayed before the end of July. However, 1 year later, these seedlings set normal buds. Mortality also occurred sporadically during the July spray dates throughout the treated plots.

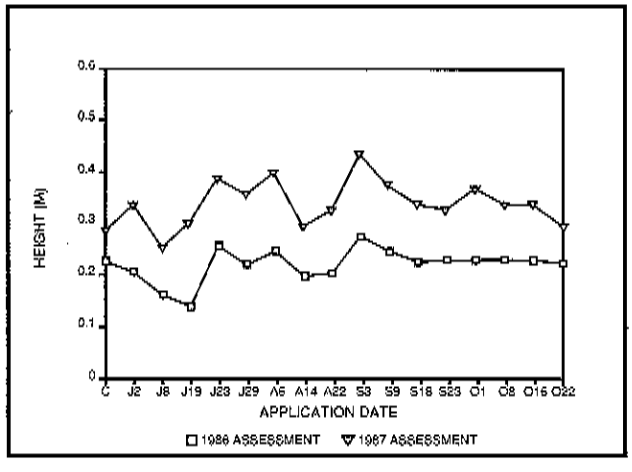

Figure 7. Average height of red pine seedlings by date of application at Cox Brook. (C=control)

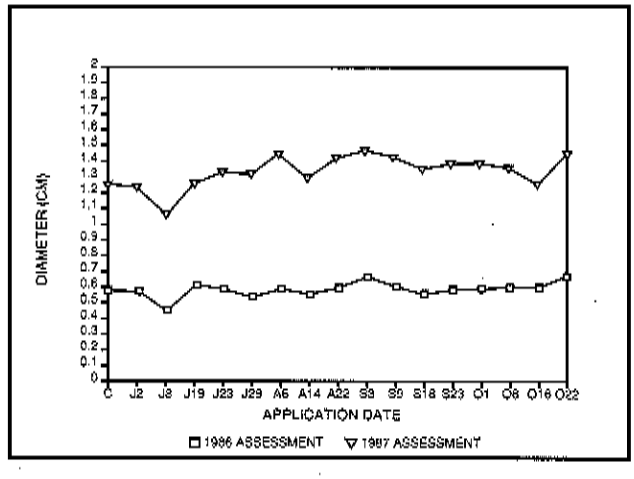

Figure 8. Average diameter of red pine seedlings by date of application at Cox Brook. (C=control)

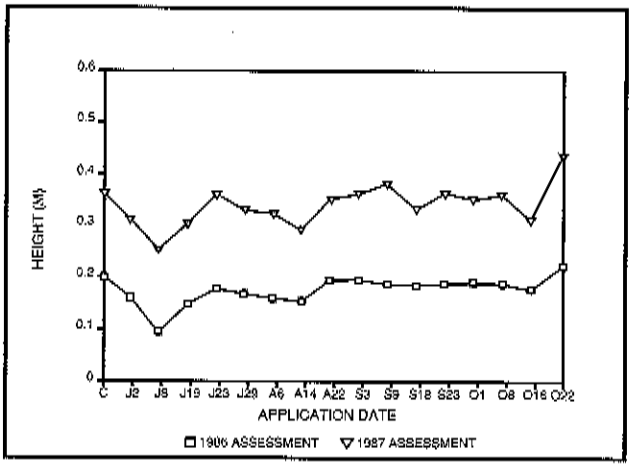

Figure 9. Average height of red pine seedlings by date of application at Duck Lake. (C=control)

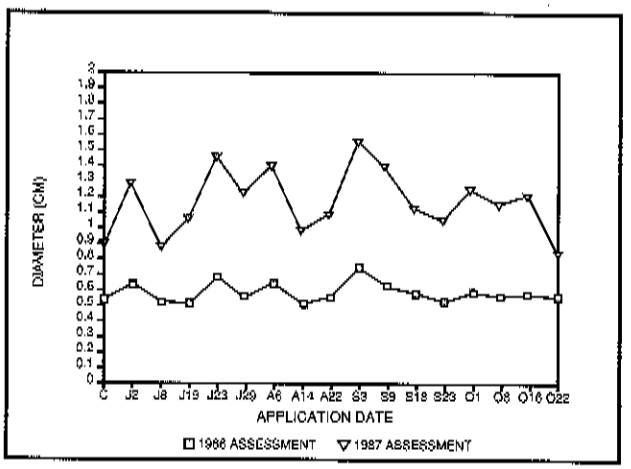

Figure 10. Average diameter of red pine seedlings by date of application at Duck Lake. (C=control)

CONCLUSIONS

One to 2 years after treating newly planted red spruce, black spruce, red pine and naturally regenerated balsam fir with two different rates of Vision® applied at 16 different dates throughout the growing season, it was found that:

1) Height and diameter growth of the treated species was independent of treatment rate (i.e. 3.2 and 4.7 litres of Vision® per hectare).
2) Some damage to foliage occurred to all species treated in July. The damage to spruce and pine species was restricted to the current year's needles, whereas, on the larger balsam fir trees needle loss was extensive, sometimes defoliating shoots up to three years old. One year after treatment, the damaged seedlings set normal buds. The more extensive damage to the naturally regenerated fir may be due to their greater height and foliage mass, resulting in more Vision® being deposited on individual trees.
3) Damage to foliage treated during the period August to late October was infrequent and minimal even though the trees were exposed to the full treatment rate. In an operational setting, the amount of Vision® actually reaching most planted or natural conifers would be considerably less because of interception by overhead competition.
4) Heights and diameters, two years after treatment, tended to be greatest for trees treated in September and least for trees treated in July. However, except for the taller naturally regenerated balsam fir, the differences between August and September treatments were not great and will likely become less significant over time.

MANAGEMENT RECOMMENDATIONS

Based on the results of this experiment and observations of operationally treated areas, damage to *newly established healthy conifers* can be minimized by delaying Vision® operations until the beginning of August for red pine, black spruce and red spruce and the beginning of September for balsam fir. It is important to note that different weather conditions may necessitate adjusting the exact timing of the conifer release operation.

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