FOREST RESEARCH REPORT

NOVA SCOTIA DEPARTMENT OF LANDS AND FORESTS
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CONTROLLING COMPETING VEGETATION WITH LOWER THAN RECOMMENDED RATES OF GLYPHOSATE

INTRODUCTION

Glyphosate (given the trade name Vision® by Monsanto Company Ltd[1]) is a herbicide that will provide control of a variety of broadleaf species (Anon, 1988; Sutton, 1978). Currently, Vision® is registered in Canada for site preparation and conifer release by ground and aerial applications (CPPA, 1986).

Previous trials carried out in Nova Scotia (NSLF, 1988) indicated that various target species could be controlled at lower than recommended rates of Vision®. The product label recommends using 6.0 litres of product per hectare for maple and *Rubus* species and 3.0 to 6.0 l/ha for the control of other species. To determine the minimum rate of Vision® (as well as other herbicides) required to adequately control various species of competition, a series of aerial and ground experiments have been established over the past 10 years at various locations in Nova Scotia. The purpose of this report is to summarize the interim results of one such experiment established in the fall of 1984. Results from the other experiments will be summarized in future reports following remeasurement and analyses of the data.

SITE DESCRIPTION

The experimental site is located adjacent to Vanderveens Road, in west-central Pictou County and is characterized by a dense cover of raspberry and hardwood sprouts (primarily red maple and sugar maple). A portion of this site (Area 1) was clearcut during 1982 and brush raked, burned and planted with black spruce multipot stock in 1983. Another portion of this site (Area 2) was clearcut in 1983 and brush raked, burned and planted with black spruce multipot stock in 1984.

1. Trade name was changed from Roundup® to Vision® as of 1987.

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METHODS

On both areas, seven blocks of two hectares each were selected for treatment with one of seven different application rates of Vision® ranging from 1.17 litres of product per hectare to 4.67 l/ha. The increment between treatments was 0.58 l/ha (Table 1). Non-sprayed control blocks were also established in each area. Both areas were treated by helicopter on September 19 and 23, 1984. The swath width was 22 m and the total solution applied in single passes was 56.2 l/ha. The temperature ranged from 3 to 12° C and wind speeds from 0 to 6 km/hr during application.

Vegetation was assessed during the summers of 1985 and 1986. Only results from the 1986 assessment will be discussed in this report. Twenty assessment plots were established systematically within each treatment block starting at a randomly selected point. Concentric plots having radii of 1.78 m and 0.58 m were used to assess woody vegetation and non-woody types of vegetation respectively. At the time of assessment the mean heights and percent cover of each species of competing vegetation were recorded. In addition the height, root collar diameter (RCD), vigour and leader length of the closest planted seedling to the centre of each plot was measured.

Table 1. Rate of Vision® applied, by block number and year cut.

Block	Rate (litres/ha)	Year Cut
1	1.17	1982
2	1.75	1982
3	2.33	1982
4	2.92	1982
5	3.50	1982
6	4.08	1982
7	4.67	1982
C1	Control *	1982
C2	Control *	1982
8	1.17	1983
9	1.75	1983
10	2.33	1983
11	2.92	1983
12	3.50	1983
13	4.08	1983
14	4.67	1983
C4	Control **	1983

* There were 10 plots in each of the 1982 controls.
** There were 20 plots in the 1983 control.

The ability of the various treatments to control overhead competing vegetation was evaluated by the following competition index:

$$CI = H \times C$$

where CI = Competition Index
H – Average height of competing vegetation (expressed in metres)
C – % of ground covered by competing vegetation

To assess the competitive effects of shorter vegetation (e.g. grass, goldenrod, hemp nettle, ferns and moss), percent cover was used.

RESULTS AND DISCUSSION

Early results (two years after application) indicate that lower than recommended rates of Vision® were effective in controlling the major species of competing vegetation at the Vanderveens site, i.e. raspberry and red maple.

TARGET SPECIES

Raspberry

Raspberry was the predominant competitor prior to treatment. All treatments resulted in a substantial reduction in the competition index for this species (Figure 1). With the exception of the highest treatment rates, the greater the amount of Vision® applied, the greater the control provided. However, observations indicated that application rates of 1.75 l/ha and greater will provide good control of raspberry.

Red Maple

The effect of the different rates of Vision® on red maple was similar to that of raspberry (Figure 2). In the older cut (1982), the average CI ranged from 2.0 to 10.5 in the control plots and from 0.0 (3.50 l/ha) to 2.0 (4.08 l/ha) in the treated plots. In the 1983 cut, the competition indices were considerably lower than those of the 1982 cut due to the shorter height of the one year younger red maple. These results, together with observations, indicate that adequate control can be achieved with treatment rates of 2.33 l/ha and greater. The reason(s) for the increase in the CI for the highest rates applied is unknown.

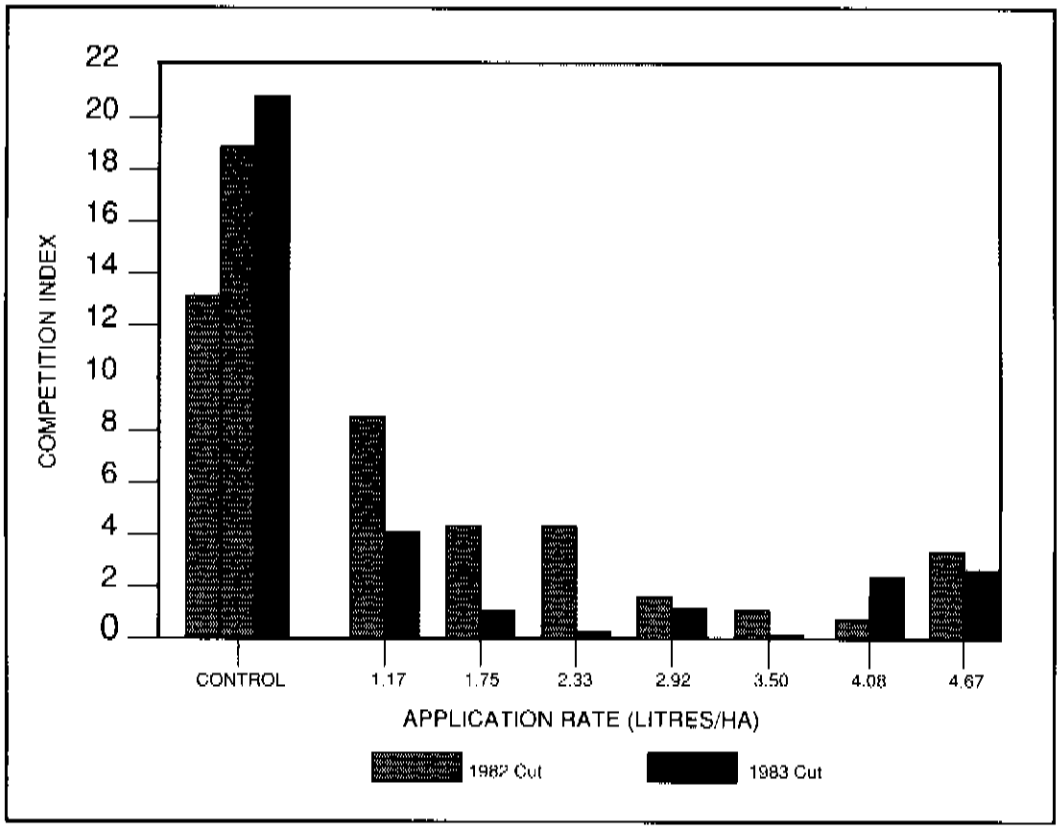

Figure 1. Competition index for raspberry, two years after treatment.

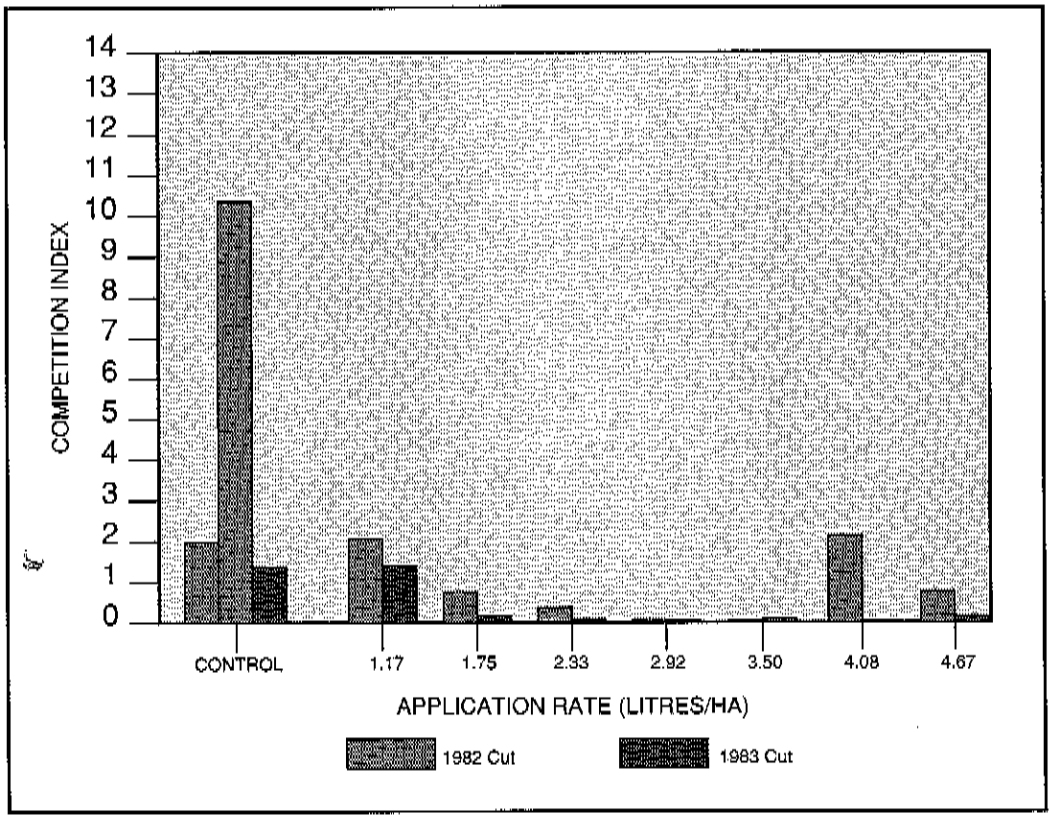

Figure 2. Competition index for red maple, two years after treatment.

Sugar Maple

There was no apparent trend in the CI for sugar maple with respect to the different treatment rates (Figure 3). This result is attributed to the greater tolerance of sugar maple to Vision® and the uneven and scattered distribution of this species in the control and treated blocks. However, it was observed that Vision® had a variable effect on individual stems of sugar maple, killing some and reducing the vigour of most.

Combined Target Species

To determine the effect of the different rates of Vision® on the target species as a whole (i.e. raspberry, red maple, sugar maple and other tree species), the competition indices for the main overhead competitors were summed. Figure 4 indicates that even the lowest rates of Vision® resulted in a substantial reduction in the CI. For example, in the 1982 cut, the competition indices for the control blocks ranged from 15.3 to 31.5 compared to 1.6 (3.50 l/ha) and 11.9 (1.75 l/ha) for the treated blocks.

NON-TARGET SPECIES

The reduction in the cover of target species was accompanied by a considerable increase in the cover of non-target species. Essentially the application of Vision® resulted in a tall layer of vegetation being replaced with a shorter layer. By 1986, most of the treated blocks had a considerably higher average percentage cover of non-target species than the control blocks (Figure 5). The increased cover is attributed to the defoliation of the overstory (target species) resulting in more light reaching the ground surface. The major species to establish and/or proliferate on all treated blocks was grass with lesser amounts of moss, goldenrod, willow herb and hemp nettle. Because of their low height and light root mass, these species were providing minimal competition to the planted seedlings.

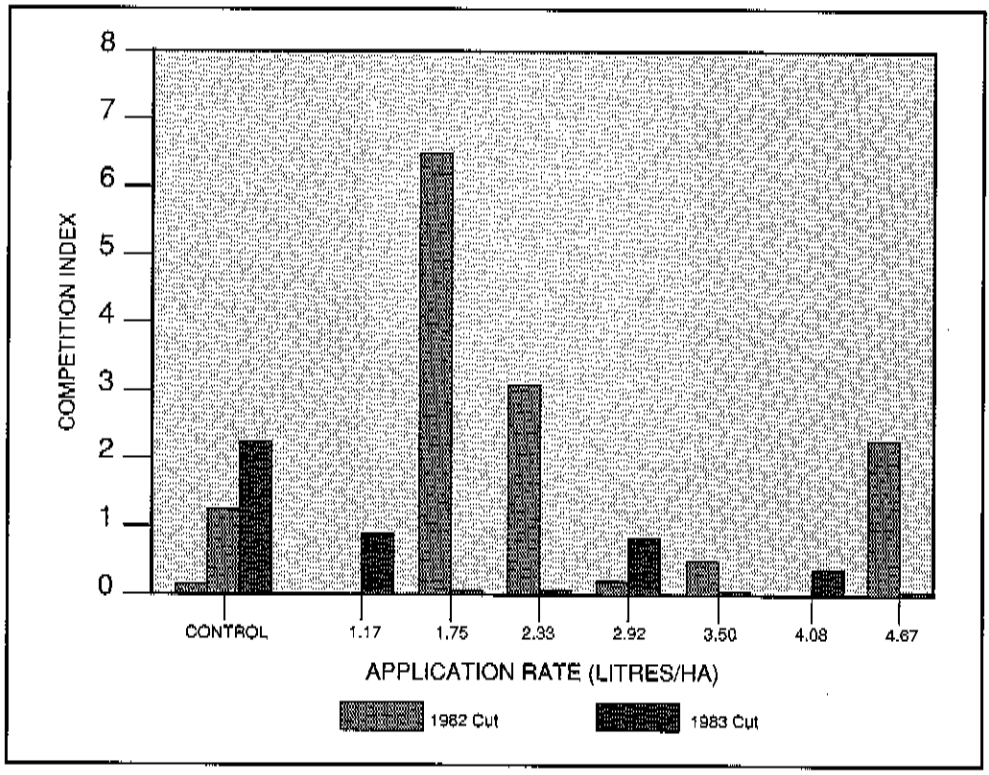

Figure 3. Competition index for sugar maple, two years after treatment.

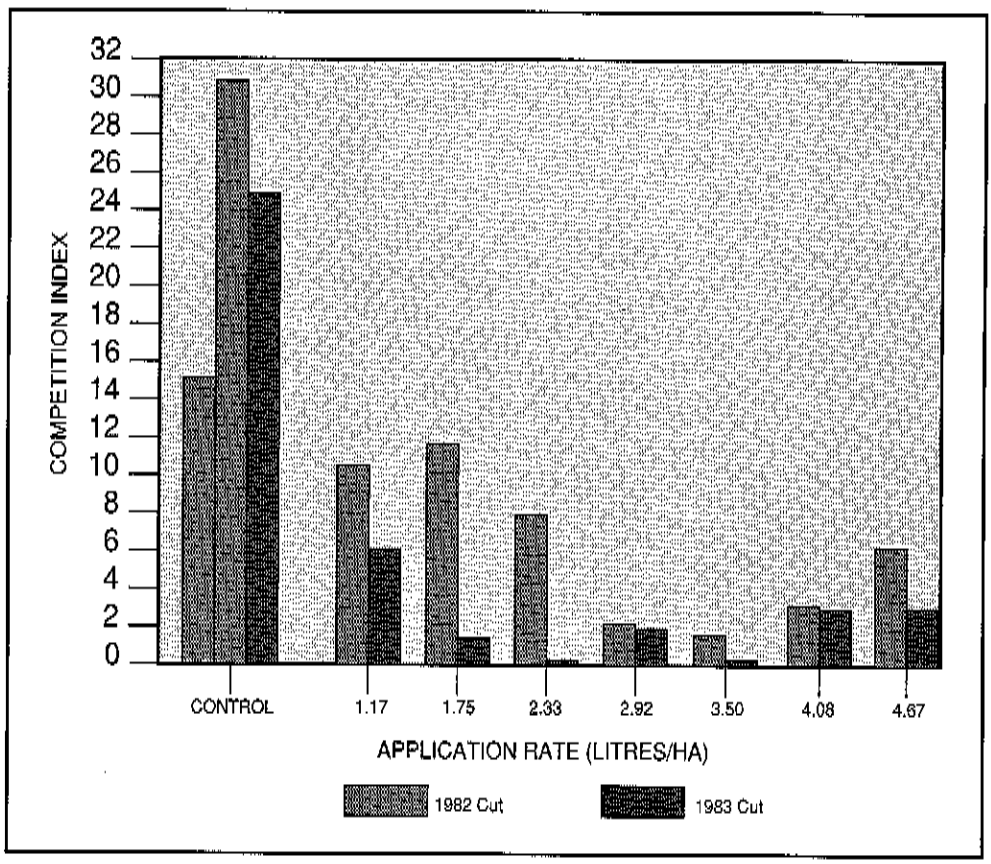

Figure 4. Total competition index for target species, two years after treatment

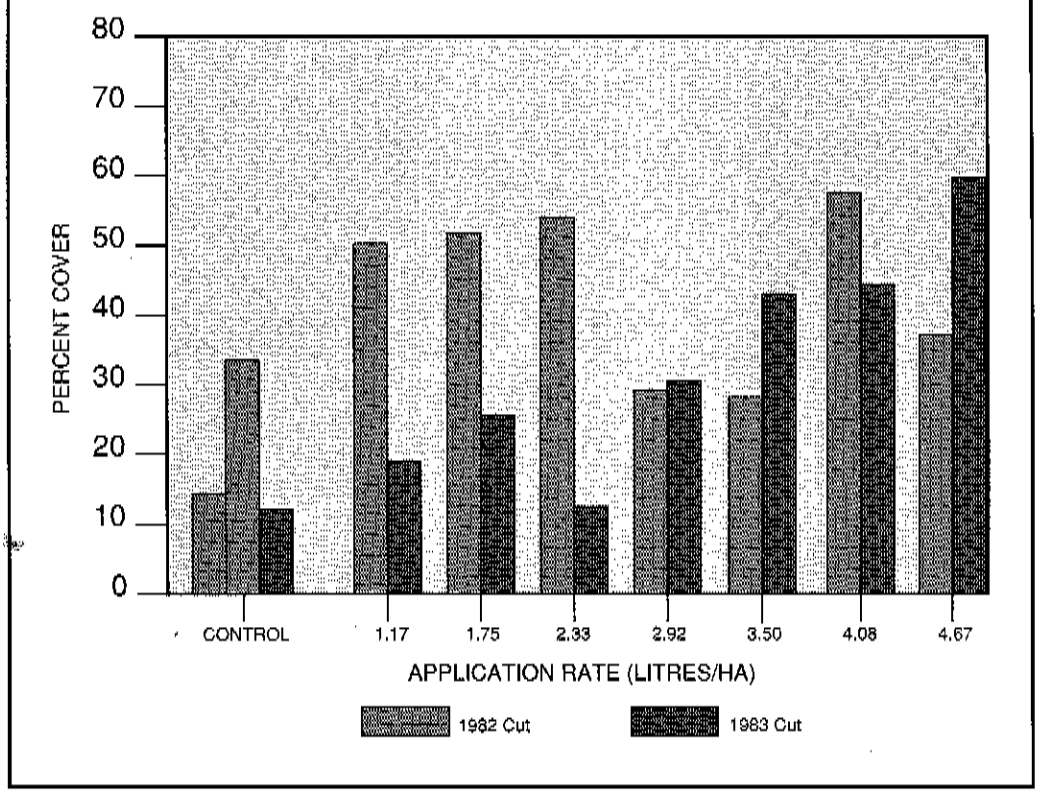

Figure 5. Percent cover of non-target vegetation, two years after treatment.

From an ecological stand point, the rapid colonization of the treated sites with these non-target species is considered beneficial because they:

1) reduce the loss to leaching of nutrients from the upper soil horizons by root uptake,
2) add organic matter to the soil through leaf fall and root decomposition; and
3). help to impede soil erosion (Thompson and Troeh, 1978).

At this time it is too early to determine the effect of different application rates of Vision® on seedling heights and diameters. This topic will be addressed in a subsequent report following the fifth year remeasurement.

DISCUSSION AND CONCLUSIONS

The major interim results of this research trial, designed to determine the minimum rate of aerially applied Vision® required to control a variety of target species, are as follows:

1) Raspberry was adequately controlled with rates of 1.75 l/ha and greater.
2) Good control of red maple was achieved with rates of 2.33 l/ha and greater.
3) Control of sugar maple was minimal, even at the higher rates, although observations indicated that the vigour and height of the scattered clumps of sugar maple were substantially reduced.
4) Grass and other non-target species of vegetation increased in quantity due to the greater amount of light reaching ground level, resulting from the defoliation of the overtopping target species. However, in this experiment, the impact of these species on the growth and survival of the planted trees is expected to be minimal because of their limited root mass and shoot height.

Subsequent reports will quantify the effects of varying rates of Vision® on the growth of the planted conifers. Growth response in relation to CI and the rate of product applied should provide the

most meaningful measure of the degree of control required. In forestry, adequate control of the competing species is achieved when their height, vigour and root competition are reduced to the point where the conifers achieve and remain in an overtopping, free growing position. Perhaps this type of criteria could be adopted by the "Regulatory Agencies" as a basis to determine if a forestry herbicide is capable of providing adequate control. Currently, according to generally accepted guidlines, herbicide labels cannot specify adequate control for a particular species unless experimental data shows that a product can produce an 80% kill rate on that species at recommended rates.

MANAGEMENT RECOMMENDATION

The results of this experiment indicate that one to two year old raspberry and red maple treated with Vision® late in the growing season can be controlled with lower than recommended rates. However, until these results are substantiated by other trials, the rates outlined in Nova Scotia's Forestry Field Handbook i.e. 4.7 litres of product/ha for red maple, and 3.2 l/ha for raspberry will remain in effect.

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