To: Seed Orchard Staff
Attention: T. Crowder, Campbell B.
R. Crown, Duncan
R. Currell, "
D. Rudolph, "
G. Morrow, Saanichton
C. Hewson, Red Rock
M. Maguire, "
T. Carter, "
R. Cox, Tappen
M. Albright, Vernon
P. Birzins, "
G. Clarke, "

From: Silviculture Branch
Date: 02/02/82
File: 955-10

634.909711/BCMFSIL/SX816
BIRZINS, PAUL.
EVALUATION OF SIX WEED
CONTROL TREATMENTS IN AN
CDDD c. 1 ma Main...........

Re: Report on SX81-601-K
Evaluation of Six Weed Control Treatments
in an Interior Spruce Seed Orchard
by P. Birzins

Enclosed above report for your information and guidance in
developing weed control prescriptions for orchards under your
direction.

It should be pointed out that effective weed control is
most important where we are converting previous farm or pasture
lands to seed orchards as weed seeds tend to accumulate under
this type of use (eg. at Vernon). Usually, when we convert
forested areas into orchard use weed problems are not a problem
during the early years of the orchard.

Where forest company orchards are planned for location on
former agricultural or pasture lands a potential weed problem
exists. In such instances this report and other relevant
literature on the topic can be provided to company seed orchardists.

J. Konishi,
Manager,
Seed Production

JK/lj
enclosure

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EVALUATION OF SIX WEED CONTROL TREATMENTS
IN AN INTERIOR SPRUCE SEED ORCHARD

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Seed Orchard Project Forester
British Columbia Ministry of Forests
Kalamalka Research Station and Seed Orchard
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Black plastic provided good weed control in an interior spruce seed orchard, but this treatment was expensive. Simazine, therefore, is recommended as an effective and economical weed control method.

Introduction and Objective

There are currently 22 ha of clonal interior spruce orchards (Picea glauca, Picea engelmannii or hybrid's of these species) in British Columbia. This represents 8,800 ramets\(^2\). Significant costs are incurred in parent tree selection, scion collection, rootstock production, grafting, orchard site development and planting to establish an orchard. Another 65 ha of interior spruce seed orchards representing 26,000 ramets are to be developed. The genetic value and initial expense of each ramet necessitates cultural practices that ensure tree survival and free growth. Weed infestation in recently established interior spruce orchards require effective and economical weed control methods.

Time of application, species, site, and possible detrimental effects are important factors to consider when developing a weed control program.

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1 The author is indebted to Mr. J. Konishi and Ms. W. Bergerud of the British Columbia Ministry of Forests for their assistance.
2 A ramet is an individual member of a clone, descended through vegetative propagation of a parent tree selected from a natural stand or plantation.
The majority of the forestry weed control literature concerns nurseries. Sawdust is a frequently used mulch in forest nurseries but can dry out readily and be blown or washed from the seedbed and can induce local nitrogen deficiencies in germinating seedlings (2). The triazine herbicides have resulted in effective weed control in nursery beds; however, if the herbicide accumulates in the soil, repeated applications can result in a reduction of crop growth (11). Weed resistance to the treatment can also develop (10). Glyphosate, a postemergence herbicide, is frequently used for weed control, but will injure white spruce (Picea glauca) when applied at the time of bud flush (6).

Cost factors should also be considered when evaluating weed control methods. Polyethylene mulches have been used successfully (3, 4) but have doubled planting time costs (8). The application of simazine, a pre-emergence herbicide, followed when necessary by mechanical harrowing or paraquat was found to reduce costs to less than 10% of handweeding (7).

Hand weeding has been the traditional method of weed control in the interior spruce seed orchards and breeding arboretum located at Vernon, British Columbia (lat. 50°14', long. 119°17'). Assuming ten minutes of labour per tree at an hourly rate of $10.22, the unit cost of weeding a tree is $1.70. Hand weeding thousands of trees at least twice during the growing season can be a costly annual expenditure. Adoption of more economical methods of weed control rather than complete reliance on hand weeding is required.

The objective of this study was to determine an economical and efficient method of weed control. This study compares the effectiveness of mulch and herbicide weed control treatments in an interior spruce seed orchard located at Vernon.
Method

On July 8th, 1981, six weed control treatments and a control were replicated 6 times in a completely randomized design. The treatments consisting of fresh coniferous sawdust, fresh coniferous chips, white polyethylene plastic (2 mm thickness), black polyethylene plastic (4 mm), glyphosate (Roundup), simazine (Princep 80 w), and a control, were applied in an area 1.44 m\(^2\) around recently planted four-year-old interior spruce ramets. (Figure 1).

Hand weeding was done prior to treatment application with the exception of the glyphosate plots. Glyphosate was applied at a rate of 1.2 kg active ingredient/ha. During glyphosate application, each tree was covered with a plastic bag to eliminate foliar contact with the herbicide. Simazine was sprayed onto the soil surface at a rate of 2.2 kg a.i./ha in 347 litre of water/ha. The plastic mulches were anchored to the soil with wire. The sawdust and wood chips were applied to a depth of 5 cm.

On September 3, 1981, the plots were assessed for material and labour costs, spruce tolerance to the treatment, broadleaf weed control, grass control, and percent weed encroachment onto the plots.

Spruce tolerance, broadleaf weed control, and grass control were assessed using the rating system adopted by the Western Canadian Expert Committee on Weeds (1). The rating system consists of a scale 0-9, where 9 indicated complete crop tolerance to the weed control treatment or complete weed control and 0 indicates complete kill or no effect. The data was analyzed by the Kruskal-Wallis test to determine if significant differences among treatments exist and compared by the simultaneous test procedure to determine what treatments differed (9).
Temperature during the experiment averaged $24.0^\circ C$ reaching an extreme of $36.5^\circ C$ and precipitation averaged 3.6 cm/month. To ensure ramet survival the trees were watered 8 times at a rate of 6-11 litre/application.

Figure 1. - Interior spruce grafts with black and white polyethylene weed control treatments in foreground, followed by a control plot.

The soil was classified as a black solonetz clay in the Spallumcheen series (5). Soil characteristics were relatively uniform among the plots.
Results and Discussion

Black plastic provided the most effective weed control while the white plastic treatment had the poorest weed control (Table 1). Light penetrated the white plastic resulting in a greenhouse effect and stimulated weed growth. Glyphosate killed the weeds present on contact, but new weeds appeared within a month. Simazine provided excellent broadleaf and grass weed control for the duration of the experiment. The weeds present at evaluation in this treatment

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Broadleaf 1* Weed Control</th>
<th>Grass 1* Control</th>
<th>Percent Weed 2* Encroachment</th>
<th>Cost of Treatments $/plot</th>
</tr>
</thead>
<tbody>
<tr>
<td>Black plastic</td>
<td>8.3a</td>
<td>9.0a</td>
<td>0.2a</td>
<td>2.51</td>
</tr>
<tr>
<td>Simazine (2.2 kg a.i./ha)</td>
<td>7.3ab</td>
<td>8.8ab</td>
<td>8.5b</td>
<td>.86</td>
</tr>
<tr>
<td>Sawdust</td>
<td>6.7abc</td>
<td>8.7ab</td>
<td>10.8b</td>
<td>.85</td>
</tr>
<tr>
<td>Glyphosate (1.2 kg a.i./ha)</td>
<td>6.5abc</td>
<td>7.3ab</td>
<td>22.5b</td>
<td>.87</td>
</tr>
<tr>
<td>Wood Chips</td>
<td>5.5bc</td>
<td>9.0a</td>
<td>26.7bc</td>
<td>.85</td>
</tr>
<tr>
<td>White Plastic</td>
<td>4.5c</td>
<td>5.8b</td>
<td>46.7c</td>
<td>1.91</td>
</tr>
<tr>
<td>Control</td>
<td>0d</td>
<td>0c</td>
<td>33.3bc</td>
<td>0</td>
</tr>
</tbody>
</table>

1 = no effect, 9 = complete control (Based on Western Canadian Expert Committee on Weeds Rating System).
2* Expressed as (area with weeds in treatment/total area of treatment) x 100.
* Values followed by the same letter indicate no significant difference at the .05 level based on a nonparametric multiple comparison by the simultaneous test procedures (STP) method.
were perennials apparently for roots not removed by hand weeding. The sawdust and wood chip mulches provided fair weed control with some perennial weeds growing through the mulch. None of the treatments caused any toxicity to the trees.

The most common weeds in the plot area were broadleaf weeds and in order of importance (frequency and size) were Canadian thistle (cirsium arvense), ground ivy (glechoma hederacea), red root pigweed (amaranthus retroflexus) and field bindweed (convolvulus arvensis).

Labour time was the main component of the cost figures (Table 1). On an operational basis the cost/plot would be considerably lower for the herbicide treatments. Assuming that one application of herbicide will result in satisfactory weed control during one growing season the black plastic would have to withstand weather conditions for at least three years to be economically desirable.

Using simazine, the percent weed encroachment values were the lowest with the exception of the black plastic (Table 1). Therefore, based on a single year trial, simazine is recommended as an effective and economical herbicide at the orchard site. Continued evaluation of its efficiency and safety will be carried out. Minimum rates should be applied with careful monitoring of weed control and effect on orchard tree vigour. The weathering of the black plastic is being evaluated and if the plastic persists at least three years, it may be considered for use operationally.
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