Evaluation of Six Weed Control Treatments in an Interior Spruce 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.

There are currently 54 acres of clonal interior spruce orchards *(Picea glauca, P. engelmanni,* or hybrids of these species) in British Columbia. This represents 8,800 ramets. Another 160 acres of interior spruce seed orchards representing 26,000 ramets are to be developed. Significant costs are incurred in parent tree selection, scion collection, rootstock production, grafting, orchard site development, and planting to establish an orchard. The genetic value and initial expense of each ramet necessitate cultural practices that insure tree survival and free growth. Weed infestations in recently established interior spruce orchards must be effectively and economically controlled.

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

The majority of the forestry weed control literature concerns nurseries. The triazine herbicides have resulted in effective weed control in nurserybeds; however, if the herbicide accumulates in the soil, repeated applications can result in a reduction of crop growth (10). Weed resistance to the treatment can also develop (9). 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 (5).

Cost factors should also be considered when evaluating weed control methods. Polyethylene mulches have been used successfully (2, 3), but have doubled planting-time costs (7). The application of simazine, a preemergence herbicide, followed, when necessary, by mechanical harrowing or the herbicide paraquat, was found to reduce costs to less than 10 percent of handweeding costs (6).

Handweeding 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 10 minutes of labor per tree at an hourly rate of $10.22, the unit cost of weeding a tree is $1.70. Handweeding thousands of trees at least twice during the growing season is costly. Adoption of more economical methods of weed control, rather than complete reliance on handweeding, 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.

Methods

On July 8, 1981, six weed control treatments and a control were replicated six times in a completely randomized design. The treatments, consisting of fresh coniferous sawdust, fresh coniferous chips, white polyethylene plastic (.08 in thick), black polyethylene plastic (.16 in thick), glyphosate (Roundup), simazine (Princep 80 w), and a control, were applied in a 16-square-foot area around recently planted 4-year-old interior spruce ramets.

Handweeding was done before treatment application with the exception of the glyphosate plots. Glyphosate was applied at a rate of 1.1 pounds of active ingredient (ai) per acre. 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 2.0 pounds of active ingredient per acre. The plastic mulches were anchored to the soil with wire. The sawdust and wood chips were applied to a depth of 2.0 inches.

On September 3, 1981, the plots were assessed for material and labor costs, seedling tolerance to the treatment, broadleaf weed control, grass control, and the percentage of weed encroachment on the plots.

Seedling tolerance, broadleaf weed control, and grass control were assessed using the rating

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system adopted by the Western Canadian Expert Committee on Weeds (1). The rating system consists of 0-9 scale, where 9 indicates complete crop tolerance to the weed control treatment or complete weed control and 0 indicates complete kill or no effect. The data were analyzed by the Kruskal-Wallis test to determine if significant differences among treatments exist and were compared by the simultaneous test procedure to determine what treatments differed (8).

Air temperature during the experiment averaged 75.2° F, reaching an extreme of 97.7° F, and precipitation averaged 1.4 inches per month. To insure ramet survival, the trees were watered eight times at a rate of 1.3 to 2.4 gallons per application.

The soil was classified as a black solonetz clay in the Spallumcheen series (4). 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 were perennials apparently from roots not removed by handweeding. 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.

Table 1.—*The effect and comparative costs of mulching and chemical treatments for weed control*

Treatment	Broadleaf weed control[1]	Grass control[1]	Percentage of weed encroachment[2]	Cost of treatments per plot
				Dollars
Black plastic	8.3a[3]	9.0a	0.2a	2.51
Simazine (2.0 lb ai/acs)	7.3ab	8.8ab	8.5b	.86
Sawdust	6.7abc	8.7ab	10.8b	.85
Glyphosate (1.1 lb ai/acs)	6.5abc	7.3ab	22.5b	.87
Wood chips	5.5bc	9.0a	26.7bc	.85
White plastic	4.5c	5.8b	46.7c	1.91
Control	0d	0c	3.3bc	0

[1]0 = 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.
[3]Values in columns by the same letter indicate no significant difference at the 0.05 probability level based on a non-parametric multiple comparison by the simultaneous test procedures (STP) method.

Labor time was the main component of the cost figures (table 1). On an operational basis, the cost per 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 3 years to be economically desirable.

With the exception of black plastic, the percentage of weed en-

The most common weeds in the plot area were broadleaf weeds. In order of importance (frequency and size) they were Canadian thistle (*Cirsium arvense*), ground ivy (*Glechoma hederacea),* red root pigweed *(Amaranthus retroflexus),* and field bindweed (*Convolvulus arvensis*).

croachment was the lowest using simazine (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 vigor. The weathering of the black plastic is being evaluated, and if the plastic lasts for at least 3 years, it may be considered for use.

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