Extension Note

June 2000

Evaluation of the Effectiveness of *Chondrostereum purpureum* for the Control of Mechanically Brushed Trembling Aspen (*Populus tremuloides* Michx.) Suckers in a 2-year-old Conifer Plantation: Third-year Results (MOF EP 1135.05)

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Introduction

Several vegetation control options are currently available to British Columbia foresters. Some of the more common options, such as herbicide application or manual brushing operations, may be limited in their effectiveness for a number of reasons. For example, public opposition may curtail the operational application of herbicides, while site conditions may preclude the use of manual brushing of competing vegetation (Boateng and Comeau 1997). Other less common methods may be restricted in their use to specific ecosystems. The Research Branch of the B.C. Ministry of Forests, in partnership with the Canadian Forest Service, the Biology Department of the University of Victoria, and Mycologic Inc., are currently involved in testing the use of a fungus, *Condrostereum purpureum*, as a method of controlling vegetation that competes with planted conifer seedlings. The purpose of this research was to evaluate promising methods for managing vegetation in conifer plantations.

Condrostereum purpureum is an ideal candidate for vegetation control (Harper et al. 1999). It occurs naturally in British Columbia forests. Because it will attack only woody species that have been selectively wounded, the effect of this mycoherbicide is restricted to the target vegetation.

This extension note reports on the mortality and growth response of trembling aspen (*Populus tremuloides* Michx.) suckers 3 years after application of the fungus *Chondrostereum purpureum* ([Pers.: ex Fr.] Pouzar). The data presented here were collected from one of two British Columbia installations that are part of a larger national research program testing the efficacy of *C. purpureum.* This extension note does not discuss the field trial that tested the effectiveness of *C. purpureum* in controlling the growth of Sitka alder (*Alnus sinuata* [Regel] Rydb). For further information on *C. purpureum* and its control of Sitka alder see Harper et al. (1999).

Methods

During the spring of 1995, a site containing a plantation of 2-year-old lodgepole pine (*Pinus contorta* Dougl.) and Western larch (*Larix occidentalis* Nutt.) seedlings was selected northwest of Grand Forks to test the effectiveness of *C. purpureum* for the control of trembling aspen. Nine treatment formulations were tested in this trial using a completely randomized design; these included two carrier formulations, one from Ontario and the other from British Columbia, in combination with two fungal isolates, JAM6 and 2139, for a total of four treatments plus a brushed treatment and a triclopyr herbicide (Release®) treatment. Three control treatments, consisting of applications of the British Columbia and Ontario formulations without *C. purpureum*, as well as a non-brushed treatment, were also included in the experimental design (Table 1). The treatment plots were manually brushed to provide the cut stem surface required for inoculation of the fungus. Each treatment was replicated five times.

One of the objectives of this trial was to observe the response of cohorts of 25 aspen stems to the applied treatments. A simple criterion was set by which the cohort was selected and which included all aspen stems greater than 1 cm in diameter and 15 cm in height. These stems were tagged and their mortality assessed annually. This method of selecting sampling units resulted in non-uniform plot sizes that were 15 m wide, but of varying length. This was necessary because of the variability in distribution of cohort stems within the treatment plots. The plot areas were also measured and recorded for the purpose of weighting responses to the treatments on a "per-area" basis (e.g., total stems per hectare). The data contained in this note were analyzed using a one-way analysis of variance (PROC GLM with the LSMeans command) and Tukey's HSD procedure for comparison of the treatment means (Harper et al. 1999).

For further details on the mode of application, formulations used, and the experimental design, please see Harper et al. (1996).

Results

Mortality of Tagged Aspen Cohorts

Cut stump application of both Release® and the British Columbia formulation with the 2139 isolate (B2139) resulted in the highest mortality of tagged aspen (Figure 1). All other treatments resulted in responses that were not statistically significant from one another.

The response of all living aspen stems in the treatment plots, including the tagged stems, was also recorded and analyzed on a stems/ha basis. Three years after treatment there were no statistically significant effects of treatments on the total number of aspen stems per hectare (Figure 2). This was due to recruitment of stems through suckering and stump sprouting.

Stem Height, Stem Diameter, Stem Basal Area, and Stem Volume

Stem height, stem diameter, stem basal area, and stem volume were calculated for each treatment. In the tagged cohorts, the only significant response to the treatments was that observed between the non-brushed control and all other treatments. Further analysis of data collected from non-tagged stems demonstrated no significant differences between any of the treatments (Table 2).

TABLE 1 *Treatment key*

Treatment I.D.	Composition of treatment formulation
B2139	B.C. carrier formulation + fungal isolate from B.C. (2139)
O2139	Ontario formulation + fungal isolate from B.C. (2139)
BJ6	B.C. formulation + fungal isolate from Ontario (JAM6)
OJ6	Ontario formulation + fungal isolate from Ontario (JAM6)
ONf	Ontario formulation only (no fungal isolate)
BCf	B.C. formulation only (no fungal isolate)
Rlse	30% Release® (triclopyr) herbicide in mineral oil
Brsh	Brushed only
notrt	Non-brushed control

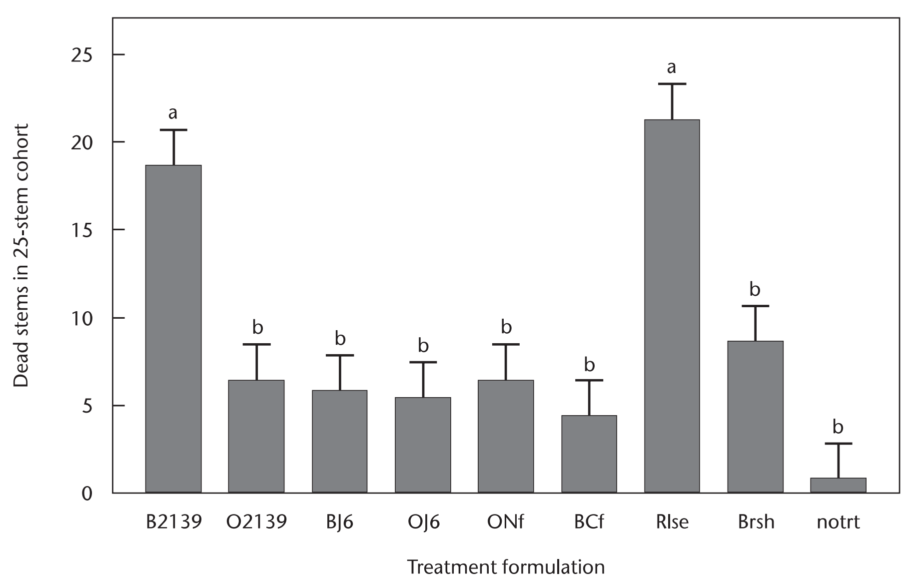

FIGURE 1 *Mean number of dead stems (with error bars) in 25-stem cohorts in response to treatment. Letters signify statistically significant differences using Tukey's HSD ($\alpha = 0.05$).*

Suckered Shoots vs. Stump Sprouts
All non-cohort stems were categorized according to whether they originated as a sucker or as a stump sprout growing from the base of a decapitated stem. The mean densities of suckers and sprouts in response to treatment is shown in Figure 3, which illustrates some of the differences in vegetative reproductive strategies. Brushing increased the mean number of sprout stems, indicating that this treatment was not effective at inducing stem mortality because terminal growth was replaced by lateral shoot growth. It also appeared that a large number of suckers were subsequently recruited into the brushed plots following the year of treatment. On the other hand, the use of Release® reduced the mean numbers of sprouts, but did not affect mean sucker densities, which were similar to those of the brushed treatment. Treatment B2139 appeared to have reduced mean stem numbers of both aspen sprouts and suckers, indicating that it may be the better candidate for control of aspen growth. These data also suggest a reason for the higher number of aspen stems found in plots treated with the O2139 formulation: brushed stems appeared to have suffered the same mortality as those treated with B2139, but mean sucker numbers were higher than in the other brushed treatments, suggesting that the efficacy of the Ontario strain was restricted to the season of application.

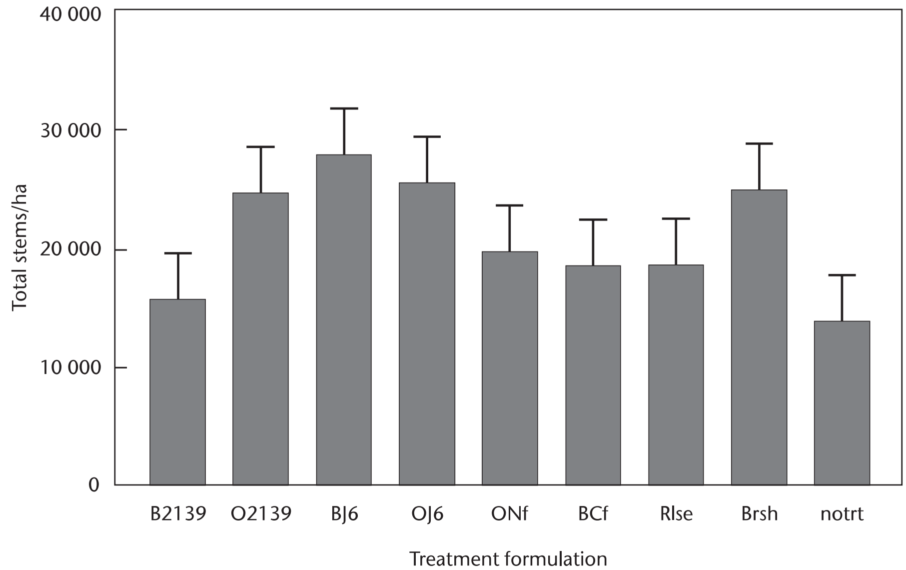

FIGURE 2 *Mean number of total aspen stems/ha in response to the applied treatments. There were no significant differences between treatment means.*

TABLE 2 *Treatment means (s.e.) of total stem diameter, total stem height, total stem basal area, and total stem volume per square metre for untagged stems. There were no significant differences between treatment means (Tukey's HSD where α = 0.05).*

Treatment	Sum of stem diameters (cm /m^2)	Sum of stem heights (cm /m^2)	Sum of stem basal areas (cm^2/m^2)	Sum of stem volumes (cm^3/m^2)
B2139	10.1 (4.4)	93.6 (39.5)	1.18 (0.65)	63.8 (50.2)
O2139	22.9 (4.4)	207.4 (39.5)	3.25 (0.65)	179.8 (50.2)
BJ6	26.6 (4.4)	249.3 (39.5)	3.52 (0.65)	204.9 (50.2)
OJ6	21.5 (4.4)	175.2 (39.5)	2.70 (0.65)	130.4 (50.2)
ONf	15.6 (4.4)	139.3 (39.5)	1.94 (0.65)	94.0 (50.2)
BCf	15.0 (4.4)	154.4 (39.5)	1.76 (0.65)	111.5 (50.2)
Rlse	17.0 (4.4)	148.1 (39.5)	2.83 (0.65)	220.0 (50.2)
Brsh	19.6 (4.4)	178.3 (39.5)	2.01 (0.65)	94.4 (50.2)
notrt	16.4 (4.4)	154.2 (39.5)	2.39 (0.65)	156.6 (50.2)

Summary

Measurements in the third year following treatment showed that both B2139 and Release® significantly increased mortality of the treated stems. However, despite the responses shown by these stems, these treatments did not significantly reduce aspen density because of subsequent stem recruitment through suckering and stump sprouting. Stem height, stem diameter, stem basal area, and stem volume did not differ significantly from treatment to treatment. The mean number of vegetatively produced shoots per treatment (root suckers vs. stump sprouts) appeared to be dependent upon the kind of treatment applied.

Acknowledgements

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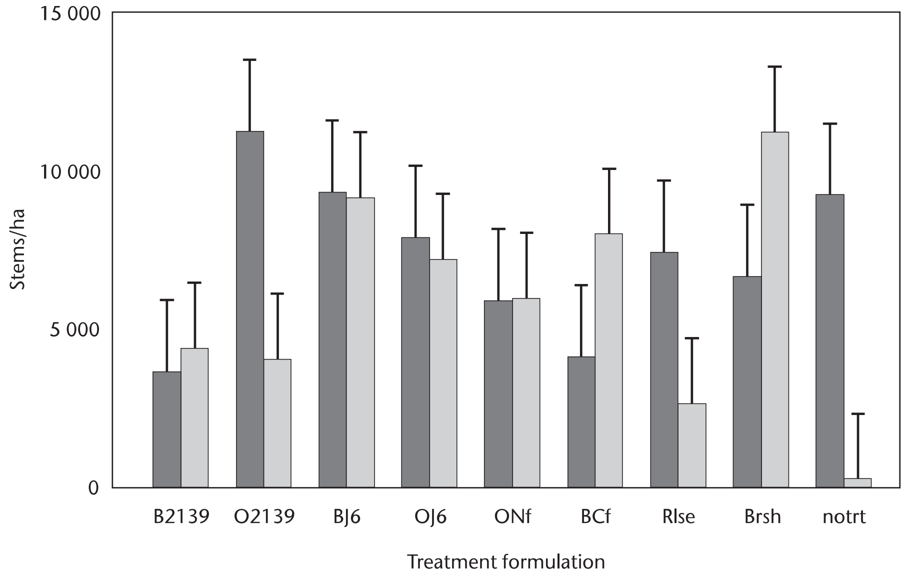

FIGURE 3 *Mean number (stems/ha) of suckered stems (dark bar) and stump shoots (light bar). The only two treatments that were significantly different from one another were the mean number of stump shoots in the brushed and non-brushed control using Tukey's HSD ($\alpha = 0.05$).*

Biring, and Bill Dobbs, B.C. Ministry of Forests. Financial support was provided by Forest Renewal BC (project number HQ96403-RE).

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