Effectiveness of repeated manual cutting of mixed shrub vegetation in an Interior Cedar–Hemlock zone spruce plantation: Fifth-year results

PHILIP COMEAU* AND BALVINDER BIRING†

INTRODUCTION

During 1995, manual treatments were applied to 38 000 ha in British Columbia, at a cost of $20 million. This represented 57% of the area brushed, and 66% of brushing expenditures (B.C. Ministry of Forests 1997). In 1995, 93% of the area brushed the Nelson Forest Region was treated manually.

Because non-crop vegetation resprouts, repeated brushing of the same site may be necessary. Whitehead (1989) found that a single cutting of thimbleberry, raspberry, and fireweed provided limited, short-term vegetation control. LePage et al. (1991) reported that thimbleberry cover returned to pre-treatment levels within 1 year following cutting. In contrast, both of these studies report that glyphosate application controlled all species for at least 3 years. Comeau (1992 A, B, C) reported that cutting repeated over a 4-year period significantly reduced cover and height of vegetation in communities composed of fireweed, ladyfern, bracken, and thimbleberry. At two of three study sites, diameter of spruce seedlings was also significantly increased by repeated cutting treatments.

METHODS

In 1992 we initiated a study to examine the effectiveness of repeated cutting for controlling vegetation in a mixed shrub-herb community to release planted Engelmann spruce (*Picea engelmannii* Parry) seedlings. The study site is located at Soards Creek near Mica, B.C. in the Interior Cedar–Hemlock very wet cool biogeoclimatic subzone (ICHvk). The site was harvested in 1983/84, broadcast burned in October 1984, and planted in June 1985. Following plantation failure, the site was mechanically site prepared with an excavator in August, 1990 and Engelmann spruce (1+0 PSB 415B) seedlings were planted in June, 1991.

Eight treatments were compared:

1. cutting once in spring of 1992;
2. cutting once in summer of 1992;
3. 3 years of cutting once annually in the spring (mid- to late June) starting in 1992;
4. 3 years of cutting once annually in the summer (late July) starting in 1992;
5. 3 years of cutting twice annually in the spring and in the summer starting in 1992;

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6. 2 years of cutting twice annually in the spring and in the summer starting in 1993;
7. applying glyphosate herbicide at 2.1 kg ai/ha during late August, 1992; and
8. an untreated control.

Treatments were replicated three times in 30 × 30-m plots.

Within each treatment plot, 20 spruce seedlings were measured during the fall of each year from 1991 to 1996. Vegetation percent cover and modal height was recorded within a 1.26 m radius plot centred on each of 10 crop seedlings in each treatment plot during the summer (July) of 1992, 1993, 1994, 1995, and 1996.

RESULTS

Vegetation Response

Repeated cutting for 3 years and glyphosate application in August 1992 resulted in reductions in total vegetation cover for 3 years. However, no significant ($p > 0.05$) differences in total cover were detected among treatments in 1995 or 1996 because of revegetation growth.

Treatments had a significant ($p \leq 0.05$) effect on vegetation height in 1993, 1994, and 1995. In the summer of 1995, the glyphosate treatment (7) and all repeated manual cutting treatments (3, 4, 5, and 6) resulted in significant reductions in vegetation height over those found in the control plots. In 1996 (year 5), no significant differences in vegetation height were detected.

Spruce Seedling Response

Survival at the end of 5 years was high in both treated (more than 90%) and untreated (control) plots (86%). Treatments had no significant effect on spruce survival 5 years after treatment (Table 1). Competition was never severe, except in localized portions of the study area.

Glyphosate application (treatment 7) and repeated cutting (annually or twice a year) (treatments 3, 4, 5, and 6) resulted in spruce seedlings with significantly larger root collar diameter than untreated seedlings at the end of 5 years. Treatments 1 and 2 resulted in intermediate values of root collar diameter that did not differ significantly from untreated seedlings (8).

Repeated summer cutting (treatment 4) significantly increased fifth-year height over that of untreated seedlings (8) and seedlings which only received a single summer manual treatment (treatment 2). However, no significant differences were detected between any of the cutting treatments and the glyphosate treatment.

CONCLUSIONS

Results from this study suggest:

- a single manual treatment is unlikely to benefit seedling growth in a mixed shrub community;
- repeated cutting of vegetation (for 2–3 years) resulted in spruce diameter growth (5 years after the start of treatments) that is equal to that of a single application of glyphosate herbicide; and
- repeated manual cutting in midsummer (for 3 years) resulted in a 31% (28 cm) increase in seedling height at the end of 5 years, which is equivalent to approximately 1 year growth at age 5.

TABLE 1 *Fifth-year (October 1996) means of seedling measurement data and vegetation (July 1996) data*[a]

Treatment	Root collar diameter (mm)	Height (cm)	H:D[b] ratio	Survival (%)[c]	Vegetation % cover	Modal height (cm)
1: Spring 1992						
[1 cutting]	23.4abc	102.6ab	44.9ab	90.0	79.9	105.4
	(2.7)	(12.1)	(3.7)	(7.6)	(18.2)	(65.8)
2: Summer 1992						
[1 cutting]	21.2bc	89.7b	44.3ab	93.3	82.8	81.1
	(1.1)	(3.8)	(0.8)	(3.3)	(2.4)	(26.6)
3: Spring 1992+						
[3 years of cutting 1×/year]	27.0ab	105.6ab	39.9b	100.0	89.9	66.3
	(1.6)	(8.4)	(0.5)	(0)	(17.8)	(16.9)
4: Summer 1992+						
[3 years of cutting 1×/year]	29.4a	118.1a	41.1b	95.0	78.7	106.1
	(1.3)	(5.0)	(0.5)	(0)	(5.3)	(56.3)
5: Spring/summer 1992+						
[3 years of cutting 2×/year]	29.4a	115.7ab	39.7b	96.7	76.0	70.5
	(0.3)	(4.9)	(1.6)	(3.3)	(16.0)	(7.3)
6: Spring/summer 1993+						
[2 years of cutting 2×/year]	27.4ab	110.7ab	41.7b	93.3	95.3	82.9
	(1.3)	(6.1)	(0.5)	(4.4)	(3.0)	(12.2)
7: Glyphosate						
[2.1 kg ai/ha]	27.5ab	109.8ab	41.6b	96.7	60.1	62.8
	(1.3)	(3.6)	(1.6)	(1.7)	(2.6)	(10.6)
8: Control	19.1c	90.2b	49.2a	86.0	102.3	100.4
	(1.8)	(5.8)	(1.2)	(1.7)	(7.0)	(7.8)
p-value for test of overall treatment effect	0.0016	0.00819	0.0120	0.3035	0.3566	0.2572

a $N = 50–60$ seedlings; standard error appears in parentheses. Letters indicate significant differences within columns between treatments detected using Tukey's Studentized Range Test at $p < 0.05$.
b H:D ratio = Height/root collar diameter.
c Survival = seedling survival (% of initial numbers).

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AUTHORS

* ***Correspondence to:*** **Philip G. Comeau**, B.C. Ministry of Forests, Research Branch, PO Box 9519 Stn Prov Govt, Victoria, BC V8W 9C2.

E-mail: Phil.Comeau@gems2.gov.bc.ca

† B.C. Ministry of Forests, Research Branch