

Response of Douglas-fir and the Mixed Shrub Complex to Manual Brushing and Glyphosate Treatment in the ICH zone

INTRODUCTION

This report describes trends in conifer and vegetation responses to herbicide treatment and manual brushing of the *Mixed Shrub* complex, a common vegetation community at low to mid elevations of the Interior Wet Belt of southern interior British Columbia. ([Description of the *Mixed Shrub* complex](#)).

The results presented here are from just two individual sites, which is insufficient replication to allow full statistical analysis of the data. For each site, t-tests have been carried out to determine if treatment responses are statistically different between brushed and untreated areas. However, because a full analysis of variance was not possible with just two sites, the reader is cautioned that results can not be directly extrapolated to other sites across the landscape. It is important to understand that brushing outcomes may differ on individual sites from the results presented here.

ABSTRACT

The following trends were identified following glyphosate treatment and manual cutting of the *Mixed Shrub* complex:

- Glyphosate had no significant effect on shrub cover.
- Shrubs sprouted vigorously after manual cutting, resulting in a significant increase in cover for 5 years after brushing.
- Brushing was not needed to achieve excellent ($\geq 94\%$) survival of Douglas-fir.
- Most Douglas-fir trees were of moderate or good vigour regardless of whether brushing was done.
- Brushing did not increase root collar diameter 5 years after brushing.
- Douglas-fir height significantly increased after manual cutting but not glyphosate treatment.
- Douglas-fir seedlings are expected to become free-growing within the required time period regardless of brushing.
- Brushing had no effect on conifer stocking.

STUDY AREA

TABLE 1. Characteristics of sites where the Mixed Shrub complex was treated.

Location	Smith Creek	Mt McLennan
BEC unit	ICHwk1/01 (mesic)	ICHmw/01
Slope/aspect	40% Northeast	30% North
Soil texture	sandy loam	sandy loam
Logging history	Clearcut 1974	Clearcut 1972
Site preparation	Chemical 1985	Mechanical site prep 1989
Regeneration	Fd planted, 3 yrs old	Fd planted, 2 yrs old
Brushing treatment	Glyphosate 1992	Manual brushing Aug. 1992
Seedling vigour	Mostly moderate and good, 3% poor	Mostly moderate, 8% poor
Seedling competitive status	Overtopped	50% overtopped, 50% threatened
Vegetation cover and height	90%, 145 cm	90%, 130 cm
Dominant vegetation	Douglas maple, red raspberry, fireweed	Douglas maple, red-osier dogwood, black twinberry, willow, thimbleberry
Measurement years since brushing ¹	0, 1, 3, 5	0, 1, 3, 5

¹ 0 = pre-treatment. 1 = 1 year post-brushing. 3 = 3 years post-brushing. 5 = 5 years post-brushing.

VEGETATION RESPONSE

- Glyphosate did not significantly reduce shrub cover (Figure 1).
- Shrubs resprouted vigorously after manual cutting and their cover was significantly greater in the treated area than the control for 5 years after brushing.
- Shrub height was significantly reduced for one year after manual cutting but was not significantly affected by the glyphosate treatment (Figure 2).
- Herb cover and height were not significantly affected by the manual cutting or glyphosate treatments (data not shown).

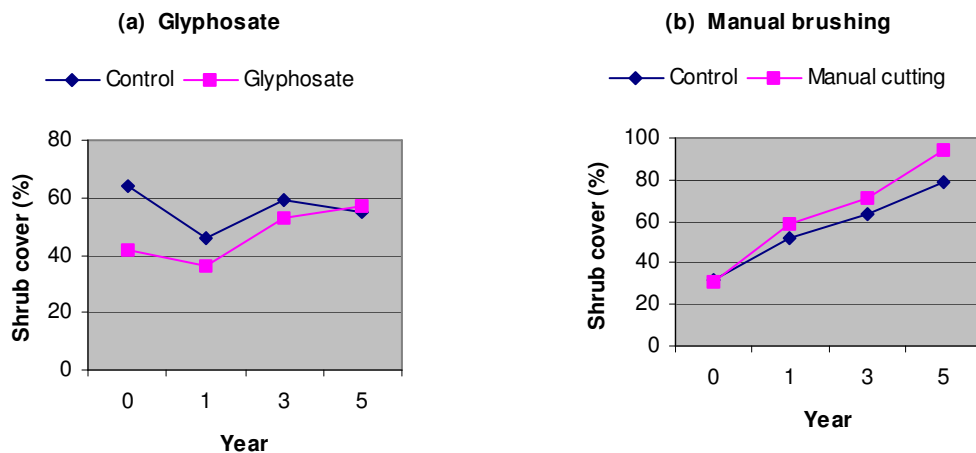


Figure 1. Shrub cover before and after (a) glyphosate treatment and (b) manual brushing.

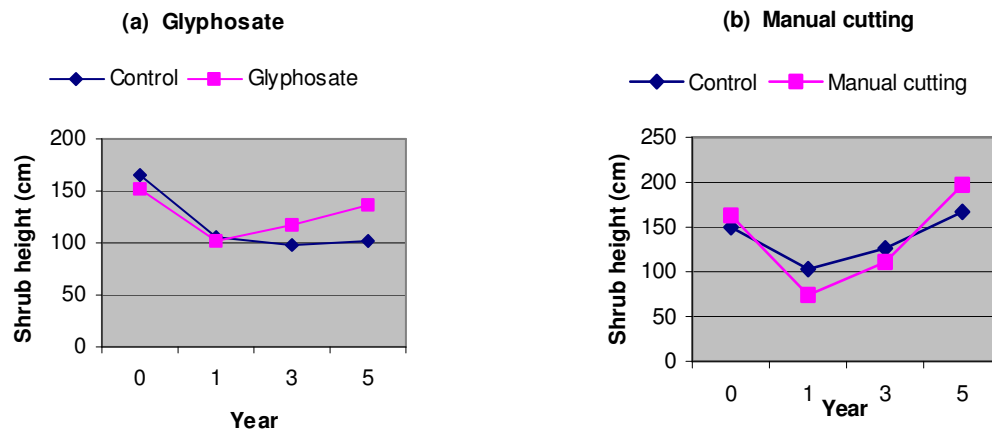


Figure 2. Shrub height before and after (a) glyphosate treatment and (b) manual cutting.

CONIFER RESPONSE

Douglas-fir growth

TABLE 2. Douglas-fir response after glyphosate treatment at Smith Creek and manual cutting at Mt McLennan.

Response variable	Pre-treatment			1 st year response			3 rd year response			5 th year response		
	C ¹	T	Sig. ²	C	T	Sig.	C	T	Sig.	C	T	Sig.
GLYPHOSATE												
Root collar diam (cm)	1.0	0.9	ns	1.7	1.5	ns	3.7	2.1	ns	3.9	3.0	s
Total height (cm)	70	58	s	97	79	s	143	113	s	188	148	s
Leader height (cm)	19	15	s	25	21	ns	25	20	ns	27	28	ns
Survival (%)	100	100		100	100		97	97		94	97	
MANUAL CUTTING												
Root collar diam (cm)	1.1	1.1	ns	1.5	1.6	ns	2.1	2.5	s	3.1	3.4	ns
Total height (cm)	46	46	ns	87	88	ns	142	156	s	197	228	s
Leader height (cm)	10	10	ns	27	36	ns	28	36	s	31	40	s
Survival (%)	100	100		100	100		100	100		100	100	

1 C = Control T = Treatment

2 s = Treatment and Control means significantly different at $p = 0.05$.

ns = Treatment and Control means not significantly different at $p = 0.05$.

- Root collar diameter of spruce was improved 3 years after manual cutting, but the increase was no longer significant in year 5 (Table 2).
- Root collar diameter was significantly less in the treated area than the control 5 years after glyphosate treatment.
- Total height significantly increased after manual cutting but glyphosate treatment had no effect on spruce height.
- Leader growth was significantly improved by manual cutting, and there was a similar but not significant trend in the chemically treated area.
- Leader growth increased greatly over time on both sites, regardless of whether brushing was done.

Douglas-fir survival and vigour

- Brushing was not needed to attain excellent ($\geq 94\%$) survival of Douglas-fir (Figure 3).
- Manual brushing resulted in a reduction in the percentage of poor vigour trees in the treated area and an increase in the control.
- Average vigour declined slightly over time in both the chemically treated area and control.

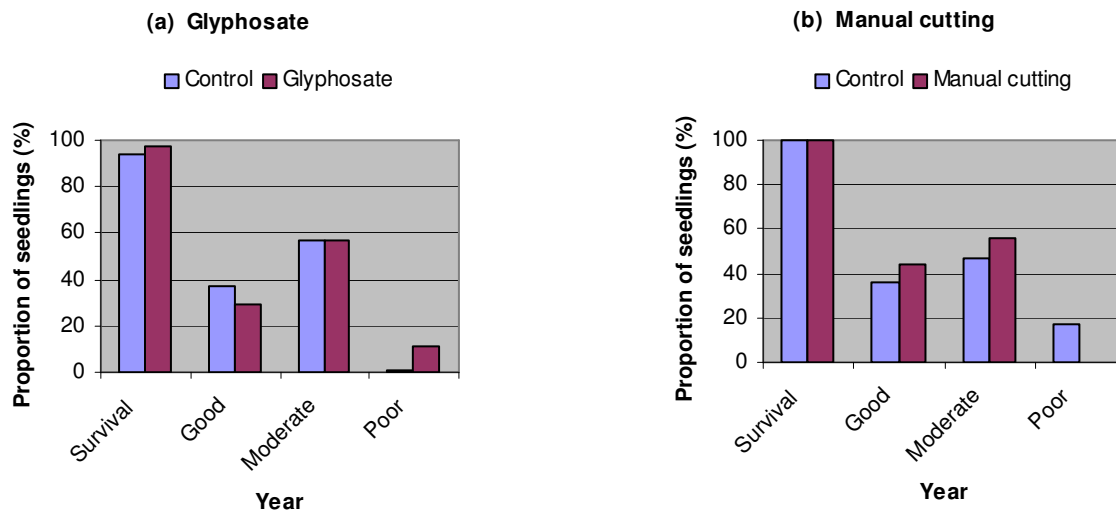


Figure 3. Douglas-fir survival and vigour 5 years after (a) glyphosate treatment and (b) manual cutting.

Conifer stocking

Table 3. Conifer stocking.

	Pre-treatment		5 Years-post treatment	
	Control	Brushed	Control	Brushed
GLYPHOSATE				
Total conifers/ha	2228	1139	2728	1828
Well-spaced/ha	667	333	922	589
MANUAL CUTTING				
Total conifers/ha	1539	2050	2250	3011
Well-spaced/ha	994	1078	1061	978

- Manual brushing or glyphosate treatment did not improve conifer stocking.
- Stocking was below the minimum requirement before and after glyphosate treatment, but was increasing over time (Table 3).
- Stocking was above the minimum requirement before and after manual cutting, and decreased slightly over time.

Douglas-fir competitive status

- Glyphosate treatment did not increase the height of Douglas-fir relative to the vegetation (Figure 4) and half of the seedlings were still shorter than the vegetation 5 years after brushing (data not shown).
- Manual cutting resulted in a slight improvement in the height of Douglas-fir relative to the vegetation but the response was not significant (Figure 5).
- At both sites, the minimum height for free-growing was reached when the seedlings were 5-6 years old. The required conifer:brush ratio is expected to be reached on both sites within the required time frame, regardless of treatment.

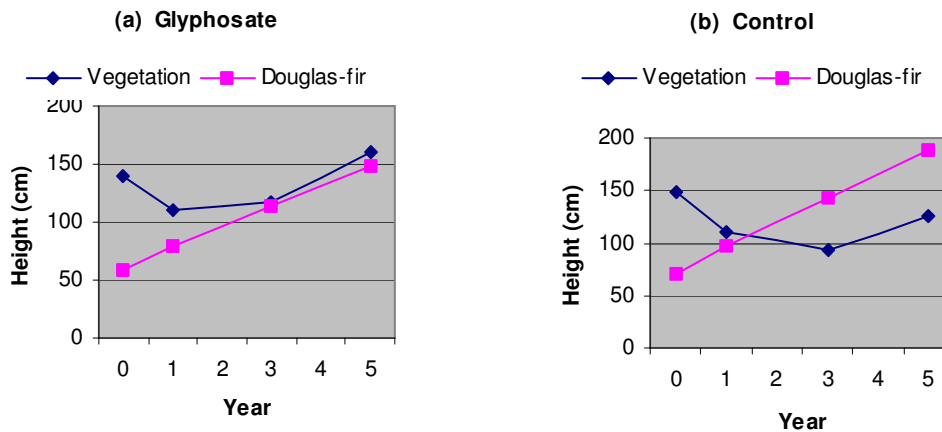


Figure 4. Height of Douglas-fir and vegetation in (a) the brushed area and (b) the control before and after glyphosate treatment at Smith Creek.

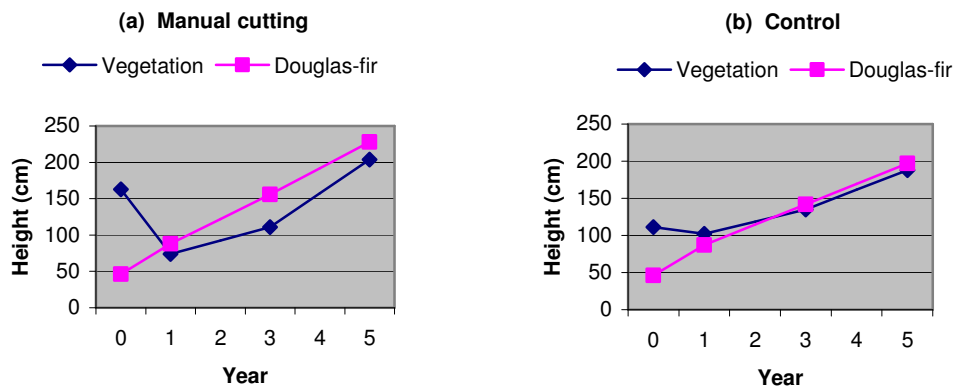


Figure 5. Height of Douglas-fir and vegetation in (a) the brushed area and (b) the control before and after manual cutting at Mt McLennan.

PRELIMINARY MANAGEMENT INTERPRETATIONS

- On our site, brushing with glyphosate resulted in no biological benefit to Douglas-fir seedlings. Survival was excellent and growth and vigour were satisfactory without brushing.
- We found that manual cutting significantly improved Douglas-fir height but had no effect on diameter growth, survival, or vigour, which were all satisfactory without brushing.
- The plantations are expected to reach free-growing within the required time period, regardless of whether brushing was done.
- Readers are reminded that the information reported here is from 2 sites only and responses on individual sites may vary considerably.