September 1991 Vegetation Management No. 194

Effect of Chemical and Manual Treatments on Salal and Conifer Development – Project 2.17

SUMMARY

Salal growing in a Douglas-fir plantation received three treatments, using the herbicide triclopyr ester, diesel oil, and manual pulling. Spring applications of triclopyr ester (4.0 kg a.e./ha) in a diesel carrier (150 L/ha) damaged above-ground components of salal; however, salal's extensive root system is undamaged and facilitates recovery. Salal had no effect on Douglas-fir survival in this 12-year-old plantation. Douglas-fir growth was enhanced when fertilizer was applied at time of planting or when salal abundance was reduced by herbicide or hand-pulling.

INTRODUCTION

Salal (*Gaultheria shallon*) dominates many forest ecosystems at low to mid-elevations on Vancouver Island and the adjacent mainland. An evergreen shrub with thick leathery leaves, salal has a shallow root system that spreads extensively. After harvesting, salal abundance increases. Conifers planted in these conditions often display poor survival and growth because salal competes for moisture and nutrients, influences humus form development, and may release chemicals that inhibit seed and plant growth or reduce nutrient availability.

Research is under way to evaluate the use of herbicides to reduce salal abundance and improve Douglas-fir (*Pseudotsuga menziesii*) growth in these salal-dominated ecosystems. Initial results suggested that triclopyr ester (Release®) applied at 4 kg a.e./ha in diesel carrier (150 L/ha) achieved the highest reduction in salal foliar cover, to below 10% cover of those tested. Third-year Douglas-fir height and stem diameter growth were enhanced following reductions in salal cover, although seedling survival was unaffected. A second trial was undertaken to determine how triclopyr ester efficacy could be improved by changing diesel carrier volume and application rates. The effect of treatment timing on herbicide efficacy was also studied. Alternative treatments tested for promoting conifer growth included conifer fertilization at planting and hand-pulling of the salal.

This memo reports the findings of this second trial on growth responses of salal and Douglas-fir measured two full growing seasons after application of treatments.

METHODS AND MATERIALS

Twelve treatments were tested (Table 1), among them: triclopyr ester applied with backpack sprayer at two rates (4 and 6 kg a.e./ha); diesel carrier applied at two volumes (150 and 300 L/ha) and in two periods, spring (March) and late summer (September); diesel-only (300 L/ha), to evaluate the efficacy of the carrier used to apply the triclopyr ester treatments; an untreated control; manual pulling of salal around all seedlings; and fertilization of individual seedlings at planting.

TABLE 1. Treatments tested to control salal

Treatment	Application rate (kg a.e./ha)	Application date	Carrier volume (L/ha)
1. Triclopyr ester	4.0	March 1988	150
2. Triclopyr ester	4.0	March 1988	300
3. Triclopyr ester	6.0	March 1988	150
4. Triclopyr ester	6.0	March 1988	300
5. Diesel oil	-	March 1988	300
6. Triclopyr ester	4.0	Sept. 1988	150
7. Triclopyr ester	4.0	Sept. 1988	300
8. Triclopyr ester	6.0	Sept. 1988	150
9. Triclopyr ester	6.0	Sept. 1988	300
10. Fertilizer	-	At planting	-
11. Manual pulling	-	Repeated	-
12. Control (no treatment)	-	-	-

The trial site was located 19 km southwest of Qualicum Beach, in the CWHxm2 biogeoclimatic variant. It was at an elevation of 600 m, with a 35% slope and west aspect. Logged in 1976, the relatively dry site (edatope of 2/A) was planted in the same year. By 1986, salal cover averaged 41% and conifer regeneration was relatively sparse.

Douglas-fir seedlings (1+0 PSB 313, Seedlot 9510) were planted within each treatment plot in May 1989. Seedlings were fertilized with 37 g (11.5 g N) of 31-0-0 special sulphur-coated fertilizer inserted in a dibble hole approximately 5 cm from the seedling.

Salal foliar cover and height were measured and the condition assessed before treatment and then annually in the 10-m^2 area around the centre stake of each plot. Conifer height and stem calliper were measured and condition assessed at planting and then annually. Sampling of salal foliage and roots (both live and dead components) took place in both the control and the spring application of triclopyr ester (6 kg in 300 L/ha diesel), one and two growing seasons following treatment.

RESULTS

All treatments, except the control and seedling fertilization, reduced salal cover in the 1st year after application and thereafter to the 3rd year. Analysis indicated the following:

Canada BC

M28 2600

- Triclopyr ester controlled salal more effectively when applied in the spring than in the late summer (Figure 1).
- Although there were statistically significant differences between application rates and carrier volumes, salal control improved little when the triclopyr ester application rate was increased from 4 to 6 kg a.e./ha or the diesel carrier volume was increased from 150 to 300 L/ha.
- The spring diesel application (300 L/ha) controlled salal poorly, with the 3rd-year cover approaching pre-treatment levels.

Comparison of salal root and foliar biomass in the control and the triclopyr ester treatment (6 kg a.e./ha in 300 L/ha diesel) must be considered exploratory because of the small sample size (6 per treatment in year 1 and 10 samples in year 2). However, the following trends were observed:

1. In untreated salal, between 70 and 75% of the plants' biomass was in the roots (Figure 2).
2. The triclopyr ester treatment initially reduced above-ground biomass (stems and foliage) more than below-ground biomass (roots), but the latter appeared to decline in the 2nd year following treatment.
3. Extensive salal root systems were found in both the control and triclopyr ester treatments. Total root length averaged 1550 km/ha in the control and 1070 km/ha in the triclopyr ester treatment 2 years after application.

Douglas-fir diameter and height were greater in those treatments that reduced salal cover (Figure 3,4). Fertilizer application was the only treatment that did not lead to a slowdown in Douglas-fir height growth during the 2nd year following planting. Thirteen seedlings have died since trial establishment throughout all treatments (1.8%), although survival remains 100% in the control unit. The most common defects in condition noted in Douglas-fir seedlings are chlorotic appearance (71% overall) and forking in leaders (21%). Occurrence of these conditions did not differ significantly between treatments.

DISCUSSION

Results showed that although triclopyr ester in diesel carrier can significantly damage salal foliage, any subsequent benefit for the growth of Douglas-fir seedlings may be short-lived. Sampling suggests that treated salal will retain an extensive root system. This reflects the poor herbicide translocation within the plant. Some salal recovery occurred the 3rd-year following the spring applications of triclopyr ester, but total cover remained below pre-treatment levels. Attempts to create a salal-free growing environment in similar ecosystems elsewhere have also shown the species' ability to survive up to three applications of triclopyr ester (D'Anjou, unpublished data).

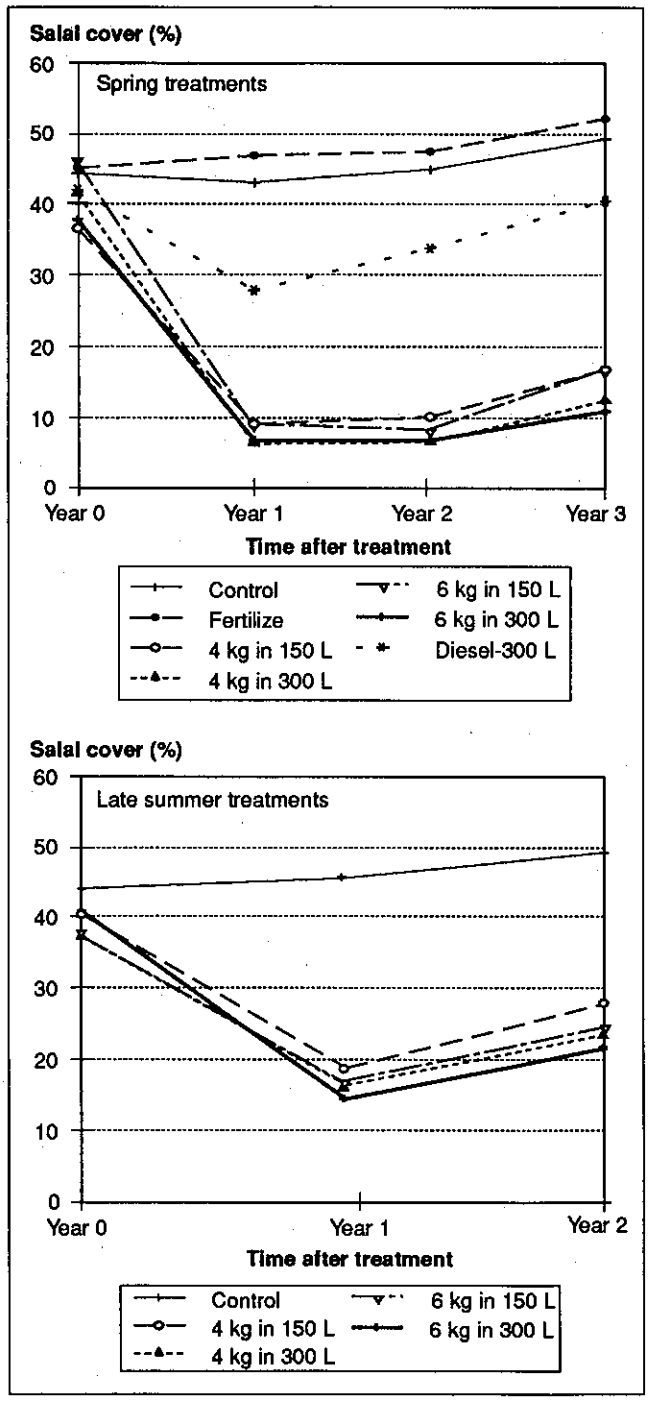

FIGURE 1. Salal cover (%) by treatment application period, treatment, and time after treatment. Application rates refer to triclopyr ester treatments.

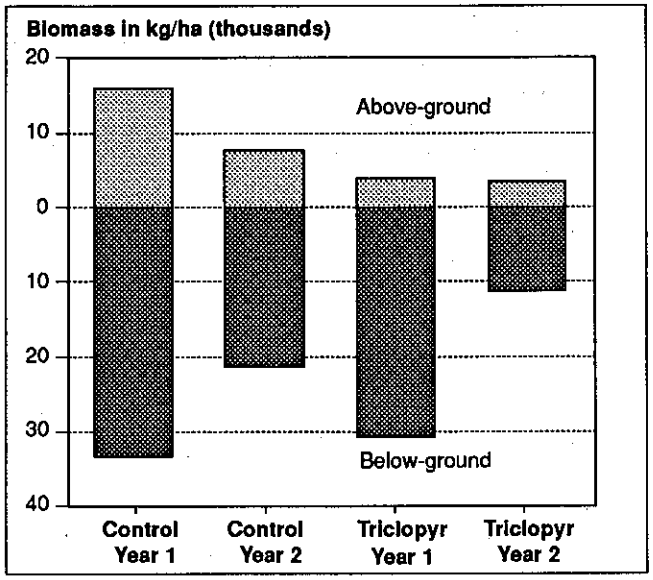

FIGURE 2. Salal biomass (above- and below-ground) in control and triclopyr ester treatments 1 and 2 years after treatment.

Salal apparently has no effect on early Douglas-fir survival. Although some trials point to short-term enhancement in Douglas-fir height and diameter growth following reductions in salal cover, these responses have been attributed to increases in soil moisture or soil nutrient availability to crop seedlings. Foliar nutrient analysis elsewhere suggests that responses of Douglas-fir seedlings to fertilization may be short-lived.

If untreated, salal's abundance increases following harvesting as a result of rhizomes resprouting. Salal is a tough, competitive plant which is ideally suited for efficient uptake of limited moisture and nutrients in these ecosystems. This competitive effect of salal may decrease as tree canopy closure limits light availability. Consequently, appropriate techniques for Douglas-fir production on these sites should aim at reducing the time until crown closure. Planting conifers at higher than current planting densities may achieve this objective. Longer-term assessment of this and similar trials will determine whether any of the treatments tested will affect time to crown closure.

CONCLUSIONS

The findings of this study, summarized below, clearly have implications for the management of Douglas-fir on drier salal-dominated ecosystems on low to mid-elevation sites:

1. Douglas-fir survival is not affected by the presence of salal in the early years following planting.
2. Triclopyr ester (4.0 kg a.e./ha) in diesel carrier (150 L/ha) applied in the spring can significantly damage above-ground components of salal. Salal retains an extensive root system following treatment, facilitating future recovery.

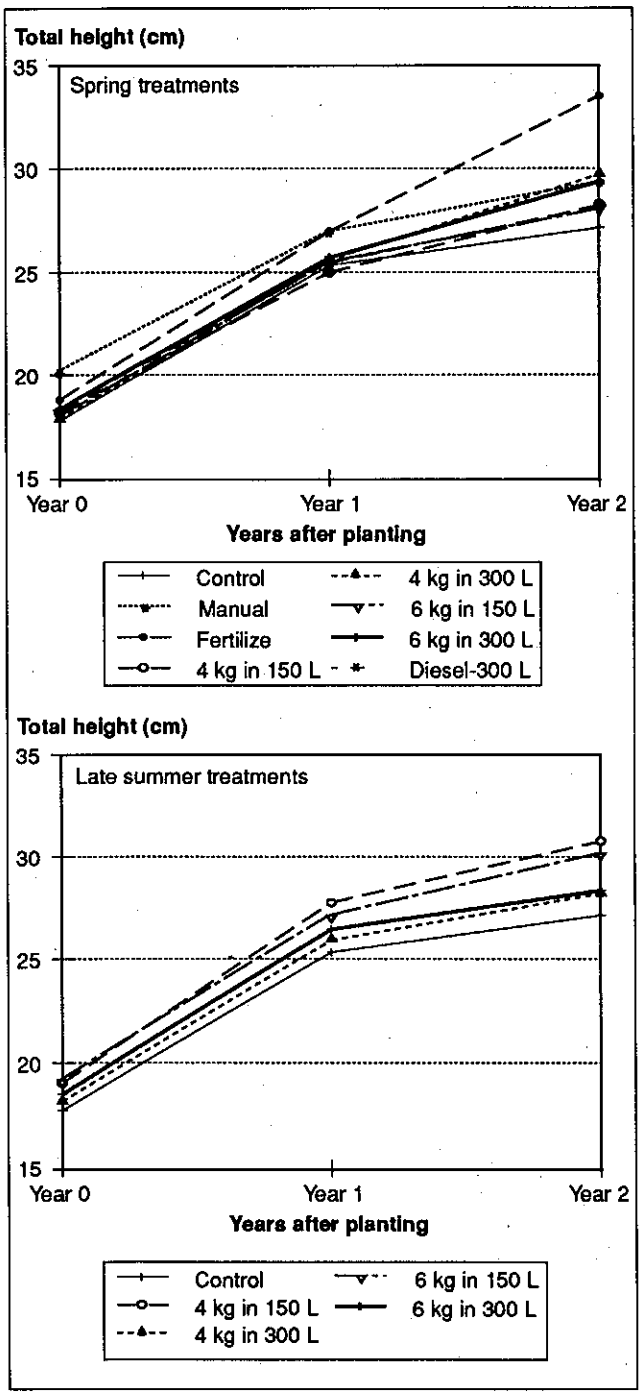

FIGURE 3. Douglas-fir total height by treatment application period, treatment, and years after planting.

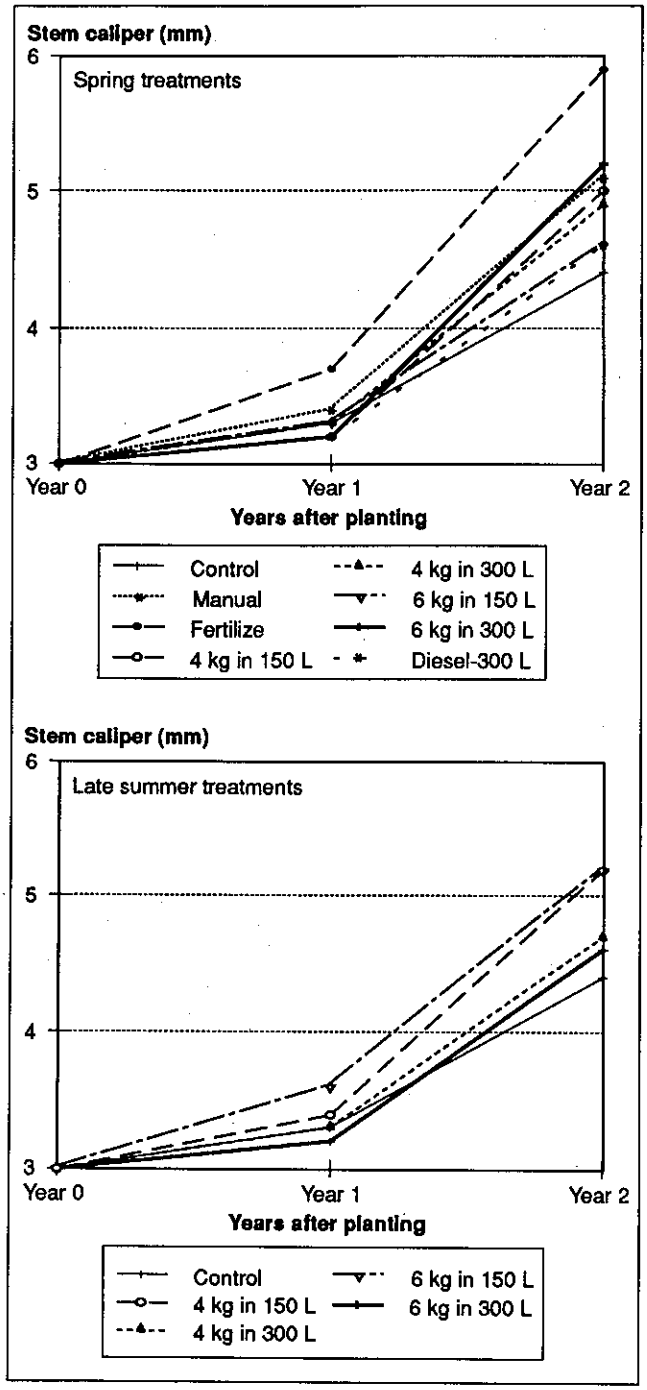

FIGURE 4. Douglas-fir stem caliper by treatment application period, treatment, and years after planting. Application rates refer to triclopyr ester treatments.

3. Reduction in salal abundance brought about by herbicides or hand-pulling, and conifer fertilization at planting, can enhance short-term Douglas-fir height and stem diameter growth.

For more information, please contact:

Brian D'Anjou
Research Silviculturist
Vancouver Forest Region
B.C. Ministry of Forests
4595 Canada Way
Burnaby, B.C. V5G 4L9
(604) 660-7531

Mention of trade names or products does not constitute endorsement by the author, B.C. Ministry of Forests or Forestry Canada.