Squamish Forest District

Extension Note

Extension Note
007
March 2004

Effects of Stock Type and Fertilization on the Growth of Planted Douglas-Fir in the Soo River Drainage: Year 12 Results

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Prepared for the Transition Zone Working Group

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INTRODUCTION

In southwestern British Columbia's Coast–Interior Transition, where ecological gradients are steep, matching stock type to site conditions is a continuing challenge for silviculturists. Drought, brush, and other damaging agents can strongly affect regeneration performance. Applying fertilizer at the time of planting may compensate for the use of large stock, or it may provide growth benefits. In 1992, the British Columbia Ministry of Forests established a trial in the Coast–Interior Transition to investigate the effects of different stock types and fertilization on the performance of planted Douglas-fir seedlings.

METHODS

The trial is located 15 km north of Whistler in the Soo River drainage on a zonal site of the Southern Moist Submaritime subzone of the Coastal Western Hemlock biogeoclimatic zone (CWHms1 01). At 660 m elevation, the site is on a lower, north-facing slope dominated by western hemlock and amabalis fir. Opening 92J025-09 was harvested in the fall of 1990 and planted without site preparation in the spring of 1992. The brush hazard on the site is moderate-high.

The six treatments involved three stock types which were either fertilized or not fertilized (control) (Table 1). Stock types were PSB 1+0 from seedlot 6542, which is of seed-orchard origin and has a genetic worth of GW+02. All stock was grown in the same greenhouse with the same treatments. Seedlings were fertilized at planting with Gromax #5 tea bags (24-4-7).

Thirty three seedlings of each stock type and fertilizer combination were replicated three times on the site. Only 10 seedlings per replicate were measured for height and diameter. After the fifth growing season, mortality had reduced the number of seedlings to an average of 11 per treatment; additional trees were therefore tagged and assessed to restore the sample size to 10 trees per replicate. Tree height and root collar diameter were measured in the fall of Years 1, 3, 5, 6, 7, 8, and 12. Damage was assessed in detail at Year 8. Detailed statistical analysis was not carried out due to difficulties with sample size and replication.

RESULTS AND DISCUSSION

Overall mortality and damage were high. Deer browsing was severe in the second year. At Year 3, survival ranged from 30 to 57%, and averaged 42% overall. By Year 5, average survival was 37% (Figure 1). Additional trees were assessed in later years and mortality became difficult to track because the trial was based on planting lines rather than on marked plots. Heavy snow loading and related damage were observed, and stem breaks frequently occurred around 1.5 m height. An assessment of damage at Year 8 revealed that 37% of all seedlings had some form of damage, including stem bending, scarring or breakage, leader dieback, and poor form (Figure 2). It appeared that treatments were affected indiscriminately, although stock type 615B received slightly more damage. By Year 12, very little new damage was observed, but the effects of high levels of earlier damage continued to be apparent.

Competing vegetation likely affected seedling development. At Year 8, the height of competing vegetation was assessed as "equal to" 20% of the trees in the trial, and "above" 64% of the trees. The main competitors were fireweed (70%) and vaccinium (15%).

Table 1. Treatments.

Stock type	Fertilizer
615A	Yes, Gromax
615A	No, control
415B	Yes, Gromax
415B	No, control
313B	Yes, Gromax
313B	No, control

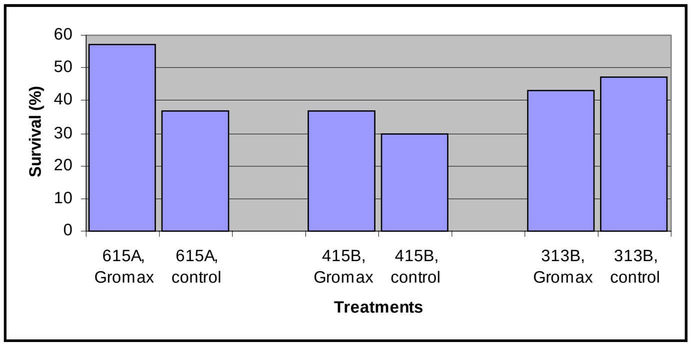

Figure 1. Survival of planted seedlings at Year 5.

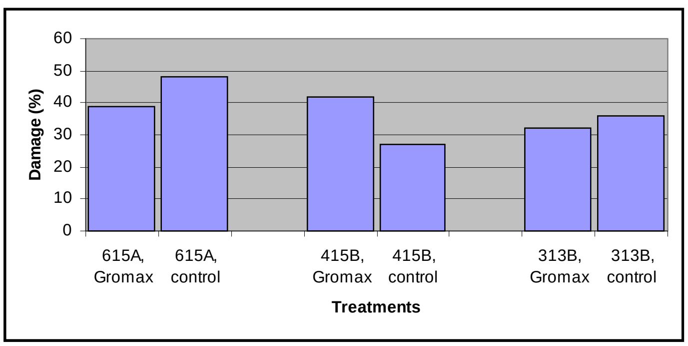

Figure 2. Portion of trees incurring damage, all damage types, at Year 8.

The greatest height and diameter were observed with the stock type 615A followed by the stock types 415B and 313B (Table 2, Figures 3 and 4).

At Year 12, for stock types 615A and 415B, fertilized trees were taller than the control trees. Stock type 415B displayed the largest differences in height (48 cm). Assessments in Years 2–7 showed that fertilization provided very little benefit for other stock types. At Year 12, fertilization-related effects were more consistent with diameter growth than with height growth (Figure 4). Other studies indicate that, compared with height, diameter has a greater response to fertilization (Bowden 1995; Heineman 1999).

The differences in growth performance are relatively small between treatments, and correspond to one year of height growth. The most effective treatment (615A, Gromax) achieved the *Guidebook* minimum height of 225 cm at Year 8 (BCMoF and BCMoE 1995), and the least effective treatment (415B, control) achieved that height one year later (Figure 5). This difference between treatments continued into subsequent years. Other studies indicate that the response to fertilizer endures for only a few years (Bowden 1995; Heineman 1999).

In terms of average diameter and volume, the spread between the most effective treatment and the least effective treatment is three years. If differences continue over the long term (i.e., an 80-y rotation), this three-year gain could correspond to a 3.75% reduction in rotation length. The early height development of seedlings was below, or at most, equal to the normals for Douglas-fir in the CWHms1 01 (Hunt 2003). Most of the damage and brush competition occurred from Year 1 to Year 8. After Year 8, seedlings recovered and average heights of treated seedlings exceeded the normals height in the CWHms1 01 (Figure 5).

Poor survival and the effects of damage overshadow the effects of stock type and fertilization at this site. Damage from browsing and snow break may have confounded treatment effects. In addition, the small sample size and poor maintenance of the trial limit the extent of data analysis.

Table 2. Year 12 results: summary.

Treatment	Sampled trees (no.)	Height		Tree diameter (cm)	Tree volume (L)
		Total (m)	Increment (cm)		
615A, Gromax	19	4.79	75	9.3	12.8
615A, control	19	4.49	67	8.6	10.4
415B, Gromax	15	4.27	60	8.2	11.0
415B, control	16	3.79	69	7.6	7.3
313B, Gromax	10	3.96	57	7.6	5.4
313B, control	20	3.96	73	6.7	6.2

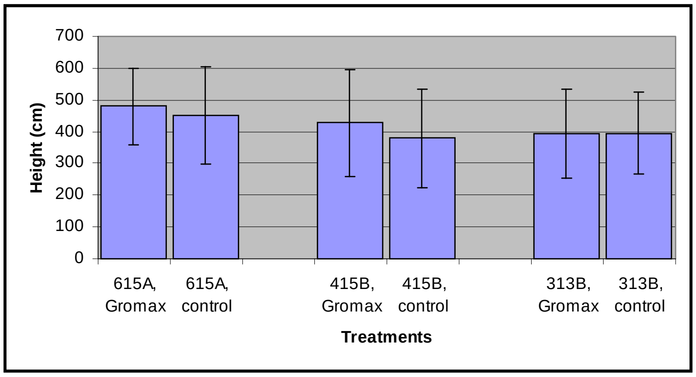

Figure 3. Average tree height at Year 12.

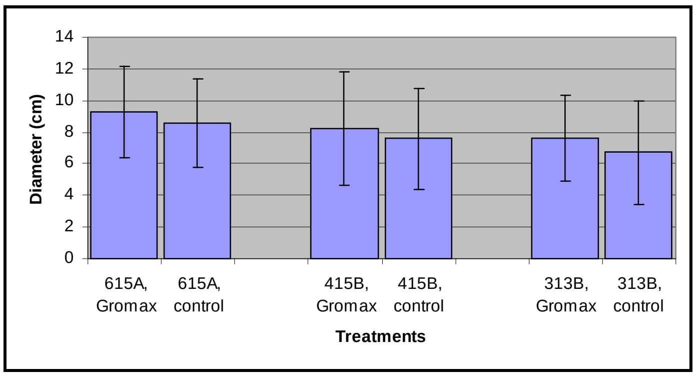

Figure 4. Average tree diameter at Year 12.

SUMMARY

This extension note summarizes the Year 12 results of a trial designed to investigate the effects of stock type and fertilization on the performance of planted Douglas-fir seedlings in the Coast–Interior Transition in southwestern British Columbia. Although the confounding effects of damage to seedlings and the poorly maintained nature of the trial make it challenging to interpret the benefits of large stock or fertilization, the results indicate that applying fertilizer at the time of planting improved seedling growth. Large, fertilized seedlings displayed the best overall results, and the effect of stock type was greater than the effect of fertilization.

KEYWORDS

Stock type, fertilization, Douglas-fir, seedling response, seedling growth, plantation performance, tree diameter growth, tree height growth, Coast–Interior Transition, British Columbia.

ACKNOWLEDGMENTS

This report was prepared for the Transition Zone Working Group, and it was funded by the Coast Forest Region of the BC Ministry of Forests. The project was co-ordinated by Doug Bacala, Squamish Forest District, BC Ministry of Forests.

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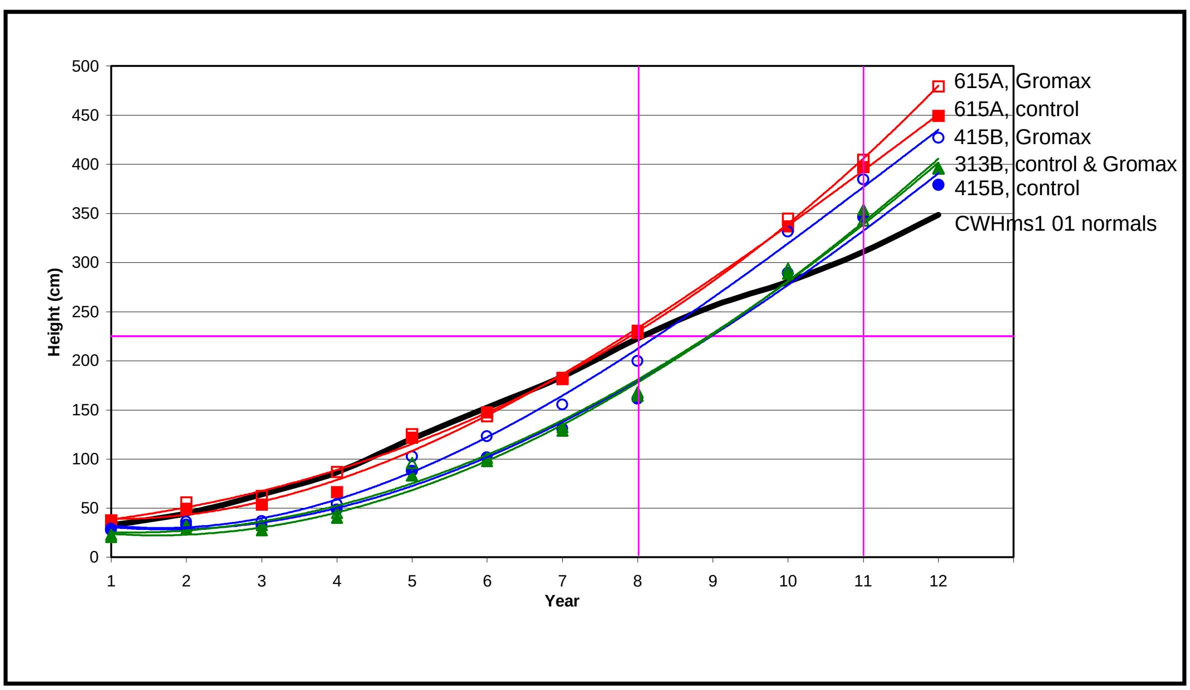

Figure 5. Polynomial curves of mean tree height over time for fertilized and nonfertilized (control) Douglas-fir compared with height performance normals for Douglas-fir in the CWHms1 01. Minimum height, and early- and late-free-growing years (according to the *Free Growing Guidebook*; BCMoF and BCMoE 1995) are shown.

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