Squamish Forest District

Extension Note

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Effects of Stock Type and Time of Planting on Performance and Survival of Douglas-fir: Year 7 Results

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Prepared for the Transition Zone Working Group

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INTRODUCTION

Plantation performance in the Coast–Interior Transition in southwestern British Columbia has not been consistent (Scagel et al. 1992). Generally, survival of planted seedlings in the Squamish Forest District has ranged from 52 to 74% in Years 3 to 6 (Hunt 2002). Poor survival of spring-planted, cold-stored Douglas-fir has been a chronic problem in the Coast–Interior Transition. Unless spring planting is done early, seedlings are not able to complete their primary growth before summer, i.e., before soil moisture deficits and high evaporative demands occur. Planting in the fall may improve performance and survival because fall-planted seedlings are not exposed to prolonged cold storage, and because their physiological development is different. The result of one exploratory trial of spring and fall planting of Douglas-fir in the Coast–Interior Transition suggested that fall-planted Douglas-fir would have greater survival than spring-planted Douglas-fir (Scagel et al. 1990). In addition to planting season, results from operational plantations and trials suggest that small container-grown seedlings may not perform as well as large stock types.

OBJECTIVES

In 1990-91, a trial was established in the Coast–Interior to examine the performance and survival of fall-planted Douglas-fir seedlings relative to those planted in spring.

METHODS

The trial is located 30 km northeast of Pemberton at Blackwater Lake on a zonal site of the Wet Warm subzone of the Interior Douglas-Fir biogeoclimatic zone (IDFww). Elevation of the site was 650 m. Opening 92J058-17 was harvested in 1990. It was planted with seven different stock types in the fall of 1990 and the spring of 1991 (Tables 1 and 2) without site preparation or subsequent brushing. Browse protection tubes were applied to every third seedling at the time of planting; these were removed in 1995.

All seven stock types were grown from seedlot 6542. At the time of planting, stock type 313B was considered an operational control, and stock type 415B was considered an operational alternative. The remaining stock types were new and untested. The trial involved three replications with 30 seedlings/treatment/plot.

Seedlings were monitored four times in the first growing season. Height, increment, and diameter were measured in Years 1, 2, 3, 4, 5, and 7.

Analysis of Variance (ANOVA) was conducted for height, height increment, and diameter. A ranking analysis was performed to determine the stability of stock type and planting date growth over the seven years. A cost analysis was also performed.

RESULTS AND DISCUSSION

Survival

High mortality occurred during the first three years. A bark beetle attack in the third year caused about 15% mortality, but mortality was not specific to planting times or stock types. After seven years the mortality stabilized because the trees in the poorest condition (i.e., the smallest ones) had perished by then, and the stronger trees were relatively resistant. Mortality was highest and most immediate among the seedlings planted in early fall, while mortality was lower and occurred more slowly among seedlings planted later. Only the spring-planted seedlings had a marginally acceptable level of survival (Figure 1).

None of the stock types had survival >70% (Figure 1). The best survival was observed with the largest stock type, 415D. The field-grown stock types, Mini-T and plug transplant, had the poorest survival overall, and 313B had the poorest survival of the container stock types. The transplant stock types were succulent and mortality was more likely to be drought-induced. Little browsing damage was observed.

Table 1. Planting dates.

Month & day	Year
August 30	1990
September 18	1990
September 29	1990
October 15	1990
April 10	1991

Table 2. Stock types.

Stock type		Sown in 1990	Height (cm)	Diameter (mm)
Transplant				
Plug-T	P ½ + ½	March 5	25	4.2
Mini-T	M ½ + ½	March 5	16	2.4
Container				
313B	PSB 313B 1+0	April 12	20	2.8
315	PSB 315 1+0	April 11	24	2.7
415B	PSB 415B 1+0	March 22	25	3.4
415B-H	PSB 415B 1+0	February 28	28	4.7
415D	PSB 415D 1+0	March 7	28	4.2

Growth

At Year 7, the data show that planting date had a significant effect on height, height increment, and diameter, but that the amount of variation was marginal (5–7%). Stock type had a significant effect on total height and diameter. At Year 7, about 10% of the variation in diameter could be explained by stock type. Interaction between stock type and planting date was also significant. However, the amount of variation that could be explained by treatment effects decreased over time. This indicates that stock types and planting times were important only at the time of planting, and that their differences did not persist. As time passed, environmental effects became more important than treatment effects.

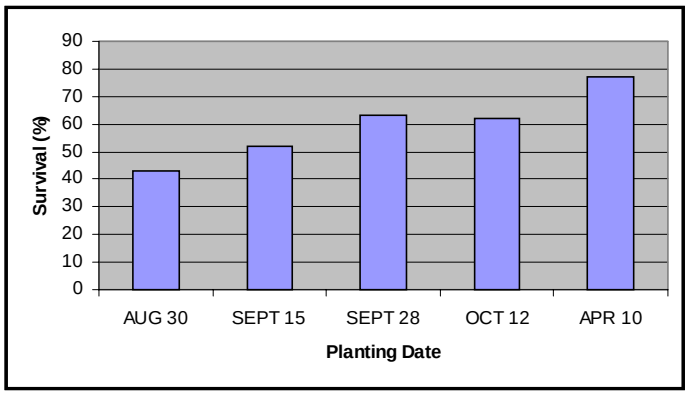
In terms of planting date, the best overall growth occurred with the late September planting (Figures 2 and 3). Height varied 10 to 15 cm, and diameter 2 to 3 mm, depending on planting date.

In terms of stock type, the largest, 415D, displayed the greatest height and annual increment consistently over the seven years. Average heights differed by 50 cm and average diameters differed by 15 cm among stock types.

Only the Mini-T stock type and September 15 plantings have remained smaller than the 1.5 m minimum height specified by the Free Growing Guidebook (BCMoF and BCMoE 1995). The best stock types and planting dates had height development that was similar to the height development normals for Douglas-fir in the IDFww 01 (Hunt 2003) (Figure 4).

Cost

The most economic *cost per surviving seedling* (Scagel et al. 1999) was $0.72 for stock type 313B planted in late September, and the most expensive cost per surviving seedling was $1.24 for the stock type PSB 415D 1+0 planted in August. The average cost per surviving seedling was $0.93/seedling; it varied by $0.15–0.20/seedling over all planting dates, and by $0.10 among stock types. The *height growth cost per surviving seedling* (Scagel et al. 1999) ranged from $0.04/cm for many stock types and planting dates to $0.08/cm for seedlings planted on August 30 and September 18. The height growth cost for the late-September planting is higher than for other planting dates, which suggests that it is still not optimal for all stock types.



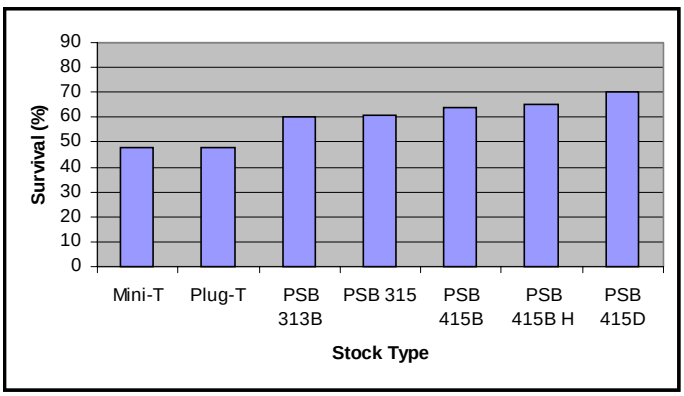


Figure 1. Average survival at Year 7, by planting date and stock type.

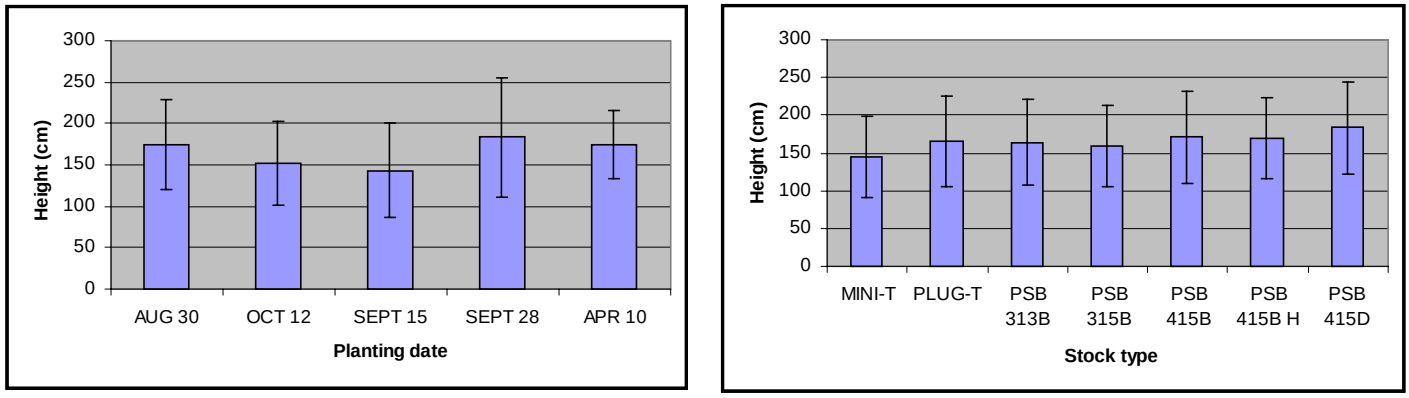


Figure 2 Average height at Year 7, by planting date and stock type.

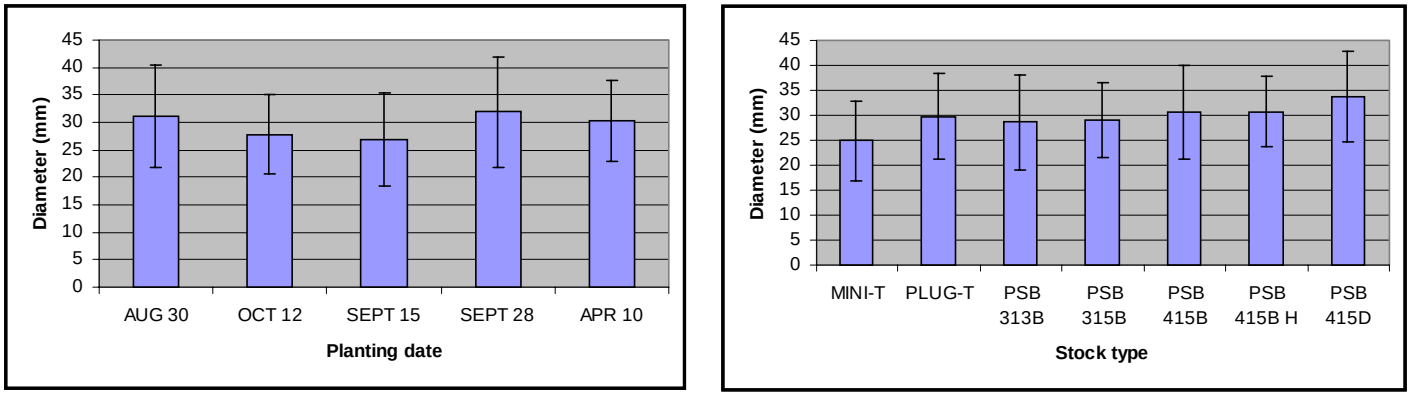


Figure 3. Average diameter at Year 7, by planting date and stock type.

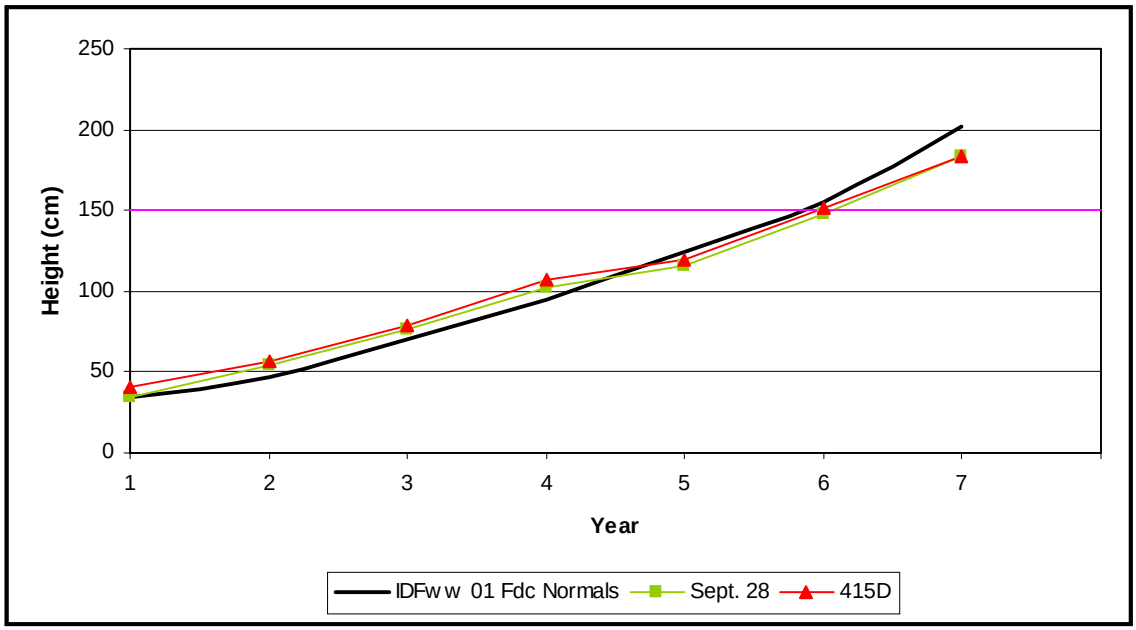


Figure 4. Average height over time for the September 28 planting date and 415D stock type treatments compared with height performance normals for Douglas-fir in the IDFww 01. Minimum height (150 cm), according to the Free Growing Guidebook (BCMoF and BCMoE 1995) is shown.

CONCLUSIONS

Seven stock types of Douglas-fir were planted on an IDFww 01 site in the late summer and early fall of 1990, and in the spring of 1991. Except for the transplant stock types, nearly all stock types survived better and grew more compared to the operational control, stock type 313B. Seedlings planted in April had the best survival. Stock type 415D had the best survival and growth. The best combination of planting times and stock types was the late September planting of stock type 415B. The ranking of growth and survival of stock types after the seventh growing season suggests that initial differences among stock type and planting date combinations have disappeared and growth trends have stabilized. All container types are suitable for fall planting provided that the stock is not succulent. Container stock is more cost effective and less variable than field-grown stock types. The average cost per surviving seedling is $0.93.

KEYWORDS

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

ACKNOWLEDGMENTS

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