Squamish Forest District

Extension Note

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A Comparison of Coastal Douglas-Fir and Interior Douglas-Fir Seedlots in the Coast-Interior Transition: Year 7 Results

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INTRODUCTION

In the Coast-Interior Transition, the survival and growth of Coastal Douglas-fir (Fdc) seedlings in the lower elevation biogeoclimatic subzones (IDFww and CWHds1), and in the south aspects of the CWHms1, have been consistently poor (Scagel et al. 1992). Seedlings typically display characteristics of planting check syndrome, including poor needle retention, small annual increment, small buds, and poor leaf production and elongation. In addition, seedlings are also damaged by drought during lammas growth and early fall frosts. The limited seedlot selection for these biogeoclimatic subzones and concerns about the poor early performance of Fdc seedlings in the Coast-Interior Transition are increasing because of:

- increasing reliance on orchard seed rather than seed from wild stand sources;
- infrequency of large, viable cone collections of Fdc seed in the IDFww and CWHds1; and
- narrow seed transfer guidelines.

This extension note summarizes an earlier report by Scagel et al. (1999), and includes new data from 2000.

OBJECTIVE

To investigate the relative performance of a variety of different seedlots of Coastal Douglas-fir (Fdc) and Interior Douglas-fir (Fdi) in the Coast-Interior Transition.

METHODS

In 1994, 1000 Fdc and Fdi seedlings from ten seedlots were planted in the Samson Creek drainage, which is north of Squamish (Figure 1, Table 1) in the Sub Maritime Seed Planning Zone (BCMOF and BCMOE 1995a). Competing vegetation at Samson Creek has been relatively low, partly due to sites being planted soon after harvesting.

Seedlots represent one local Coast-Interior Transition source, one Coastal seed orchard source, and eight Interior sources. Fdi originate from both Dry Belt and Wet Belt provenances (Table 2). Seedlots were taken from a narrow range of elevations, 600–900 m.

Each seedlot had four replications. Analysis of variance was used to determine p-values for all pairwise differences for height and diameter values by seedlots for the Year 7 data.

STOCK CONDITION

Operational 315 container stock was used. At the time of planting, the proportion of reflushing, or lammas growth, was high for the Fdi seedlots.

No consistent geographic trends to the different weight fractions, height, or root collar diameter at planting were evident. The Fdc seedlots had the lowest root weights and the highest shoot : root ratios of all the seedlots. The Fdi seedlots appeared to be far more variable in their root weights than the Fdc seedlots. The Fdc seedlots were, on average, the tallest seedlings with the largest root collar diameters. The Fdi seedlots appeared to be more variable in height growth than the Fdc, reflecting a greater frequency of lammas growth.

A flushing survey was conducted in the first spring (May) following planting.

RESULTS AND DISCUSSION

The flushing survey showed pronounced differences in flushing condition and rate of flush elongation. The Fdc seedlots flushed earlier than Fdi, but their rate of shoot extension was slower

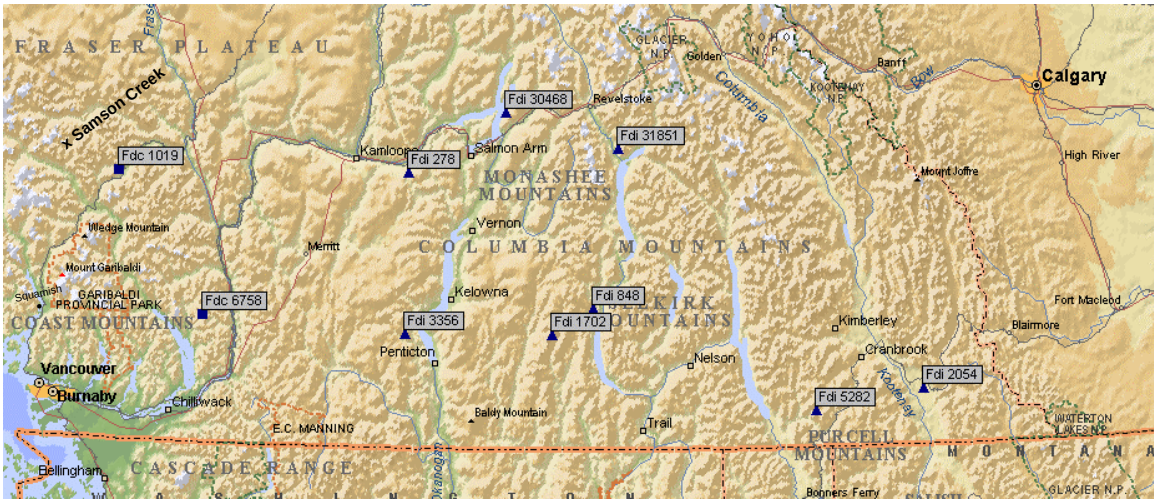

Figure 1. Location of Samson Creek study site, and origin of seedlots.

Table 1. Description of Samson Creek study site.

Opening	92J055-519
Biogeoclimatic subzone	CHWds1
Site series	05
Soil moisture/nutrients	3-4/C
Site index	24m
Elevation	775 m
Aspect	SW
Soil texture	SaL
Humus depth	10 cm
Soil depth	50 cm
Harvested	Spring 1994
Planted	April 1994
Assessed	1994, 1995, 1996

than the Fdi seedlots. Scagel et al. (1999) suggest that the Fdc seedlots have a higher risk of being damaged by late frosts. In addition, their slow flushing predisposes them to flushing during late spring droughts, which would impede the elongation of the flush. Concerns about differences in flushing among seedlots in the second year are probably not valid because the practical differences among the seedlots are not great at Year 7.

At Year 7, average height, survival, and diameter were greater for the Fdc seedlots than for the Fdi seedlots (Figure 2, Table 3). Some significant pairwise differences in height and diameter were found between the poorer-performing seedlots (1702, 3356, and 2054) and the better-performing seedlots (6758, 1019, 30468, and 278) (Appendix A). Significant differences in height and diameter were found between the Coastal and Interior species groups. No significant differences in height or diameter were found within the Coastal seedlots (orchard and local). Using orthogonal contrasts, significant differences in height and diameter were found among the Interior seedlots.

Table 2. Seedlot collection information. Seedlots arranged by decreasing longitude. Dry Belt Fdi. Wet Belt Fdi.

Seedlot	Class	Year seed collected	Location	Seed Planning Zone	Biogeo-climatic subzone	Elev. (m)	Latitude	Longitude
Fdc 1019	B3	1966	Devine	SM	IDFww	900	50°34"	122°32"
Fdc 6758	A4	1989	Dewdney SO	SM	-	775	49°35"	121°41"
Fdi 278	B5	1958	Monte Creek	TOA	IDFxh2	701	50°37"	119°52"
Fdi 3356	B2	1970	Trout Creek	TOA	-	884	49°40"	119°52"
Fdi 30468	B3	1990	Anstey Arm	SA	ICHmw2	610	50°58"	118°58"
Fdi 1702	B3	1969	July Creek	WK	-	914	49°40"	118°33"
Fdi 848	B5	1964	Inonaklin	WK	-	671	49°50"	118°10"
Fdi 31851	B3	1989	Crawford Creek	WK	ICHa2	600	50°45"	117°57"
Fdi 5282	B2	1980	Kid Creek	WK	ICHa	905	49°13"	116°12"
Fdi 2054	B3	1971	Suzanne Lake	EK	-	914	49°20"	115°14"

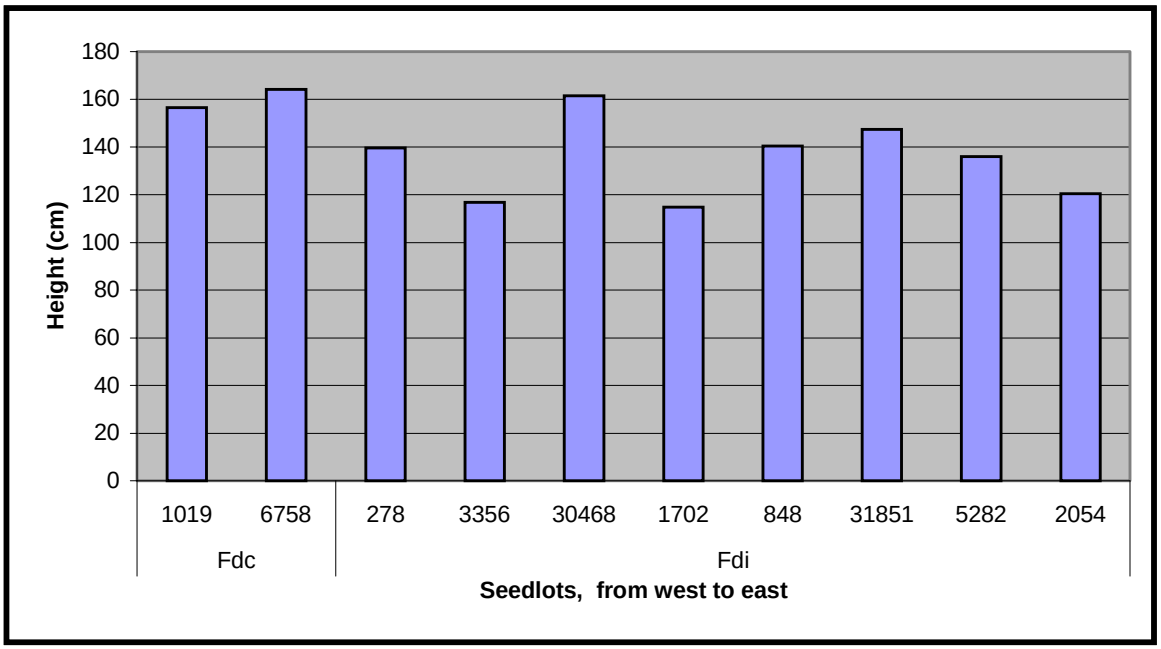

Figure 2. Height growth of Fdc and Fdi at Year 7.

Table 3. Height, diameter, volume, and survival of Fdc and Fdi: Year 7 results. Wet Belt Fdi.

Species/ seedlot	Height (cm)	Diam. (mm)	Volume (L)	Survival (%)
Fdc 6758	164.1	29.7	0.45	86
Fdc 1019	156.5	29.7	0.41	82
Avg.	160.3	29.7	0.43	84
Fdi 30468	161.6	29.0	0.44	72
Fdi 31851	147.4	27.7	0.35	80
Fdi 848	140.4	27.8	0.33	74
Fdi 278	139.7	28.6	0.36	86
Fdi 5282	136.1	27.3	0.32	90
Fdi 2054	120.4	22.9	0.21	80
Fdi 3356	116.9	23.0	0.25	78
Fdi 1702	114.9	23.5	0.21	88
Avg.	134.7	26.2	0.31	81

It is estimated that the three Fdi seedlots with the poorest height growth will barely achieve the minimum height of 2.25 m at Year 11, as indicated in the *Establishment to Free Growing Guidebook* (BCMOF and BCMOE 1995b). Survival ranged from 72 to 90%, with Fdi 582 and Fdi 1702 surpassing Fdc. The greatest diameter was observed with the two Fdc seedlots. No clear trends were evident in the performance of Wet Belt Fdi compared to Dry Belt Fdi.

At Year 7, about 11% of surviving trees had some stem damage (bent, forked, multiple leader), with seedlots 2054, 1702, and 3356 incurring the most damage. Roughly 7% of all trees had some vegetative competition at Year 7. No real differences in damages were evident between the Coastal seedlots (orchard and local).

The Seed Planning and Registry System (SPAR) shows the Genetic Worth of the orchard seedlot 6758 is G+02, which indicates a 2% potential growth gain over natural stand seed. At Year 7, the Class A orchard seedlot is 4.8% greater in height and 9.7% greater in volume than the local Class B3 Coastal seedlot (Table 3). Further testing of orchard seed may be warranted to verify that Genetic Worth gains can be realized on brushier sites (McDonald et al. 1999).

The use of Interior seed in the Sub Maritime Seed Planning Zone would be prohibited because the transfer limits state that seed cannot be transferred outside its native Seed Planning Zone. Interior seed must be used within the same biogeoclimatic zone and within the same Seed Planning Zone, and may not be transferred more than 3° west (BCMOF and BCMOE 1995a). Therefore, the Fdc would be expected to outperform the Fdi.

RECOMMENDATIONS

The trial should be maintained to:

- Monitor the genetic gain of the orchard seedlot.
- Validate assumptions regarding minimum height and green-up used in timber supply analysis (Tanz 2001).

SUMMARY

Performance of eight Fdi seedlots, one local Fdc, and one orchard Fdc seedlot were compared. At Year 7, average height, survival, and diameter were higher for the Fdc seedlots than for the Fdi seedlots. Significant differences in height and diameter were found between the Coastal and Interior groups of seedlots.

Survival ranged from 72 to 90%, with seedlots Fdi 582 and Fdi 1702 surpassing Fdc. The Fdc orchard seedlot had 4.8% greater height and 9.7% greater volume than the local seedlot, which exceeds the assigned G+02 Genetic Worth. Concerns about differences in flushing condition and rate of flush elongation that occurred in Year 2 were not born out because practical differences among seedlots in Year 7 were not great.

KEYWORDS

Seed, genetic worth, seed transfer, seedling response, plantation performance, Coast-Interior Transition, British Columbia.

ACKNOWLDEGMENTS

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APPENDIX A: ANOVA TABLES

Table A-1. Test of pairwise significant differences for height. Bold values are significant. p = probability.

		Species/seedlot									
Species/ seedlot	**Mean height (m)**	**Fdc 6758 (p)**	**Fdi 30468 (p)**	**Fdc 1019 (p)**	**Fdi 31851 (p)**	**Fdi 848 (p)**	**Fdi 278 (p)**	**Fdi 5282 (p)**	**Fdi 2054 (p)**	**Fdi 3356 (p)**	**Fdi 1702 (p)**
Fdc 6758	164.1		1	1	0.901	0.626	0.534	0.342	**0.027**	**0.012**	**0.008**
Fdi 30468	161.6	1		1	0.974	0.811	0.746	0.559	**0.071**	**0.035**	**0.025**
Fdc 1019	156.5	1	1		0.998	0.938	0.902	0.750	0.117	**0.058**	**0.042**
Fdi 31851	147.4	0.901	0.97	1		1	1	0.992	0.444	0.272	0.210
Fdi 848	140.4	0.626	0.81	0.94	1		1	1	0.833	0.662	0.568
Fdi 278	139.7	0.534	0.75	0.90	1	1		1	0.830	0.650	0.552
Fdi 5282	136.1	0.342	0.56	0.75	0.992	1	1		0.943	0.827	0.743
Fdi 2054	120.4	**0.027**	**0.07**	0.12	0.444	0.833	0.830	0.943		1	1
Fdi 3356	116.9	**0.012**	**0.04**	**0.06**	0.272	0.662	0.650	0.827	1		1
Fdi 1702	114.9	**0.008**	**0.03**	**0.04**	0.210	0.568	0.552	0.743	1	1	

Table A-2. Test of pairwise significant differences for diameter. Bold values are significant. p = probability.

		Species/seedlot									
Species/ seedlot	**Mean height (m)**	**Fdc 6758 (p)**	**Fdc 1019 (p)**	**Fdci 30468 (p)**	**Fdi 278 (p)**	**Fdi 848 (p)**	**Fdi 31851 (p)**	**Fdi 5282 (p)**	**Fdi 1702 (p)**	**Fdi 3356 (p)**	**Fdi 2054 (p)**
Fdc 6758	29.7		1	1	1	0.987	0.978	0.931	**0.047**	**0.025**	**0.023**
Fdc 1019	29.7	1		1	1	0.988	0.979	0.934	**0.049**	**0.026**	**0.025**
Fdi 30468	29.0	1	1		1	1	0.999	0.994	0.150	**0.090**	**0.084**
Fdi 278	28.6	1	1	1		1	1	0.999	0.176	0.104	**0.097**
Fdi 848	27.8	0.987	0.988	1	1		1	1	0.424	0.291	0.274
Fdi 31851	27.7	0.978	0.979	0.999	1	1		1	0.399	0.266	0.250
Fdi 5282	27.3	0.931	0.934	0.994	0.999	1	1		0.532	0.377	0.356
Fdi 1702	23.5	**0.047**	**0.049**	0.150	0.176	0.424	0.399	0.532		1	1
Fdi 3356	23.0	**0.025**	**0.026**	**0.090**	0.104	0.291	0.266	0.377	1		1
Fdi 2054	22.9	**0.023**	**0.025**	**0.084**	**0.097**	0.274	0.250	0.356	1	1	