Factsheet 3

Seedlot Genetic Worth Values Verified for Coastal Douglas-fir at Age 20

Jack Woods[1] and Michael Stoehr[2]

INTRODUCTION

This is the second report in a series[3] on coastal Douglas-fir genetic realized-gain trials that were established in 1996 by the Ministry of Forests, Lands, and Natural Resource Operations.

A primary purpose of the study is to evaluate whether genetically selected orchard seed meets expectations for stem-volume growth gains on a per-hectare basis, and whether these gains hold up across a range of plantation densities and site indices. A more detailed report on age-12 data and the study design is provided by Stoehr et al. in Ministry of Forests and Range Extension Note 104 and in Stoehr et al., 2010[4]. This Factsheet summarizes key operational information.

Seedlings from a mix of seven wild-stand seedlots with a genetic worth for growth of zero (GWg=0) were compared with two select seedlots representing a moderate genetic gain for growth rate (mid-gain GWg=10) and high genetic gain (GWg=18). Seedlings were planted in replicated 144-tree blocks (12 x 12) on five field sites with a range of site indices. All sites are located in the south-coastal area of British Columbia, under 700 meters elevation. Four plantation spacings were used (1.6 m, 2.3 m, 2.9 m and 4.0 m; 3906, 1890, 1189 and 625 stems/ha, respectively). Stand density levels purposely bracketed operational densities to provide information for growth-and-yield modelling purposes. Each of the five sites has 2 replications x 3 genetic levels x 4 spacings x 144 trees/plot = 3456 trees. The inner 10x10 (100 trees) in each block were measured to reduce any block edge effects.

RESULTS

Mortality

Plantation initial survival was high on all sites (>95%). By age 20, the most-dense spacing (1.6 m) was beginning to show competition-induced mortality. No significant differences were observed in early mortality or in competition-induced mortality among the seedlot genetic-gain levels.

Growth

Average tree height, diameter (DBH), and stem volume varied widely among the five sites, reflecting the range of site indices. All three parameters increased with seedlot GWg on all sites, indicating that genetic gains in growth are consistent across a range of site quality.

(continued...)

FGC Forest Genetics Council of British Columbia

Average volume per hectare (total 100-tree plot volumes extrapolated to a per-hectare basis) also varied substantially with site quality, and increased consistently with GWg level (Figure 1)[5]. Actual genetic gains relative to wild seed averaged 22% for GWg=10 seed and 33% for GWg=18 seed. Expected gains in volume per hectare at a rotation age of 60 years, relative to wild seed, are 10% for GWg=10 and 18% for GWg=18. At age 20, expected gains are 15% for GWg=10, and 26% for GWg=18 based on the stand growth and yield model used (TIPSY[6]). These greater-than-expected gains were also observed at age 12 (29% and 48%).

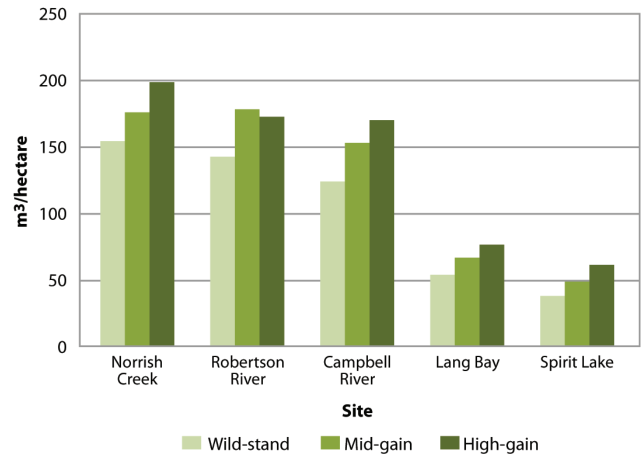

Figure 1. Comparison of age-20 volume/ha by site and seedlot genetic worth (GWg) across five coastal Douglas-fir realized genetic-gain trials. Wild-stand seed (GWg=0), mid gain (GWg=10), and high gain (GWg=18) are compared in 100-tree block plots.

Data show average volume/ha for the 2.3 m, 2.9 m, and 4.0 m spacings. Data from the 1.6 m spacing are excluded here, as this stand density is outside normal operational practices.

Stand density effects

Both volume per hectare and DBH varied significantly among the stand densities used, with the tighter density having the greatest per-hectare volume and the smallest average per-tree volume. Height differences among densities were small, but the data suggest that height suppression may be starting in the narrowest stand density.

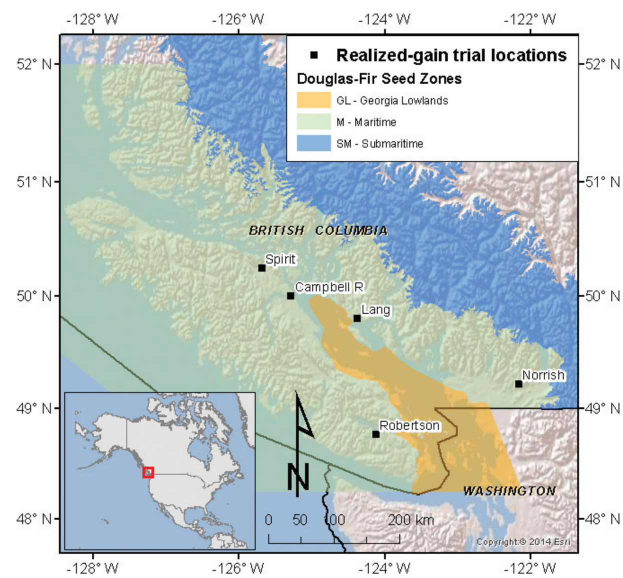

Figure 2. Douglas-fir realized-gain trial site locations.

APPLICATION OF RESULTS

Results from this study add confidence to seedlot genetic worth estimates and the application of these values in timber supply analyses. These, and future data from this study will help refine growth models, such as TASS and its interpolation program, TIPSY, and support the ongoing development of genetic selection procedures for tree breeding and seed orchards.

[1] Technical Advisor to SelectSeed Ltd. and the Forest Genetics Council of BC. jwoods.FGC@shaw.ca

[2] Scientist, BC Ministry of Forests, Lands, and Natural Resource Operations, Tree Improvement Branch Michael.stoehr@gov.bc.ca

[3] The first technical report in this series reported age 12 results. See http://www.fgcouncil.bc.ca/Factsheet2-DFir-13Apr11-Web.pdf

[4] Stoehr, M., K. Bird, G. Nigh, J. Woods, and A. Yanchuk. 2010. Realized genetic gains in coastal Douglas-fir in British Columbia: Implications for growth and yield projections. Silvae Genet. 59(5):223-233.

[5] Data for 1.6 x 1.6 m spacing excluded as this spacing is not used operationally.

[6] Mitchell, Kenneth J., Stone, Michael, Grout, Shelley E., Di Lucca, Carlos Mario, Nigh, Gordon D., Goudie, James W., Stone, Jeff N , Nussbaum, Albert J., Yanchuk, Alvin, Stearns-Smith, Stephen, and Brockley, Robert. 2004. TIPSY V4.2 http://www.for.gov.bc.ca/hre/software/