COMMERCIAL DOUGLAS-FIR

Douglas-fir *(Pseudotsuga menziesii)* has been grown in New Zealand for over 160 years. The good structural qualities of its timber have earned it a sound international reputation and world-wide market.

QUALITY WOOD, SOLID MARKET

Douglas-fir is a softwood species indigenous to North America and Canada. It was first introduced to New Zealand mainly from Washington state in the USA and British Columbia, Canada. Provenance trials with seed sourced from the USA in the 1950s identified that trees from the warmer, southern end of their natural range were better adapted to New Zealand conditions than earlier introductions.

New Zealand's southern South Island regions are among the best in the world to grow Douglas-fir. Although slow growing initially, the volume growth of 50-year-old stands can be as much as 50 cubic metres per year. Although Douglas-fir can live for 1,000 years, maximum stand volumes are attained at less than 200 years.

Site productivity and growth. Early plantations of Douglas-fir were slow to establish, however awareness of the role of mycorrhizal fungi has resulted in current New Zealand planting stock carrying the correct mycorrhizae to the planting site. Trees can now double their height in the first year.

Douglas-fir was originally seen as a shade-tolerant species with excellent health. Swiss needlecast *(Phaeocryptopus guemannii),* was first noticed around Rotorua in 1959, spreading slowly southwards until it had permeated all Douglas-fir stands in New Zealand by 1980 and dampened enthusiasm for further planting. However, stands in the colder, drier southern regions had much lower levels of infection and better health than North Island stands.

Further foliage studies showed that provenances orignating from the coastal 'fog-belt' regions were more resistant to needlecast than those from inland areas with dry summers. Seed that had been collected near Fort Bragg (in the Californian fog-belt) came into production in New Zealand in 1978 and were the source of some large stands from the early 1980s onwards.

An increase in price for Douglas-fir timber in the 1990s led to an upsurge in plantings, but on higher altitude sites, making them prone to form problems due to wind damage.

Douglas-fir (Pseudotsuga menziesii) *foliage*

The good structural qualities of Douglas-fir timber have earned it a sound international reputation and world-wide market.

Wood quality. Sawing studies and stake tests on locally grown Douglas-fir confirmed the timber had the same good wood properties (high strength and durable heartwood) as USA grown timber. However, the knotty wood and wider 5-8mm growth rings of the younger locally grown trees compared unfavourably to the clear timber and 1-2mm growth rings from old growth trees. The wood from 'second growth' stands is now all that is currently available from America, and looks much the same as New Zealand grown timber.

Genetics. The first genetic improvement work focused on improving growth rate. With funding from Proseed, Scion selected 200 vigorous, well formed trees in the provenance trials and grafted them for a seed orchard in 1988 and 1989.

Additional seed was collected from young, vigorous stands in the fog-belt zone of California and Oregon to establish a large scale breeding programme in New Zealand. A progeny trial from this seed was planted in 1996 on four sites of good growth, and seed source trials of bulked provenances planted on seven high altitude sites. These were assessed in 2007, and 10-12 trees were selected from the most vigorous and best formed families for testing timber stiffness. Sixty of these were then selected for grafting into seed orchards.

These are well-formed trees with above average timber stiffness and growth rate despite the negative correlation between the two traits. Fifty further selections were made and grafted up from stands of coastal Californian origin, producing their first seed crop in 2010. The resultant seed collections were used to plant genetic gain trials on three sites in 2012, with seed commercially available from Proseed and Dusky Forest Seed.

Silvicultural practices. Thinning and pruning trials were installed into a number of stands in 1993 and 1994 and measured regularly since. The green crown has risen high enough so that branches along the log length are dead and branch diameters can now be measured.

Recent studies have shown that the lowest stocking of 250 spha allows branches to grow unacceptably large. Even moderate stockings of 500- 750 spha lead to the formation of branches big enough to downgrade stiffness. Pruning for stiffness is a possibility but the premium will need to be more than the current $5 per cubic metre.

Current regimes favour planting 1,666 spha to enable early canopy closure and restrict branch diameter growth. The next step is a thin-to-waste to 800 spha at a mean height of 14 metres (age 15-20). A further production thin to 500 spha at about 30 years is possible on sites that are not too steep for logging machinery.

Heading into the future. Work on producing clonal lines showed that young plants could be multiplied into good planting stock, but the cuttings remained dormant in the nursery for one year and tree vigour fell with the age of the stool plants. Experiments with embryogenesis, based on techniques discovered with radiata pine, have proved successful. We aim to use this as a platform for other technologies, including the development of continuous stool bed systems.

ABOUT SCION

Scion is a Crown Research Institute that specialises in research, science and technology development for the forestry, wood product and wood-derived materials and other biomaterial sectors. Scion's purpose is to create economic value and contribute to beneficial environmental and social outcomes for New Zealand. We offer research and development services across the entire forestry value chain, including forest and climate change, forest health and biosecurity, rural fire research, forest management and tree improvement.

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This research now sits within the Specialty Wood Products Partnership.