

# Douglas-fir

## Research Cooperative

No. 7, December 2005 **Newsletter**

### Chairman's comment

We have had another busy year, again with growing membership, and expanded research areas. Membership is greater now than the Co-op has been previously, which is very encouraging as it is running against the current forest industry trends.

Research projects cover the full spectrum of the Douglas-fir industry from genetic improvement through to timber properties. They include work relating to test-house research run by BRANZ, following up on durability/permeability properties, and stiffness comparisons with radiata pine in line with changes to MSG and visual stress-grading requirements. The Co-op has always set itself the goal of maximising output against members' contributions, and this year has been no exception with a record number of projects completed.

Both Leith Knowles, our manager, and Nick Ledgard, our secretary, continue to be leading authorities in their respective areas. In particular, Leith continues to interact with PNW Douglas-fir growers, resulting in joint research projects, while Nick

continues to gain respect on Douglas-fir environmental issues. It is this depth of knowledge, and the satisfaction that comes with rapid progress, that keep the Co-op in the must-have category for the various members.

The Co-op has firmed its relationship with the newly incorporated Douglas-fir association, which shares much common membership, and we look forward to new challenges in 2006.

*Co-op Chairman Phil De La Mare (middle) and Manager Leith Knowles (right) address members in a production-thinned Douglas-fir stand at Naseby Forest.*



### Benefits for members start to accumulate

The benefits of more than 10 years of research are becoming increasingly available to members and associate members of the Co-operative. This newsletter summarises some of the main areas of activity and recent advances which have enabled us to:

- Enhance the short-term production and availability of quality seed
- Utilise the significant seed sources available within New Zealand to achieve long-term genetic improvement
- Develop techniques for propagating Douglas-fir vegetatively
- Develop methods to identify trees and stands with stiffer timber
- Continue to develop and improve the Douglas-fir calculator
- Develop individual-tree growth models
- Better understand wilding spread
- Maintain, measure, and analyse the long-term silvicultural trials
- Quantify the effect of site and exposure on growth and stem malformation
- Compare growth of Douglas-fir in New Zealand with the Pacific Northwest

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## Understanding wilding spread

Natural regeneration, or wilding spread, of introduced conifers is causing increasing concern in many parts of this country. Over recent years, more than 50% of the Department of Conservation's weed control budget has been spent on wilding control. The most well-known cases of wilding spread usually involve species which are not planted commercially today — larch and contorta, Corsican, dwarf mountain, and Scots pine.

Douglas-fir is known to be more shade-tolerant than the common

The risk of spread can be minimised by proper siting of plantations, relative to exposure (which aids distant seed dissemination) and surrounding land use — particularly that involving grazing, which even at light levels, can markedly reduce wilding establishment. Current research is aiming to assist members by determining how risk of spread can be reduced further by marginal plantings of less spread-prone species, and the strategic use of fertilizers to increase competition from adjacent resident vegetation.



*Douglas-fir, being more shade-tolerant than most pines, is capable of growing through low stature shrubs.*

pines, which makes it of greater risk to open native shrublands and forests. Despite this, Douglas-fir did not feature in early publications addressing wilding spread. The situation has changed significantly over the last 10–15 years, with increasing incidence of Douglas-fir wildings being recorded. The main reason is thought to be greater availability of the appropriate mycorrhizas, which enable young seedlings to survive and grow rapidly from an early age. Spread of Douglas-fir is enhanced by the light seed weight (30% of that of radiata pine), and by the way cones are displayed to release seed — hanging from the ends of branches (cf. radiata pine cones held close to stem and branches).

## Enhanced seed production

We have known for some time that Douglas-fir grown in New Zealand from seed sourced from Coastal California and Coastal Southern Oregon confers considerable growth advantages compared to seed from more northern and inland sources. With pitch canker being recently detected in New Zealand on material from a North American Douglas-fir seed orchard, we have no choice but to become self-sufficient in seed production.

Douglas-fir often exhibits erratic seed production, especially in the central North Island, whereas in Nelson, Canterbury, Otago, and Southland seed yields can be copious and less intermittent. Suitable stands in these regions in the 12–25 years age bracket are being identified. The best trees for “growth and form” are marked, and sound velocity measurements are taken at breast height. After thinning, seed will be preferentially collected from those with high sound velocities. Scion material will be collected from the very best for addition to the breeding programme.

## Improved genetics

In the 1980s, trees of good growth and form were selected from the 1957 and 1959 Douglas-fir provenance trials, and from some production stands. These “plus” trees were climbed for scion material, which was grafted for seed production. Additionally, in 1993 the Coop collected seed from wild stands in coastal Oregon and California, and received additional seed from selected parents under test in tree improvement programmes in the Pacific Northwest.

In 1993, seedlings from 222 open-pollinated families, together with eight New Zealand land-race seedlots, were planted out in nation-wide seed source and progeny trials to enhance our breeding population.

Early results from these trials confirm the better performance of coastal Californian and Southern Oregon seedlots, with the New Zealand landraces of that origin consistently in the top bracket. Of possibly even greater significance, was the very good growth of control-pollinated (CP) seedlots from the grafted trees resulting from the 1959 provenance trial selections.

This bodes well for future access by Coop members to seed produced from the orchard — especially when the 1996 trial plantings reach sufficient maturity (probably around age 12–15 years) for wood quality traits to be assessed in detail. Ongoing selections of this material will continue to feed into the breeding programme.

## Rewards from long-term silvicultural trials

Currently the Co-op is responsible for eight large replicated silvicultural trials. These are designed to test thinning and pruning options on a range of sites, and contain some 200 permanent sample plots. Most of these are assessed on a 2- to 3-year cycle, with the results being fed into the permanent sample plot (PSP) system. Such data are vital for accurate growth prediction and modelling. In addition to growth and yield information, the known silvicultural histories mean that at maturity these trials also provide ideal material for comparative studies of wood quality.

## Exposure and stem malformation

Forestry visitors from North America frequently comment on the poorer form of New Zealand-grown Douglas-fir compared to their homeland. There is no doubt that a major cause is our rapid growth in combination with exposure to our more windy environment. A recent study has used Topex to measure exposure and to quantify its effect on volume growth and stem form. The end result will allow managers to use Topex maps to site Douglas-fir plantations so that the effect of exposure is minimised.

## Vegetative propagation

The ability to readily propagate Douglas-fir vegetatively is important for speeding up the genetic improvement process. It allows for more rapid bulking up of scarce material from selected families or clones. Douglas-fir is not an easy species to grow from cuttings, but research is showing that certain strategies can enhance the process. This technology will enable Co-op members quicker access to improved seed.

## Comparison of Douglas-fir growth in New Zealand and the Pacific Northwest

Collaboration with the Stand Management Cooperative at the University of Washington in Seattle has permitted a general comparison of the growth of managed Douglas-fir plantations in New Zealand and the Pacific Northwest (PNW). Data from some 300 sample plots located between Coastal British Columbia and Coastal Oregon were compared with data from some 1600 sample plots located throughout New Zealand. The analysis showed that in terms of height growth, both sets of data are similar, with a mean site index (mean top height at 40 years) of around 32 m. In terms of basal

area growth and overall volume yield, they are quite different. For the same silviculture and age, Douglas-fir in New Zealand has much higher annual basal area increments, and therefore much higher stand volumes. The 500 Index, which is an estimate of the mean annual volume increment ( $m^3/ha/yr$ ) of a 40-year-old stand that has been thinned to 500 stems/ha by a mean top height of 15 m, is 18.8 in NZ and 12.4 in the PNW. This shows that volume growth of Douglas-fir is typically 50% higher in New Zealand than in the PNW.

## Develop methods to identify trees and stands with stiffer timber

For structural timber, stiffness is the most important wood quality trait. Because it varies so much between individual trees and between stands, a simple means of measuring stiffness in standing stems is an essential component for stand description, and to enable cost-effective tree selection for the breeding programme. Various acoustic tools are being used to relate tree and log characteristics to sawn timber stiffness. So far three stands have been sampled — Rotoehu, Tapanui, and Whakarewarewa — with the method being steadily refined to the point where we are now ready to apply these techniques on a wider scale. The results show that stiffness of Douglas-fir timber can be predicted from non-destructive measurements at breast height on standing trees, and even better from measurements of logs.

Overall, the studies are confirming that Douglas-fir timber is much stiffer than standard values commonly used for radiata pine, and that timber stiffness can be predicted from tree and log measurements.



*Measuring timber stiffness on a standing tree using the IML meter.*

## Douglas-fir Calculator V2

From modest beginnings, the Douglas-fir calculator has been further developed in collaboration with the New Zealand Farm Forestry Association. Technical knowledge and funding from the Co-operative have been combined with substantial additional funding from the MAF Sustainable Farming Fund. The Douglas-fir Calculator V2 includes all the latest New Zealand-wide functions developed for predicting Douglas-fir growth and quality at the stand level. Training courses have been run throughout the country, and suggestions for improvements have been included in the latest release.

Patrick Milne, associate member of the Co-operative, forestry consultant, and NZ Farm Forestry Association vice president, is a keen advocate. At a recent field day in North Canterbury Patrick used the calculator to inform the 100 or so participants of the growth performance and potential of the



*Farm foresters in a 190-ha Douglas-fir plantation on Island Hills in North Canterbury. The Calculator was used to inform those present about the performance and potential of Douglas-fir on this site.*

Douglas-fir stand they were inspecting. He calibrated the site for productivity, scheduled the stand for thinning, and compared alternative silvicultural regimes for yield and profitability. He also examined log and wood quality issues. Patrick says "It is difficult to imagine how I

could quickly source such information without the calculator. It comes into its own in delivering the extensive knowledge generated by the Co-op in a form that I can use in my everyday work. It is also extremely easy to use".

## Individual-tree growth models.

In addition to developing a nation-wide growth model that operates at the stand level, the Cooperative has just completed development of three growth models that operate at the level of the individual tree. These are designed mainly to project data from mid-rotation and pre-harvest inventories, where detail at the level of the individual tree is required. The three models are based on data from the South Island, the North Island, and for all New Zealand. The models can be utilised within any computerised simulation system (such as Atlas Cruiser, Atlas Forecaster, YTGen) to more accurately reflect the growth history and probable future growth of individual trees within forest stands. The models will soon be released for testing by members.

### Membership

#### Members (13)

CHH Ltd  
City Forests Ltd  
Ernslaw One Ltd  
Fairlight Station Ltd  
JPS  
Kaingaroa Timberlands Ltd  
P.F. Olsen & Co Ltd  
Proseed NZ Ltd  
Rayonier NZ Ltd  
Red Stag Timber Ltd  
Selwyn Plantation Board Ltd  
Wenita Forest Products Ltd  
Weyerhaeuser New Zealand Ltd

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#### Associate Members (19)

Appletons Tree Nursery Ltd  
Avenel Farm  
Guild Forestry  
Edendale Nursery  
Ford's Nurseries  
Forest & Woodlot Consultants Ltd  
A W Gordon  
Laurie Forestry Ltd  
Leithfield Nursery  
Mark Belton & Associates  
PFS Consultants Ltd  
Piers Maclaren & Associates  
Rangiora Nursery  
Ruru Willis and Co Ltd  
Southern Cypresses Ltd  
Southern Forests NZ Ltd  
Waiariki Institute of Technology  
Warren Forestry Ltd  
WSM Ltd

**Next Co-op meeting in Dunedin, 20–21 February 2006**

**Hosts: City Forests, Wenita, and P F Olsen**