





Sustainable Land Management Programme

### Introduction

Douglas-fir ranks as the second most important softwood in New Zealand, after radiata pine, and occupies about 5% of the total plantation forest area. Most of the Douglas-fir sawn timber that is produced comes from the central North Island and from the northern South Island.

Douglas-fir occurs naturally in western North America where it is better known as Oregon Pine. It was first introduced to New Zealand in 1859 and was commonly used for amenity and farm plantings, especially in the South Island.

On favourable higher altitude sites, Douglas-fir exhibits a significant growth advantage over other species. A high proportion of the tree's wood is heartwood, which is non-durable in ground contact. Consequently, it is most commonly used for structural purposes in engineering and construction.

# Siting

Douglas-fir grows well over most of the country in areas which receive moderately high rainfall (1000 to 1500mm annually). Growth is generally best on moist, free-draining uncompacted soils of moderate fertility. The altitudinal limit for good growth of Douglas-fir is about 900 metres in the North Island.

Generally, at all altitudes, wind exposure is considered to be the main growth limitation in NZ. Nevertheless, Douglas-fir can recover well from



Fifty-five year old stand of Douglas-fir

exposure damage, and during the first 20 years of growth it can often replace a stripped or deformed leader resulting in little permanent stem malformation. Exposure damage can be reduced by planting at stocking levels sufficiently high enough to create mutual shelter among the established trees.

Damage and mortality caused by late spring or summer frosts are important factors causing failure of Douglas-fir plantings. If severe frosts occur at the time when seedlings are flushing, soft foliage may be killed and buds and bark may be damaged. Frost damage can allow fungal attacks and mortality can be high. Frost damage is most probable whenever airdrainage is poor, therefore, frost hollows should be avoided.

### **Establishment**

Good seedling quality, planting procedures and weed control are necessary for the successful establishment of Douglas-fir. In addition, success with Douglas-fir will be enhanced when well-grown, correctly conditioned seedlings with moist roots are planted on weed-free sites. Seedlings are generally slow growing over the first few years, however, by using sturdy stock of moderate to large size, survival and growth potential is improved on most sites.

Larger seedlings are more tolerant to browsing damage, compete better with weeds, and inoculate new sites with beneficial mycorrhizae. Mycorrhizae fungi have a beneficial association with the roots of Douglas-fir and may be essential for healthy growth of the tree. In general, seedlings should conform to the following specifications:

- Height
- 30-60 cm 8-11 mm
  - **Root-collar diameter** Shoot/root length ratio No more than 4:1
- **Root system**
- Fibrous, mychorrizally active, moist at planting Dormant; cool-stored
- General condition

Note: Douglas-fir seedlings have fine root systems and should be prevented from drying out

### Silviculture and Management

Historically, Douglas-fir has provided timber for framing or engineering purposes due to its high stiffness and strength. High grade timber is produced through planting densities. For example, after canopy closure, shaded branches are naturally suppressed, leaving sound knots within the stem. Generally, pruning is not practised to produce framing timber because Douglas-fir has many small branches and pruning costs are twice as much per tree as radiata

pine. If trees are pruned to produce clear-wood, a crown height of 5-6 metres should be left.

Current silviculture regimes aim to produce high strength timber over a 45 year rotation using initial stocking rates of 1500-1600stems per hectare (sph). Early thinning is necessary to maintain diameter growth and facilitate a healthy crown. A final stocking rate of 250-500 sph should be targeted.

Initial stocking rates should be greater on exposed terrain at higher altitudes so that trees benefit from mutual shelter. Furthermore, an initial stocking level of 1600 sph is recommended to restrict branch diameter to less than 400mm.

Trees are thinned to waste before age 20, to achieve a density of 300-600 sph if no further thinning is intended, or 500-800 sph if production thinning is planned for later.

Production thinning is usually scheduled at 25-30 years of age with the stand being reduced to 250-300 sph.

### Weed Control

Douglas-fir seedlings are sensitive to weed competition. Consequently, growth may be significantly retarded if weeds are not effectively controlled during the first two years after planting.

Pre-plant spraying is important because Douglas-fir has a low tolerance to many forestry herbicides. Before planting, existing vegetation should be removed with glyphosate (eg. *Roundup* or *Trounce*) and/or metsulfuron (*Escort*). If *Escort* is used, planting should be delayed for at least two months and possibly as long as nine months due to residues. Gardoprim (*terbuthlazine*) is the only herbicide with a specific label recommendation for use with Douglasfir and can be sprayed directly over the top of the tree before bud burst (ie, while trees are dormant).

Achieving a high survival rate is paramount, as Douglas-fir tends to extend its branches radially into crown gaps, and in doing so dramatically increases branch size.

# Growth and yield

Douglas-fir can out-perform radiata pine on some sites, despite requiring a longer rotation length and producing smaller logs. This usually occurs at higher altitudes where wind and snow damage can reduce the growth of radiata pine.

Douglas-fir has a distinctive growing season, from September to April in New Zealand. Growth stops completely for winter, making it resistant to seasonal frosts. However, new growth remains susceptible to out-of-season frosts.

Up to 30 years of age, increases in wood volume are relatively slow. When harvested at 45 years of age, an average recoverable volume of 720 cubic metres per hectare can be expected.



Open grown Douglas-fir

### Regeneration

Douglas-fir regenerates freely around mature trees in the absence of browsing, and can self-seed onto open country or pasture. Viable seed production occurs at age 12 which may result in undesirable establishment – if not controlled.

### Pests and disease

Douglas-fir is a relatively healthy species, however, it can be affected by a wide variety of insect pests, pathogenic fungi, environmental factors, and animal damage. In the past, Swiss needle-cast fungus has caused a significant reduction in the growth of many older stands. However, good management such as the use of the most suitable genetic material, and careful siting should partly offset the productivity loss due to Douglas-fir defoliators.

Newly planted Douglas-fir is also susceptible to browsing by hares and rabbits, which need to be brought under control before planting.

For further advice or information contact:

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