

Establishing a Radiata Pine Woodlot

Sustainable Land Management Programme

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Introduction

Plantations of radiata pine cover 1.6 million hectares, more than 90% of New Zealand's exotic forests. In 1999, forest products contributed almost \$3 billion to export earnings.

Radiata pine's natural habitat is the Monterey Peninsula of California, and its correct name is in fact Monterey pine. It was introduced to New Zealand in 1859, reputedly by gold prospectors migrating from California. Ironically it has now contributed more to New Zealand's prosperity, than the gold they discovered here in the 1860s. Seed was initially used to propagate specimen trees for planting round homesteads and gardens. By the 1870s, settlers realised the species had a fast growth rate in the local climate, and started to use radiata for shelterbelts and woodlots. New Zealand became self-sufficient in radiata pine seed from the early 1880s, so today's trees are all descended from those early imports.

Private landowners, local bodies and the Department of Lands' new Forest Service began to establish commercial plantations from the 1890s onwards. The 1920s saw radiata pine become the main species for large-scale afforestation undertaken by the state to replace dwindling native timber reserves. At the same time, research began into utilisation of the timber. This laid the foundation for sawmilling from 1939, and for pulping and papermaking from 1950.

After the Forest Service was broken up in 1987, cutting rights to state plantations were sold. Since then, almost all new planting has been carried out by the private sector. An increasing proportion are by private landowners, rather than forestry companies. Farmers, joint ventures between farmers and investors, or partnerships of small investors, now account for about 40% of annual plantings.

This information sheet discusses the things a private landowner in Taranaki needs to consider when establishing a radiata pine woodlot. Information sheet (43) summarises the pros and cons of silvicultural (tree management) regimes once a woodlot has been established. Information sheet (44) outlines matters to be considered when harvesting the trees.

Growth potential

Growth potential on different sites used to be recognised by site index (mean height at age 20 years of the hundred largest-diameter trees planted on a hectare). However, site index is not a good guide to likely volume and quality of timber at harvest. Basal area at harvest is a far better guide. Dividing basal area by 60 cm gives an estimate of yield for a pruned stand; and by 50 cm, an estimate for an unpruned.

Yield tables (cubic metres per hectare) are even better. These are extrapolated from sites where the Forest Research Institute (FRI) has measured tree stands around the countryside, taking tree genetics and silvicultural regime into account.

Here are some yields for 30 year old radiata, pruned and thinned to final stand densities of 200-400 sph (stems/hectare)

Moist climate, warm summers, mild winters:
420 to 610 cubic metres of timber a hectare (m³/ha)
Dry climate, warm summers, mild winters:
560 - 780 (m³/ha)
Moist climate, mild summers, cool winters:
450 to 630 (m³/ha)
Dry climate, hot summers, cold winters:
310 to 700 (m³/ha)



Figure 1 Typical hill country woodlot

Site characteristics

The choice of a suitable site for radiata pine is arguably as important as the choice of a suitable tending regime. Radiata is a coastal species from a warm climate. Although a “weed” which can grow just about anywhere, it will grow better on sites which resemble its natural habitat.

Site characteristics which increase growth are :

- Warm, north-facing slopes
- Deep, fine-textured soils
- Well-drained but water-retentive soils
- Gullies sheltered from strong wind
- Few or mild frosts
- No or light snowfalls
- Regular rainfall

Site characteristics which decrease growth are :

- Cold, south-facing slopes
- Shallow or stony soils
- Poorly-drained or waterlogged soils
- Ridgetops exposed to strong wind
- Frosts greater than -7°C
- Heavy dumps of snow
- Irregular rainfall or drought

Taranaki’s climate and terrain generally favour growth of radiata. However, north-facing and west-facing slopes produce trees with large diameters and large branches. Here a higher volume of timber can be carried as a final crop compared with southern or eastern slopes, where trees are thin and tall with smaller branches.



Figure 2 Pine trees grow better on a sheltered site with good soil

Apart from climate and soil, some sites’ potential for tree growth may be limited by the risk of extreme events :

- The Taranaki hill country is particularly susceptible to damage by soil slips. Erosion of hillsides can be significantly reduced by

planting trees, but very steep hillsides or gullies are still prone to slipping or toppling of larger trees; particularly where shallow soils over-lie sandstone or siltstone (papa).

- The Taranaki coast is prone to occasional strong gales which can break or uproot a proportion of trees. Constant salt spray malforms tree-tops.
- While the frequency of volcanic eruption is low in Taranaki, a heavy ash-fall could damage stands on the ring-plain, and any stands in the path of a lahar will be destroyed.

Some sites also have “man-made” limitations to tree growth. Examples are :

- Greater fire risk near roadsides, picnic areas and camp grounds
- Social constraints on planting near scenic reserves or waahi tapu
- Regulatory restrictions on tree-planting near power lines and airstrips
- Poor access, which may preclude planting areas at the back of a farm, without roads or tracks

What to plant

Today a young radiata pine is very different genetically to old trees descended from the original introductions. For many years now, FRI has been selecting seed from trees with good growth rate, form and disease resistance. Seedlings or cuttings propagated from these superior parents are coded according to the type of improvement :

GF	Growth and form
DR	Dothistroma resistant
LI	Long internode
HD	High wood density

The codes allow landowners to select seedlots with the traits required. Young trees are ranked according to the degree of improvement in growth and form, and numbered according to the seed source. An example is GF17 90.162. The number denotes radiata pine, with growth and form improvement ranking 17, propagated from seed collected in 1990, seedlot number 162 for that year.

FRI has released the more promising strains to commercial nurseries. Plants supplied by nurseries should come with a certificate identifying its origin and quality. Commercial forest plantations are typically planted with GF13-18 seedlings. GF19-27 seedlings are also commercially available but supply is as yet limited, so these tend to be used for small woodlots, or just a few compartments in large forests.

Planting material can be purchased either as seedlings or cuttings. Here are a few observations about their relative merits :

GF 0 seedlings - un-selected, variable quality. Unlikely to be supplied by reputable nurseries.

GF 1-14 seedlings - rarely available these days, except for GF13-14. 45 to 65% of stems acceptable as sawlogs; up to 18% gain in timber volume at harvest, relative to GF0. Growth rate will be slower than the new varieties, and tree form will not be as good. However provided stands are well-managed, timber properties such as proportion of heartwood, wood density and percentage defect-free core can be just as good as the newer varieties.

GF 15-23 seedlings - available in bulk from commercial nurseries. 70 to 80% of stems acceptable as sawlogs; 15 to 32% gain in timber volume at harvest relative to GF0. Will generally produce a well-formed tree, with a merchantable log, in 25 to 30 years' time. Timber quality should equal that of older GF 1-13 stands.

GF 24-27 seedlings - available in limited quantities. More than 80% of stems acceptable as sawlogs; better than 32% gain in timber volume at harvest. Produce very well-formed trees, generally merchantable at 25 to 26 years of age if planted on a good site. However, the fast growth rate may detract from timber quality, if not properly managed.

GF 28-37 seedlings - still being evaluated by FRI prior to release, or being bulked up by commercial nurseries prior to commercial sale.

Cuttings - available in limited quantities from some nurseries. Usually propagated from material with a GF rating in the range 17 to 27, cuttings are taken from plants up to 5 years of age in nursery beds or tree stands. When planted out in the nursery, they develop roots and superficially resemble seedlings. They then appear to recognise a "biological clock" so that a cutting from a three-year-old tree knows that it is three years old, and grows differently from a seedling. Advantages are smaller branches, fewer forks, straighter stems, sturdier growth form, less likelihood of root distortion at planting, less taper and thinner bark. On the other hand, some disadvantages have been observed where cuttings have been planted; notably greater branch growth at an early age. More pruning is needed. On windy or wet sites, a greater proportion of trees may lean or topple.

When and where to plant

Radiata seedlings or cuttings are planted in winter when they are dormant. Some tips to ensure successful planting follow.

Ordering - it is a good idea to order trees several months in advance, to ensure the nursery has sufficient in stock. If aged cuttings or high GF-rated seedlings are required, more than a year's notice may be necessary.

Storage - seedlings and cuttings are supplied bare-rooted. They are cheaper, easier to handle, and survive better than containerised stock. Good stock should have a root collar diameter of about 5 mm at base of stem, and a shoot length of about 300 mm green top. Keep it cool and moist, and plant it out within 2 days of receipt. Otherwise, there is a risk of planting failure.

Timing - . Taranaki frosts are usually not severe enough to damage pine seedlings, so need not be a factor in deciding when to plant. On fertile sites, plant in late winter or early spring - trees planted early in winter grow too fast and become prone to toppling at about 2 years age. On dry sites e.g. sand dunes, it is wise to plant early in winter, to ensure that trees are fully established before a drought arrives

Site preparation - if there is a weed problem, deal with it at the appropriate time in the season prior to planting e.g. March or April for blackberry; taking care not to apply residual herbicides such as Escort within two months of planting date. In Taranaki, pre-spraying with glyphosate is no longer the usual method of spot-releasing prior to planting pines in pasture. Instead, post-spray with valzine, terbuthylazine or hexazinone. Planting in native scrub requires clearance by cutting or crushing – best avoided, as it is expensive and may de-stabilise steep slopes.

Planting technique - the best tool is a tree-planting spade designed specifically for the job. "Cultivation" of planting spots is essential for good root placement. It allows roots to penetrate laterally for nutrition and vertically for anchorage. The following technique is recommended by FRI, and widely used :

- Dig the spade in a full spade-depth, and "cultivate" the soil by wiggling it back and forth. This creates a planting hole that is wide enough to take the roots. Single-cut planting is not as good a method. *Alternatively, use the newer +/- planting technique.*
- Place the seedling's roots in the bottom of the hole, and replace earth around them

- Pull the seedling up through the fill about 10 centimetres, to ensure roots are straight and foliage is clear
- Continue to hold the top of the seedling after pull-up, and firm the soil around the stem with the sole of your boot (holding the stem while firming-in prevents soil from bending the roots).

Spacing - What spacing to plant at, depends on what silviculture (tree management regime) is intended. For advice on this topic, refer to information sheet y, which also covers topics such as post-planting maintenance to protect against weed competition, pest damage or disease infestation.

Establishment costs

Typical establishment costs (winter 2000) are :

Site preparation

- spraying weeds, \$70-150/ha
- clearing scrub, \$500-1000/ha
- controlling pests, \$2-\$20/ha

Plants

- seedlings, \$210-\$260 per 1000
- cuttings, \$550-\$700 per 1000

Planting

- self-planted, \$0 a hectare
- contract labour, \$220-\$320 a hectare

Post-plant spraying

- \$150-\$250 a hectare

Remember to budget for additional items such as a constructing a stockproof fence (\$10 per metre) and bulldozing an access track (\$0.80 per metre), if needed.

Professional advice

It is a good idea to talk to forestry consultants, loggers, or timber buyers who have up-to-date information about silviculture, mill requirements, markets and prices for different grades of timber, tax planning, and similar topics.

Remember though, that these things cannot really be taken into account when planning to plant trees. They may be very different, when the trees are ready to harvest.

So this information sheet has outlined the things a landowner can control :

- Identify a site on the farm, where pines will grow well
- Check that trees can be easily harvested and transported from the site

- Obtain good-quality seedlings or cuttings
- Plant them well
- Choose an initial spacing which enables flexibility in future decisions about silviculture

Neglecting these things results in a poor stand of trees. Taking care of them at the outset, ensures that a good pine woodlot will be ready for whatever market conditions prevail, in 30 years' time.

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