Radiata Pine

Info Sheet No. 2 - Establishment

Private Forests Tasmania

This series on Radiata Pine has four parts. Each part can be read individually or as part of the series.

1. Overview
2. **Establishment**
3. Management Regimes
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ESTABLISHMENT

The successful establishment of any plantation crop requires careful planning, consideration of site factors, managing the timing of operations, and consideration of the season. Establishment includes the selection of the planting stock, site preparation (cultivation and weed control), planting, and post-plant management (browsing and weed control).

PLANTING STOCK

The genetics and associated growth, form and characteristics of *Pinus radiata* (Radiata pine) now available for commercial planting is very different to that available 10 or 20 years ago. Seed orchards have been established in Australia and New Zealand to improve the following characteristics:

- **Growth Rate** - Improved volume production.
- **Stem Straightness** - Increased percentage of acceptable trees within a stand.
- **Branching Habit** - Reduced pruning costs and higher quality unpruned logs.
- **Dothistroma Resistance** - Reduced incidence of needle-cast disease.
- **Wood Density** - Improved density for greater strength in end-products.
- **Spiral Grain** - Reduced spiral grain for improved stiffness and strength.

Seed is currently available from some forest companies and seedlings grown from improved seed are available from some Tasmanian nurseries. The degree of genetic improvement, which can be significant, will be reflected in the cost of the seed/seedling.

The type of seed orchard can reflect the degree of genetic improvement. Generally, moderate genetic improvement comes from **seedling seed orchards**, highest genetic improvement comes from **clonal seed orchards**. The type of seed production can also affect seed genetic quality and subsequent tree quality.

Seeds from **Open Pollinated** (OP) orchards are produced through random natural cross-pollination between trees, whilst seeds from **Control Pollinated** (CP) orchards are produced by artificial (manual) cross-pollination of specific trees with the desired characteristics.

Cost - As the level of seed improvement increases, so does the seed and seedling price. For OP seed an increasing level of improvement adds a few cents to the cost of each seedling.

CP seed can add 10-20 cents to the cost of seedlings, but produces a superior, more consistent and more reliable outcome than OP seed.

Fertile sites - Due to the rapid growth rates on high productivity sites, ***control pollinated seed bred for high wood density is highly recommended.*** There is currently concern in Australia and New Zealand regarding the volume of low quality wood produced by trees where breeding programs targeted growth rate and tree form alone. It has been observed since the harvesting and processing of such trees that fast growth rates can be associated with low wood density and poor wood quality.

Cuttings may be either ***nursery cuttings*** or ***physiologically aged cuttings***.

Nursery cuttings are taken from seedling stock and offer no real advantages other than the ability to multiply scarce seedlings.

Physiologically aged cuttings are taken from trees with excellent growth habits within established plantations or from nursery stoolbeds propagated from such material. Physiologically aged cuttings have the growth habit of a young tree rather than a seedling, with the following characteristics:

- Improved stem form with reduced taper.
- Smaller branch size and improved branch habit.
- Potential for greater wind firmness.

Cuttings can be considerably more expensive than seedlings. Cuttings are clonal material and the form of the tree is more consistent or uniform. This stock may be preferable to seedling stock when grown on very fertile sites or when planted at low initial stockings. On high fertility sites and situation of low initial stocking, ordinary seedlings may develop poor form. This additional investment in cuttings is often offset because better formed trees are produced at lower planting densities which have lower establishment costs. Such cuttings are worth considering when establishing small-scale agroforestry plantations or single row timber shelterbelts.

INITIAL STOCKING LEVELS

The initial stocking level (stems/ha) depends upon:

- Choice of intended management regime.
- Type of planting stock (seedlings or cuttings).

Clearwood Regimes

For clearwood regimes, considerably more seedlings are planted than the planned final stocking to ensure enough trees with suitable form, vigour and spacing are available for clearwood pruning.

Recommendation for high to very high productivity sites

Open-pollinated seedlings	Plant at 1,000 stems/ha (4.0m x 2.5m)
Control-pollinated seedlings	Plant at 833 stems/ha (4.0m x 3.0m)
Physiologically aged cuttings	Plant at 625 stems/ha (4.0m x 4.0m)

Recommendation for low to medium productivity sites

Initial stocking levels can be the same for high to very high productivity sites. If there is some doubt as to potential site productivity and the certainty of clearwood production on lower quality sites, a higher initial stocking has advantages. When planted at stocking levels, as recommended for clearwood regimes, the option of converting to a knotty sawlog regime is maintained. Growth rates can be measured at around age 5-6 to determine likely site productivity and a more informed decision made as to whether a clearwood regime or knotty sawlog regime is appropriate.

Knotty Sawlog Regimes

Higher stockings are recommended for knotty sawlog regimes as branch size is reduced and structural products have improved strength.

Recommendation

Open-pollinated seedlings plant at 1,111 stems/ha (3.0m x 3.0m) to 1,333 stems/ha (3.0m x 2.5m).

Preservation Regimes

Preservation regimes for posts and poles are usually established at very high stockings to control branch size and improve the strength of the products.

Recommendation

Open-pollinated seedlings plant at 1,600 stems/ha (2.5m x 2.5m).

SITE PREPARATION

Site preparation prior to planting is required to facilitate successful establishment and involves the following:

- Cultivation (required most sites).
- Weed Control (essential).
- Browsing Control (essential).

CULTIVATION

Soil cultivation is usually required to:

- Increase the effective rooting depth and ease of root penetration through the soil profile.
- Increase moisture availability (particularly at depth), survival and uniform growth.
- Reduce waterlogging during the establishment phase on wet sites by mounding.
- Improve weed control, particularly when residual herbicides are applied to cultivated soil.
- Provide easier planting conditions and therefore cheaper planting costs.

Deep Ripping to a depth of 60cm to 1m should be undertaken prior to the autumn break when soils are dry to enable the subsoil to be shattered. Deep ripping should not be undertaken when soils are very wet, as the subsoil is sliced rather than shattered. This can lead to soil damage and the concentration of roots along the rip lines, increasing the potential for windthrow. Ripping to these depths requires large bulldozers.

Note: *Ripping is not suitable for all soil types. Deep sands will not benefit from ripping. Soils with dispersible subsoils should not be ripped as additional water infiltration can result in dispersion of the subsoil, leading to potential tunnel and gully erosion.*

Mounding concentrates topsoil along the planting lines and should be positioned over the rip line. Mounds should be at least 30cm above the general ground level. Higher mounds are advisable for wet sites to increase drainage and successful establishment. Mounds should not consist of large clods because air pockets can reduce seedling survival. A second pass with cultivation equipment can be useful to reduce the extent of large clods of soil in the mound. Mounding in the autumn followed by spring planting is beneficial to enable winter rains to settle the mounds and reduce air pockets.

Row direction is important to conserve moisture and reduce the potential for soil erosion following cultivation. Refer to the Forest Practices Code or seek further advice on cultivation. Mounding on the contour is advisable even on relatively flat sites. On wet sites a slight fall towards drainage lines can help to reduce waterlogging. On dry sites, a slight fall away from the drainage lines towards the ridges can improve moisture retention.

First Rotation Sites

It is standard practice to undertake ripping and mounding for the establishment of Radiata pine plantations on ex-pasture sites. Cropping, in particular, can result in soil compaction. Some sites can be planted without cultivation, such as steep slopes with well-structured soils. Poorly structured soils will require cultivation. Spot cultivation may be possible on steeper sites.

Second and Subsequent Rotation Sites

Second rotation plantation sites are often spot cultivated. Spot cultivation while expensive provides numerous benefits. It is possible to plant between the stumps on second rotation sites. Although planting costs are higher, cultivation expense is foregone, resulting in considerably cheaper establishment. Snig tracks and landings usually require deep ripping to reduce compaction.

Note: *The Forest Practices Code provides guidelines and restrictions upon cultivation practices, depending upon soil type, erosion potential and slopes. Refer to the Forest Practices Code or seek further advice regarding cultivation for plantation establishment.*

WEED CONTROL

Pre-Planting Weed Control

Successful weed control prior to planting is essential to obtain successful, uniform establishment of radiata. In particular, the control of grasses is important on ex-pasture sites to reduce competition for resources. The use of residual herbicides, in accordance with label directions, is particularly important for weed control into the first summer. The presence of weeds during dry summer and autumn conditions can greatly reduce early growth and survival. Failure to control weeds successfully prior to planting can result in major difficulty and expense associated with post-planting weed control.

- Slash or graze the site to reduce the existing weed volume if grasses and broadleaved weeds are the major weed species. Woody weeds such as blackberry and wattles should be treated with herbicides 6-12 months prior to slashing or burning to ensure sufficient uptake and death of the root systems, ensuring minimal germination post-planting.
- Strip or broad scale spray with knockdown herbicides (eg: glyphosate) along planting lines 4-6 weeks prior to cultivation. Although sites can be cultivated without initial knockdown, a finer tilth is often achieved if existing weeds and associated root systems are dead.
- Apply residual herbicide and plant in accordance with the label instructions.

The following herbicide chemicals are for guidance only and does imply any endorsement by Private Forests Tasmania, additional advice must always be sought before selecting and applying chemicals.

General herbicide options for knockdown of existing weeds

- **Glyphosate** - knockdown capability only.
- **Triclopyr** - woody weed herbicide for the control of species such as blackberry.
- **Hexazinone** - knockdown and residual control.

Herbicide options for residual control of weeds

- **Hexazinone** - knockdown and residual control.
- **Simazine** - residual control only.

Hexazinone applied as a liquid formulation. Broadscale (ground and aerial), strip or spot application is possible.
Hexazinone applied as a granular formulation. Broadscale (ground and aerial), strip or spot application is possible. Spot application is undertaken with a Weed-a-Metre.
Hexazinone and simazine. Broadscale (ground and aerial), strip or spot application is possible.

Important Note: *Hexazinone and simazine have restrictions on the method and volume of application depending upon soil types, slopes, proximity to watercourses, etc. These chemicals require moist soil so that the chemicals can be absorbed by the root systems of weed species.* ***Do not*** *cultivate following the application of residual herbicides. Soil disturbance can greatly reduce the effectiveness of the herbicide. Read the label carefully and follow any restrictions upon use. Seek expert advice before carrying out on ground work.*

On sites where no cultivation is undertaken, slash or graze the site to reduce the existing weed volume. Strip or spot application of granular or liquid hexazinone is recommended. Planting should be delayed until the planting lines/spots become clearly visible.

Post-Planting Weed Control

Post planting weed control (releasing) can be achieved with the following techniques:

- Application of **hexazinone** specifically designed for weed control in radiata pine plantations, this herbicide can be used over the top of seedlings without shielding,

provided label directions are followed. Releasing with liquid or granular hexazinone is recommended.

- Application of **glyphosate** shielding against spray contact is essential as radiata is extremely sensitive to glyphosate. Can be successful with extreme care, although generally not recommended. Where possible, safer options for weed control are advisable.
- **Mulching** or the use of weed mats may be suitable in some bespoke cases but can be very labour intensive and expensive and is not commonly used for broad scale plantings.
- **Slashing** between the rows may reduce competition from weeds and improves access. Rows must be wide enough for a tractor and slasher and clear of obstructions. Steep side slopes can be hazardous.

BROWSING CONTROL

- Radiata pine is palatable to browsing species such as wallabies, possums, deers, rabbits, hares and livestock. Rabbits and hares can be responsible for snipping off seedlings at or near the base.
- Fresh pasture may be grazed preferentially to Radiata pine with seedlings remaining relatively free of browsing on some sites. Maintaining strips of pasture between the planting lines, or undertaking spot weed control retains an alternative food source. However, browsing should always be anticipated and prevention taken prior to planting.
- Heavy browsing pressure can be expected on ex-forest sites or on sites adjacent to forests where alternative food sources may be limited.
- Poisoning, shooting and trapping may be used individually or in combination. A permit from the Department of Natural Resources and Environment is required for these activities.
- Stock-proof fencing is required to exclude livestock. Stock may browse young trees or cause bark stripping. Cattle can cause physical damage by pushing trees over as they move through the plantation.
- Although expensive, wildlife-proof fencing to exclude native animals is recommended where browsing pressure is high. Wire netting with an electric outrigger to exclude possums or electric fences with multiple hot-wires can be used.

FERTILISING

Fertilising at establishment can substantially increase early growth and survival on most sites.

- Either 100g DAP (Di Ammonium Phosphate) applied to moist soil 1-2 months post-planting, provided that adequate weed control has been achieved, or 20g of a controlled release fertiliser (such as Multicote or Basacote) applied at the time of planting.
- High fertility ex-pasture sites and cropping soils with a history of fertiliser input may not require fertilising at establishment. Additional fertiliser, particularly nitrogen, can result in poor form. Double leaders and 'speed wobbles' can occur due to fast growth rates on high fertility sites.
- Nutrient deficiencies may occur on some sites. Laboratory analysis of pine needles can identify nutrient deficiencies. If necessary, seek professional advice, as some

symptoms may be representative of a number of potential factors. Once the deficient nutrient(s) are identified, fertilising can be undertaken from the ground or by air.

- Some Tasmanian soils are known to have nutrient deficiencies. Soils within the Launceston Tertiary Basin and the Midlands are often deficient in Potassium (K) and sometimes Boron (B). A specific N:P:K fertiliser may be required for such sites. Sandy soils may be deficient in micronutrients such as Copper (Cu). Trace elements can be applied with DAP or later if nutrient deficiencies occur.

It is recommended that professional advice be obtained, as it may be difficult to determine the exact fertiliser requirements for particular sites.

FURTHER READING

Maclaren, J.P., (1993), Radiata Pine Growers' Manual, FRI Bulletin No.18, New Zealand Forest Research Limited.

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