



Radiata pine for farm forestry

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*Radiata pine is a widely used plantation species in southern Australia. This Agriculture Note describes the characteristics, site requirements and wood quality of radiata pine (*Pinus radiata*) as a farm forestry species.*

Radiata pine is a versatile and popular plantation species, with almost 700,000 hectares planted in Australia. It can grow under a range of site conditions, is easy to establish, and produces large quantities of useable wood over a relatively short rotation. Management of radiata pine is well understood and documented, with improved genetic stock readily available. Radiata pine has a relatively low market risk, with established markets for a range of products.

Natural occurrence

Radiata pine naturally occurs at five locations in North America. Three of these locations are in California; Año Nuevo, the Monterey Peninsula and Cambria. The other two populations are found on the Mexican islands of Cedros (*Pinus radiata* var *cedrosensis*) and Guadalupe (*Pinus radiata* var *binata*). The species was introduced to Australia in the 1850's as an ornamental tree however was soon identified as being a suitable plantation species for a range of sites. There is a great deal of variation between the natural provenances, with a mixture of the Año Nuevo and Monterey provenances thought to be the main genetic basis of the plantation radiata pine in Australia.

Site requirements

Radiata pine requires minimum annual rainfall of 600 mm, with best development on sites with at least 750 mm annual rainfall. This species is unsuitable for plantations at altitudes above 900 m. It will tolerate 5-50 heavy frosts per year and even some light snow, however heavy snowfalls may cause stem damage. A mean temperature range of 25-27°C in summer and 2-5°C in winter is ideal. Radiata pine grows well on a range of soils, from deep sands to clays, although wet, heavy clays are not recommended. It shows best development on well-drained sandy clay loams at least 1 m deep. Radiata pine does not grow well in soils with a hardpan close to the surface, and has a low tolerance of poor drainage. For this reason it tends to grow better on slopes than on flat areas. Radiata pine may be blown over by strong winds on very wet or exposed sites, especially after heavy thinning.

Growth rates

Radiata pine is a fast growing tree, generally managed over a 25-35 year rotation. The average growth rate of radiata pine in Victoria is currently 18 m³/ha/yr, with more than 30 m³/ha/yr achievable on good sites. In New Zealand growth rates of over 50 m³/ha/yr have been recorded.

Management

Traditional management of radiata pine in Australia involves planting at a close spacing with multiple thinning operations carried out over the rotation. This management regime provides interim returns while increasing the value of the final crop trees.

In the past, owners of small pine plantations often found it difficult to market their thinnings, due to a limited market and the small volumes they had available for sale.

Consequently, many small growers have tended towards a 'clearwood' management regime, widely adopted in New Zealand. Under this regime, good quality trees are planted at a lower initial density and high-pruned to produce clearwood logs (see Agriculture Note AG1070: Radiata pine planning and establishment). Returns from thinnings are foregone in favour of production of high quality logs over a shorter rotation.

Radiata pine generally has very good form, depending on the quality of the site, planting stock and management. The genetic characteristics of the stock being planted are worth considering since extensive selection and breeding has been carried out in Australia and in New Zealand. Planting stock with particular genetic improvements can be selected to suit the site. Pruning and thinning requirements will vary depending on planting density and desired products. Weed control is essential during early growth, until the trees begin to shade out competition.

Pest and disease risks

Browsing by rabbits, hares, possums, wallabies or livestock may damage the growing tops or stems of young trees. Plantations that are under stress due to drought, severe pruning, over stocking or other factors are more susceptible to insect or fungal attack.

Pine needle blight (*Dothistroma septospora*) is a fungus that does not usually kill infected trees but may cause partial defoliation and slow growth. Diplodia canker

(*Diplodia pinea*) may cause leader dieback, crown wilt and whorl canker. It is also a major cause of blue stain of timber.

Sirex wood wasp (*Sirex noctilio*) is no longer regarded as a major threat to plantations due to improved stand management and biological controls. Another insect pest of radiata pine plantations is the fivespined bark beetle (*Ips grandicollis*), which infests young trees.

Monterey Pine Aphid (*Essigella californica*) was first identified in Australia in 1998. It has been associated with mild to severe defoliation in *Pinus radiata*. The potential impact of this aphid on commercial pine plantations is yet to be fully assessed.

Radiata pine itself may be considered a pest species, with wild seedlings germinating along roadsides and in areas of native vegetation. In some municipalities radiata pine is classified as an environmental weed, making it difficult to obtain a planning permit if required.

Radiata pine is a fire sensitive species, with a relatively poor ability to withstand moderate intensity fires.

Uses

Radiata pine may be used for a wide range of purposes, including light construction, furniture, panelling, internal flooring, mouldings, joinery, veneers and pulpwood. When treated with preservatives the wood is suitable for outdoor applications such as posts and poles. Small diameter logs produced from thinning operations are generally used for posts or pulpwood. Green foliage may be used as fodder for sheep and cattle, however can cause abortion if consumed in large quantities during pregnancy.

Wood quality

The wood is pale yellow-brown and is generally straight grained with prominent growth rings. It has low durability, however may be readily treated with preservatives for outdoor use. The wood machines and polishes well, with good nail holding and gluing ability, and resistance to nail splitting.

Green density is around 800 kg/m³, with an air-dry density of around 500 kg/m³ at 12% moisture content. Wood density increases as the tree ages, and may also be influenced by environmental factors. New Zealand research has found that trees grown at lower altitudes in warmer areas have a higher wood density than those grown at higher altitudes in cooler areas.

Logs tend to be free from internal defects and growth stresses, although resin pockets may be a problem, especially in areas subject to droughts and high winds. The central core may have pronounced spiral grain, shorter fibres and lower wood density (as low as 350 kg/m³). This corewood is usually confined to the first ten growth rings only.

Rapid harvesting and processing are required to avoid blue stain fungus infecting the wood, especially during the warmer months. This fungus does not affect the structural properties of the timber, however renders it unsuitable for appearance purposes.

Drying characteristics

Radiata pine is easy to dry, except for the central core that is prone to twisting. The timber dries rapidly, and is usually kiln dried directly from the green condition. Improved stability of the seasoned product is achieved by pre-steaming for several hours.

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Further information

Refer to Agriculture Notes: AG1070: *Radiata pine planning and establishment*.

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