



Using Rainforest Research

Forestry plantations on private lands: early growth rates encouraging

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With the World Heritage listing of rainforests in 1988, logging in north Queensland State Forests came to an abrupt halt. This resulted in a major decline in the availability of rainforest cabinet timber. Subsequently interest arose in the establishment of high value tropical hardwood plantations on cleared private land. A 1998 study involving Rainforest CRC researchers, identified 41,000 hectares of freehold land as suitable and potentially available for development of such plantations. Much of this land was on high rainfall sites capable of sustaining rapid tree growth.

At the time, lack of experience with hardwood species in plantations meant there was little information to use as a basis for management decisions on species choice, site selection, silviculture and other issues. The Queensland Forestry Research Institute (QFRI), a Rainforest CRC partner, has since established several species and silvicultural trials in the north Queensland region in order to address this deficiency.

Permanent Plots Established

Since 1992, government-sponsored programs such as the Community Rainforest Reforestation Program (CRRP) have resulted in the establishment of nearly 2,000 hectares of plantations on private land, a good proportion of which was considered agriculturally marginal. Most of these plantations are mixtures of native and exotic rainforest trees with other tropical hardwood species.

QFRI established a permanent series of sample plots within the CRRP plantations in order to measure tree growth across a range of sites in the Wet Tropics region. Researcher Mark Annandale and several Rainforest CRC students worked on this project at different times. Information from these plots will be used to:

- Select better performing species
- Identify appropriate sites for preferred species
- Develop management prescriptions for spacing, thinning and pruning
- Improve understanding of the interactions between species in mixed plantations



Mark Annandale beside a 9.5 year old *Cedrela odorata* during a taxa trial in the Innisfail area

In total, 104 plots were established at 56 different sites with an average stocking rate of 667 trees per hectare. Measurements have been taken for 51 species in all. Forty percent of the stands are considered in good condition, a further forty percent average, and twenty percent are poor. The most rapid early growth was observed in those with Eucalypt species, with mixtures of Eucalypts and rainforest species next most productive. Results from all sites have been summarised into four major regions (see overleaf):

- Cooktown-Ayton (10 sites)
- Innisfail (23 sites)
- Ingham (23 sites)
- Atherton Tableland (48 sites)

Conclusions from early results

The results of this study indicate that native and exotic rainforest trees and other tropical hardwood species can be successfully established in mixed species plantations on a range of sites throughout the Wet Tropics, including degraded and marginal agricultural land. With appropriate establishment techniques, early growth can be very rapid.

Further monitoring is required to determine whether these growth rates can be maintained. Analysis of the results of this study and other research will allow more careful matching of species to sites, and provide further information to plantation owners and managers to improve the overall performance of private plantations.

Providing science for the conservation and management of Australia's World Heritage tropical rainforests.



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The Rainforest CRC is a research partnership involving the Commonwealth and Queensland State governments, the Wet Tropics Management Authority, the tourism industry, Aboriginal groups, CSIRO, James Cook University, Griffith University and The University of Queensland

Annual Growth Rates for species in the four major regions

Figures in brackets refer to average height per year over 10 years, or mean annual increment (MAI). They are given for best performing species only in each region. See Table 1 for growth rates for the majority of other species.

Ingham (23 sites)

Plantations in this area were located on the coastal lowlands and upland areas around Mt.Fox. Average growth rates over 2m per year:

- *Eucalyptus grandis*
- *Eucalyptus cloeziana*
- *Tectona grandis*
- *Acacia mangium*
- *Eucalyptus resinifera*
- *Corymbia citriodora*

Notable species:

- *Elaeocarpus angustifolius*
- *Eucalyptus tereticornis*
- *Grevillea robusta*
- *Flindersia brayleyana*

Atherton Tableland (48 sites)

Growth on higher altitude sites was generally lower than on the lowlands. Only two species achieved greater than 2 m per year:

- *Eucalyptus grandis*
- *Eucalyptus pellita*

Growth between 1.5m and 2m:

- *Eucalyptus cloeziana*
- *Eucalyptus camaldulensis*
- *Eucalyptus crebra*
- *Eucalyptus dunnii*

Rainforest species with good growth rates:

- *Elaeocarpus angustifolius*
- *Alphitonia petrei*
- *Flindersia brayleyana*

Innisfail (23 sites)

Best average growth:

- *Eucalyptus urophylla* (3.3m)

Average growth rates over 2m per year:

- *Eucalyptus cloeziana*
- *Melia azerderach*
- *Eucalyptus robusta*
- *Eucalyptus pellita*
- *Acacia mangium*
- *Cedrela odorata*
- *Flindersia brayleyana*
- *Agathis robusta*
- *Cedrela odorata*

Cooktown-Ayton (10 sites)

Best average growth:

- *Acacia mangium* (3.3m)
- *Elaeocarpus angustifolius* (2.7m)
- *Eucalyptus cloeziana* (2.5m)

Next best average growth:

- *Eucalyptus tereticornis*
- *Acacia aulacocarpa*
- *Eucalyptus pellita*
- *Corymbia citriodora*
- *Eucalyptus camaldulensis*

Table 1 Average Height growth (m per year) of tree species planted in different regions of north Queensland

Species	Cooktown	Innisfail	Ingham	Tableland	Mean
<i>Acacia mangium</i>	3.32	2.28	2.08	-	2.56
<i>Eucalyptus cloeziana</i>	2.54	2.82	2.17	1.94	2.37
<i>Eucalyptus pellita</i>	2.18	2.43	1.70	2.04	2.09
<i>Eucalyptus resinifera</i>	-	2.02	2.09	1.86	1.99
<i>Elaeocarpus grandis</i>	2.56	1.74	1.92	1.73	1.99
<i>Eucalyptus tereticornis</i>	2.44	1.77	1.98	1.62	1.95
<i>Melia azerderach</i>	-	2.70	1.81	1.06	1.86
<i>Flindersia brayleyana</i>	2.46	1.86	1.69	1.36	1.85
<i>Tectona grandis</i>	1.20	-	2.11	-	1.66
<i>Corymbia citriodora</i>	2.12	-	2.01	0.74	1.62
<i>Cedrela odorata</i>	1.17	2.17	1.67	1.31	1.58
<i>Cardwellia sublimis</i>	1.46	1.36	-	-	1.41
<i>Khaya nyasica</i>	1.07	1.06	-	1.59	1.24
<i>Blepharocarya involucrigera</i>	-	-	1.56	0.74	1.15
<i>Flindersia pimenteliana</i>	1.38	-	1.27	0.71	1.12
<i>Terminalia sericocarpa</i>	0.64	1.24	1.25	-	1.04
<i>Euodia xanthoxyloides</i>	-	0.94	-	1.03	0.99
<i>Araucaria cunninghamii</i>	-	0.84	0.99	0.87	0.90
<i>Agathis robusta</i>	-	0.87	0.96	0.67	0.83
<i>Castanospermum australe</i>	-	1.00	1.03	0.46	0.83
<i>Paraserianthes toona</i>	0.78	0.72	0.83	0.65	0.74
<i>Alstonia scholaris</i>	-	0.83	-	0.55	0.69

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