CHAPTER 6 - ESTABLISHMENT AND NUTRITION

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Eucalypts can grow exceptionally fast if they are well sited and given the right conditions at establishment. If given the right start they can rapidly occupy the site, but if critical establishment inputs are missed out, they can sulk and remain moribund, albeit alive.

To achieve maximum productivity the strategy should be to cultivate fully, plant seedlings of superior quality, apply starter fertiliser amounts and maintain weed-free conditions until canopy closure.

Best growth occurs when cultivation, weed control and fertiliser are all supplied (Table 13).

Cultivation

Loosening of soil before planting is important for the successful establishment of eucalypts. It promotes root penetration and makes weed control easier. Effective cultivation can be achieved by V-blading, deep ripping, rotary hoeing or mounding. Mounding provides excellent protection from ground frost. If mechanical cultivation is impossible, soil in the planting spot should be loosened thoroughly with a spade.

Planting

Eucalypts should be planted in spring, after the winter frosts.

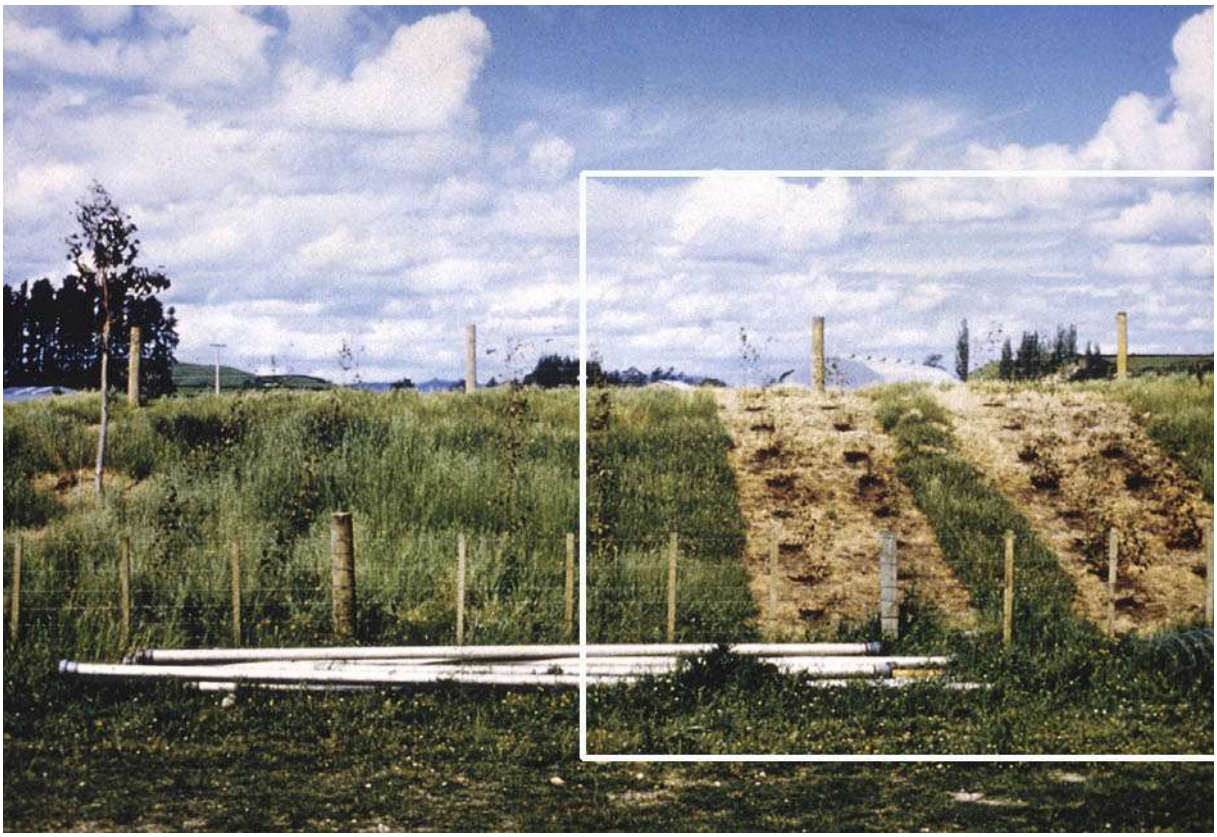
Eucalypts can be planted as 1/0 bare-rooted seedlings, although the use of container-grown seedlings is increasing. Containers increase efficiency if specific seedlots are to be used, and facilitate the raising of nursery stock for designated planting times. They are more convenient if stock has to be held over in the nursery.

Planting should take place within 48 hours of lifting the seedlings from nursery beds to minimise the time out of the ground. It is vitally important that they should not be allowed to dry out. Bare-rooted seedlings should be packed in polythene-lined multi-walled bags or in cardboard planting boxes, stored and transported in planting crates.

Each seedling must be planted carefully. The “positive pull up” technique will help to straighten the roots in the soil within the planting hole. Soil should be packed firmly around the roots to minimise distortion.

Table 13: Early growth of *E. regnans* planted on pasture near Hamilton, Waikato.

Treatment	Height at 14 months (m)	Survival (%)
No weed control; no fertiliser	1.5	22
No weed control; fertiliser	2.5	6
Weed control; no fertiliser	3.2	83
Weed control; fertiliser	3.6	94



Effects of weed control

14 months after planting

Weed control

Suppression of weed growth is essential. Competition from other plants must be kept to a minimum during the first two years if young trees are to establish successfully. The following procedures have been shown to assist establishment of eucalypts:

- *Pre-plant spraying*: Treatment of the site with a systemic herbicide (e.g., glyphosate) two to eight weeks before cultivation and planting to kill the tops and roots of grasses, ferns and blackberry.
- *Post-plant spraying*: Accidental spray-drift damage to eucalypt foliage should be avoided at all times. Depending on the range of weeds present, Gallant and Versatil, alone or in mixture, can be used during periods of active tree growth as well as periods of dormancy. Gardoprim has some limited knockdown ability, but if reasonable care is taken it is suitable for application around bare-rooted seedlings, especially when grass is short, but should not be used on low organic soils such as sands. Some growers have had considerable success release spraying around seedling eucalypts with glyphosate, either with or without a shield. However great care is needed to avoid spray getting on to any of the seedling foliage. Caution is needed when applying herbicides around container-grown stock (especially peat pots which can absorb and concentrate the chemicals in the pot walls).

Well prepared eucalypt planting site

Weed control spot size

The effect of the size of the weed-free area on early growth of *E. nitens* and *E. fastigata* has been investigated. Areas of increasing size between 0 and 8.4 m^2 were treated with a non-residual herbicide prior to tree planting on pasture near Rotorua. These were maintained around each tree by periodic spraying.

Preliminary results after one year showed that weed-free areas greater than 2.95 m^2 did not improve volume growth of *E. nitens*. There was no significant difference in the volume growth of *E. fastigata* planted in weed-free spots with areas between 1.4 and 4.2 m^2.

Source: Coker *et al.* (Unpublished report)

Fertiliser treatment

Application of fertiliser either slow release tablets at planting or applications approximately one to two months after planting is beneficial, especially where the soil has been cultivated and weed growth controlled. Although trials have only been carried out on a limited number of sites, it is generally accepted that fertiliser containing both nitrogen and phosphorus (applied at the rate of 90-120 g/tree) should be applied. On pumice soils only nitrogen fertiliser (urea - 60 g/tree) is needed. In order to avoid chemical damage to stem or root, the fertiliser should be placed in a slot located at least 20 cm from the base of the tree.

Eucalypt nutrition

Most eucalypts grow best on fertile soils, although some species (*E. muelleriana* and *E. pilularis* and some other *monocalypt* eucalypts) will tolerate poorer conditions. To increase early growth rates, the aim should be for balanced nutrition with high levels of nitrogen and phosphorus in stems, leaves and roots. Before a plantation is established on a new site, requirements for cultivation, weed control and fertiliser application should be considered. Growth response to the addition of nitrogen and phosphorus will differ with location and cannot always be predicted from the results of soil tests. Analysis for soil total nitrogen and Bray and Kurtz No. 2-available phosphorus are useful for identification of acute deficiencies. Repeated fertiliser application usually results in growth increase, but some trials have shown little long-term benefit and the extra expense may not be justified. On pumice soil, fertiliser treatment at time of thinning has been shown to increase stem diameter.

Table 14: Foliar nutrient levels recorded for *E. nitens.*

Nutrient	Number of samples	Mean	Range
N (%)	578	1.57	0.61-2.82
P (%)	553	0.11	0.50-0.219
Al (mg/kg)	20	17.24	7-33
B (mg/kg)	43	19.69	9-55
C (%)	20	54.92	54.19-55.6
Ca (%)	43	0.61	0.26-1.57
Cu (mg/kg)	43	3.6	1.3-6.0
Fe (mg/kg)	43	32	19-98
K (%)	43	0.80	0.30-1.35
Mg (%)	43	0.13	0.54-0.21
Mn (mg/kg)	43	651.56	73-2282

The importance of mycorrhizal interactions with eucalypts in New Zealand forestry is not well understood. Evaluation of mycorrhizal associations with eucalypt nursery stock is underway with nursery trials of *C. maculata* (Sustainable farming fund project 05/142).

The nutrient concentration of eucalypt leaves is not a reliable indicator of growth rate. Trends in the seasonal variation of foliar nutrient concentrations are not always repeated in subsequent years, and further research is needed to refine techniques of foliage sampling for diagnostic purposes. The total nutrient content of above-ground portions of tree stands has been quantified, but the long-term effects of eucalypt litter and harvesting residues on soil properties have not been studied in New Zealand.

Based on the nationwide *E. nitens* wood density study (see Chapter 2), there was some indication that very high rainfall and high levels of foliar nitrogen, phosphorus, and magnesium led to extremely low wood density.

Key Points

- Eucalypt species vary in their fertility requirements, several eucalypt species require fertile soil for optimum growth, while others such as some of the monocalypts can grow well on infertile sites.
- Establishment and early growth are improved by soil cultivation, weed control and fertiliser application.
- Foliar analysis is not a good indicator of eucalypt growth performance.

Suggested reading:

FRI 1982

Hall 2006

Hunter *et al.* 1989

Knight & Nicholas 1996

Nicholas *et al.* 1991

Vanner 1991