



## Establishment Performance of Native Shrubs - a comparison of container and open-ground plants



*Trials comparing the establishment performance of New Zealand native shrubs raised in open-ground nursery beds with those container-raised. Site now forms part of the Mahurangi Farm-Forestry Trail.*



### INTRODUCTION

The previous article describes two quite different methods used to raise native plants in nurseries: containers and open-ground beds. This article reports on the establishment performance of plants raised using the open-ground method and two common types of container. These results were obtained from planting trials established in three North Island regions since 2008 using a variety of native shrub hardwood and monocot species. The trials have recently been re-measured providing a good indication of the establishment performance of each nursery method, three to five years after planting.

#### *Collaborative project*

*This work, made possible by a grant from the Sustainable Farming Fund, builds on a previous SFF project initiated by Mahurangi Action. Collaborators include Tāne's Tree Trust, Lake Taupo Protection Trust, Auckland Council, Waikato Regional Council, Bay of Plenty Regional Council, Scion and Future Forests Research, and Taupo Native Plant Nursery.*

## Nursery methods

This article reports on the establishment performance of plants raised using the following 3 methods:

1. open-ground
2. pot, semi-rigid (1.2-litre) or planter-bag (PB3, 3-pint/1.7-litre)
3. root trainer (Hillson-sized)

Although some planter bag plants were used in the trials, for simplicity here both planter bags and pots are mostly referred to as pots.



*Dissimilar siblings—although grown from the same seed source and germinated at the same time, because open-ground, pot and root trainer plants, progressively, have less room for canopy and root development, their respective sizes at planting differ markedly (see Technical Article 5.3).*

## PLANTING TRIALS

### Trial sites

Planting trials were established in three North Island regions:

- Auckland region – Sandspit Road, Silverdale (a hill country site and a river terrace site);
- Waikato region – Waihaha, western Taupo;
- Bay of Plenty region – near Rotorua at Ngongotaha and Rerewhakaaitu.

Sites ranged from marginal erosion-prone hill country to recently retired riparian zones characteristic of productive landscapes throughout New Zealand. For all planting trials the trial layout is a randomised complete block design.

### Species

The trials focussed on evaluating the performance of the native shrub species commonly used in forestry revegetation programmes. These were raised in less than one year at the Taupo Native Plant Nursery. Seven species were raised by each of the three nursery methods, and used in most of the planting trials:

- harakeke (flax, *Phormium tenax*)
- karamu (*Coprosma robusta*)
- koromiko (*Hebe stricta*)
- manuka (*Leptospermum scoparium*)
- ti kouka (cabbage tree, *Cordyline australis*)
- toetoe (*Austroderia fulvida* and *A. fulvida*)
- kohuhu (*Pittosporum tenuifolium*).



*(Right) Kohuhu raised in a PB3 planter bag 4 years after planting in the Ngongotaha trial, near Rotorua – pole is 2m high.*

*(Above) Kohuhu planted 4 years at Ngongotaha. Rows with smaller seedlings and gaps indicate the relatively poor establishment performance of the root-trainer plants, compared with plants raised open-ground or in planter bags*



*Planting trial on a retired steep hill slope at Waihaha, western Taupo, 2 years after planting comparing the 3 nursery methods – open ground, pots, root trainers. Note the 3-tree rows for each species as part of the randomised complete block design (inset).*

### Site preparation and planting

In the Auckland region trials, rank grass sites were mowed before planting while recently retired sites had been grazed to leave short grass swards. There was no pre-plant spraying with herbicide.

At the Taupo and Rotorua trials, pre-plant spot spraying was used with glyphosate, surfactant and marker dye at label rates. For Taupo trials, rabbits and hares were excluded by the erection of a rabbit-proof fence and laying of pindone poison immediately after planting.

Plant spacing for the Auckland region trials was 1.4 x 1.4 m (5102 stems per ha) and 1.5 x 1.5 m (4444 stems per ha) elsewhere. Weeds were controlled at least twice per year for up to a maximum of 2 years after planting using glyphosate applied by knapsack sprayer.

## PLANTING PERFORMANCE

### Growth across all sites

Mean survival, and mean annual increment for height and crown spread for the 7 species within the first 3-5 years after planting across all sites is given in Figure 1. Survival averaged more than 80% for 6 of the 7 species and across most nursery methods, except for root-trainer ti kouka which averaged less than 40% survival, and for toetoe which averaged less than 60% survival for all nursery methods.

Height and crown spread increment was similar if not better for open-ground plants across most species compared to pot or planter bag plants (Figure 1). Manuka height growth for open-ground plants was the fastest for all species and methods. Height increment of root trainer plants, particularly for the monocots ti kouka, harakeke and toetoe, were less than the woody shrub hardwood species.

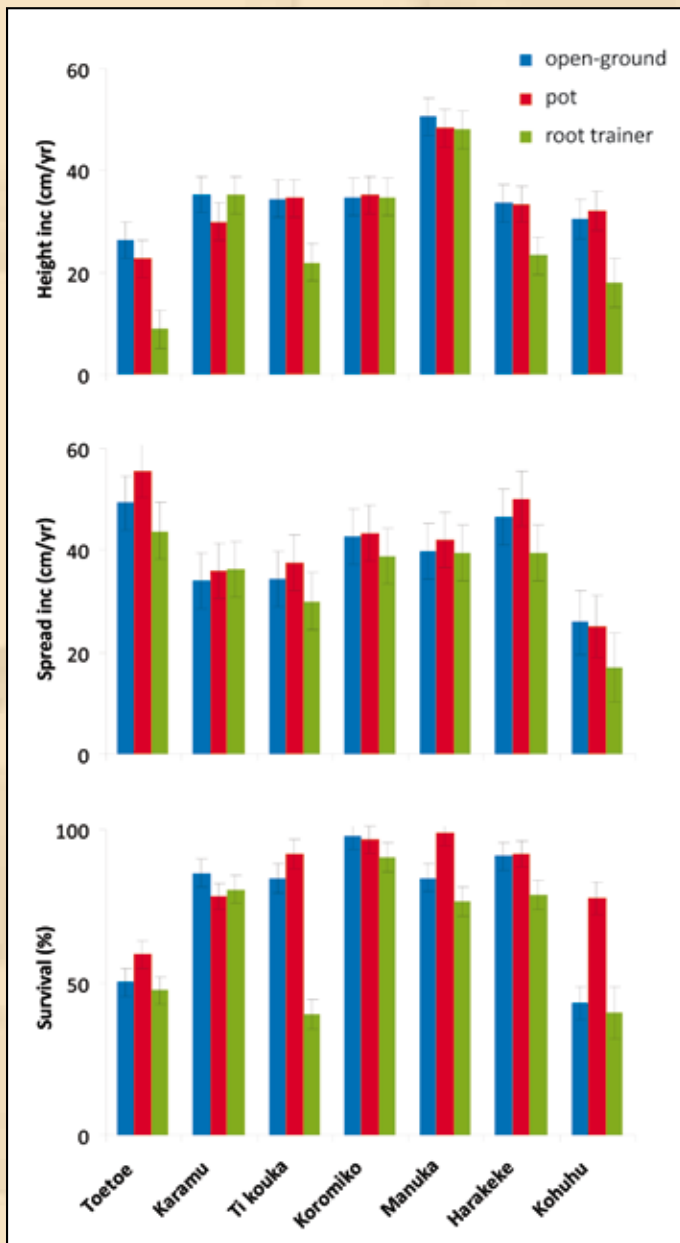
### Differences in planting performance

There are exceptions for some species raised open-ground. Consistently higher survival was a feature of manuka raised in the pots across all sites, compared to open-ground or root trainer plants. However, this advantage is likely to be more than offset by the significant cost difference between the nursery methods.

It can be difficult to form a compact fibrous root system open-ground with species such as *Pittosporum*, which tends to stay sparse and woody without extra care in root conditioning. This was reflected in poor survival of open-ground kohuhu plants in the Bay of Plenty and Taupo trials.

Harakeke survival was similar for open-ground and pots, with root trainers, particularly in most of the North Auckland sites, significantly less.

Survival of karamu was reduced in the first year after planting at the Taupo site due to an out-of-season frost, but there has been no significant additional mortality in the second and third years after planting.



**Figure 1:** Mean annual increment of height and crown spread, and mean survival, for the 7 native species raised open-ground, in pots (or planter bags) and in root trainers, 3 to 5 years after planting. Not all species were trialled at all sites. Error bars indicate standard errors.

## CONCLUSIONS

In general, there was no significant difference in survival and growth within the first 3-5 years between plants raised open-ground and in the larger containers (1.2-litre pots and PB3 planter bags) for the shrub hardwood and monocot species trialled. Higher mortality rates and/or maintenance costs, and slower growth can be expected in plants raised in small containers (Hillson-sized root trainers) with losses largely due to spindly plants being overtopped by grass competition, especially where timely weed control is not carried out.

These trials only evaluated establishment of some hardy pioneer shrub hardwood and monocot species often used to provide a protective cover as a first step in revegetation of indigenous forest. The results indicate an opportunity to significantly reduce the cost of establishing planted native forests using plants raised by the open-ground nursery method.

### Authors:

Cimino Cole, Mahurangi Magazine  
David Bergin and Mark Kimberley, Scion

Contact: Tāne's Tree Trust

Website: [www.tanestrees.org.nz](http://www.tanestrees.org.nz)



Tāne's Tree Trust promotes the successful planting and sustainable management of New Zealand native trees and shrubs for multiple purposes.