



TĀNE'S TREE TRUST

Native Forests for our Future | Hereherea te Wao-nui-a-Tāne

Establishing Native Forests

TĀNE'S TREE TRUST FACTSHEET SERIES

How to plant native seedlings

FACTSHEET 5, 2022 – by Mike Bergin & David Bergin

Refer to the [other factsheets in this series](#) for more about successfully establishing native forests.

Online version of this document with clickable links: <https://docs.tanestrees.org.nz/1281/>



A hillside retired from grazing with natives planted within sprayed spots.

Introduction

Good planting techniques are essential to the success of any planting project whether establishing a few natives in a garden or at a larger scale as part of a restoration project or establishing a native forest plantation. If planting is not done properly, it is inevitable plants will become unthrifty, unstable or even die - wasting time, money and effort.

This factsheet provides a list of equipment required for planting and covers the basics of good planting methods for small or large planting projects.

Equipment you will need

Planting spades

- While every household will have a spade adequate to plant a few seedlings, it is worth investing in high-quality planting spades when planting thousands of seedlings.
- A standard planting spade is constructed of steel with a plastic handle grip, strong pipe handle and a wedge-shaped metal blade.
- A foot on top of the blade is essential for powering the spade deep into hard ground with the boot.
- Keeping a sharp cutting edge will assist penetration through surface vegetation and the soil - keeping a file on hand to maintain a good edge is useful especially if the ground is rocky.



Planting contractor using a heavy-duty planting spade and fitted with a planter bag of bare root native seedlings.

Clothing and boots

- While sturdy shoes are all that is required for small-scale or community organised planting events, steel cap boots may be advisable for contract planters especially if using motorised equipment and sharp spades.
- Gloves for planters including community group planting can be useful.
- Appropriate clothing is all part of best practice health and safety in the workplace; check contractors have appropriate and up-to-date training and operating Health and Safety requirements.

Post hole borers and augers

- A motorised post hole borer or planting auger may be practical for hard soils and deep hole cultivation.
- They are especially useful for preparing consistent holes at the desired plant spacing ahead of community planting events; however, contract planters and the vast majority of planters use spades.
- Single-operator post hole borers are available with a range of auger sizes – large container stock such as PB3 planter bags require a 150 mm diameter auger, while a 100 mm diameter auger is sufficient for smaller containers although larger augers allow for more cultivation.
- Cordless drills with auger attachment can be used for smaller containerised seedlings.
- Care is required to ensure that sides of planting holes dug by a post hole borer in wet clay soils are not glazed, as this prevents root penetration; glazed sides need cutting by spade to break any seal.



A petrol-powered motorised planting drill with light auger is an efficient way to provide planting holes, especially for community planting days to ensure consistent depth of planting.

Planter bags and boxes

- There are a range of planter bags and frames with harnesses developed for the exotic plantation industry that can also be used by planters to carry native seedlings.
- Planter bags are ideal for carrying bare-root stock whereas frames that carry a box are better for containerised stock.

Biosecurity - clean your gear before planting!

- Best practice planting and management includes making sure weeds, pests and diseases are not spread from one planting site to another.
- There are general guidelines on biosecurity relating to spread of weeds in forests and fungal diseases such as kauri dieback, e.g. [Department of Conservation](#) and [Ministry of Primary Industries](#).
- Basic requirements for planters to reduce biosecurity risks is to clean planting spades, boots and other equipment before starting at new planting sites.



Removing the container

- At the planting spot, remove the plant from the container carefully, retaining as much soil around the roots as possible; root systems of container-grown seedlings should be sufficiently developed to bind potting mix into a cohesive mass that does not disintegrate when removed from the pot.
- Care is required in removing plants from root trainers where roots may be tangled with adjacent seedlings.
- Removal of containers can be done by those laying out the plants just ahead of the planters but care is required to ensure exposed roots balls are not left too long before planting, as they can quickly dry out.
- For large scale contractor planting, and where root systems are binding the soil adequately, planters sometimes remove containers at the pick up point before placing debagged seedlings within planter boxes for transport to the planting site. Care is required in handling exposed roots.
- Collect plastic pots and planter bags after planting for recycling.



Checking root system

- Root-bound or grossly distorted or under-developed root systems should have been detected during quality control at the nursery; root-bound plants are slow-growing and plants with distorted roots are vulnerable to instability even decades after planting. Reject plants at the nursery that do not hold the potting mix and container in place or are root bound.
- If seedlings with less than optimum root systems must be used, the root ball needs loosening and fibrous roots teased out or cut to encourage growth into the surrounding soil after planting. Attempts at remediating poor roots at the planting site is not practical when planting at scale and should have been rejected at the nursery.
- The soil-root mass needs to be moist at planting so make sure the plants are thoroughly watered prior to planting.



Cultivation and digging holes

- Cultivating the soil at the planting spot will improve drainage and encourage early root penetration especially in heavy clay soils or where compaction has occurred.
- If necessary, skim dense grass cover off the soil surface using the spade (screefing) taking care not to remove too much topsoil.
- Using the spade, aim to penetrate the surface several times with a series of deep parallel cuts each time tilting the spade to loosen the soil followed by several cross cuts to leave the planting spot well cultivated; the weight of the spade can be used to drive it into the ground to do the initial cuts using the boot to get deeper; it takes more time to cultivate a hole on compacted sites.
- For large planting grades, remove cultivated soil so that a hole is sufficiently large enough to accommodate the root ball and potting mix.
- Loss of soil on steep slopes can be an issue for infilling or when holes are dug several days before planting where rain could disperse excavated soil.
- For pre-dug holes, planters will still require a spade when planting to ensure holes will accommodate the root ball; or deepen the hole if it is partially infilled; or for scoring glazed, bored holes in wet clay soils; and for refilling the planting pit with excavated soil.

Planting technique

- Place the root ball in the planting pit so the base of its stem (root collar) is at least 5 cm below adjacent soil surface; deeper planting is especially critical on dry sites as it allows the roots to access lower moist horizons. In wetter regions, deep planting is not required and leaving a depression around the base of the seedling may induce rot of the stem through prolonged ponding.
- Replace soil into the planting pit to surround roots using a combination of spade and boot, and firming with the boot leaving a slight depression if practical to catch rain in drought prone regions; all planting operations can be done while remaining on your feet.
- Rather than remove soil from the cultivated planting spot, for smaller-grade seedlings, displace a wedge of soil using an upward motion of the spade to leave a gap sufficiently wide and deep to place the seedling root into the hole, then use the boot to firm the loose soil back into the hole surrounding the root ball.
- Keep an upward pull on the seedling to avoid any distortion of the root system while firming the soil.
- If seedlings are planted shallowly or poorly firmed, there may be twizzling (spinning around) of poorly anchored seedlings if there are high winds soon after planting.
- For large-scale planting, professional planters take between 20 to 30 seconds to plant a native tree or shrub; a fit experienced planter can plant 50 to 100 native plants per hour depending on conditions.



Plant markers (stakes)

- Plant markers or stakes (usually bamboo) erected next to each planted seedling makes them easier to locate during monitoring and maintenance sessions, particularly on sites where dense weed growth is expected.
- Staking adds further cost and takes time to distribute across the planting site and to insert each next to a seedling so may not be practical at scale. However, time will be saved several months after planting when locating plants within weeds for releasing; an alternative is to only use them for the slower growing tree species.
- Place a stake (e.g., 60-90 cm high bamboo) next to each seedling; insert the stake on the same side of each plant, e.g. north side, and within 15 cm of the planted seedling to make it easier to locate the plant at the next visit.
- Plants generally do not need to be tied to stakes, but if required then use biodegradable ties and attach to an upper branch to avoid strangling the main leader; in urban areas stakes can attract vandalism or theft.





Protecting planted seedlings

Reducing browsing damage

- Areas to be planted with natives require permanent fencing to exclude grazing stock.
- While wild animals such as rabbits should be controlled, it is inevitable that on some sites animal pest control may not be totally effective.
- Application of animal repellents at planting time is an option although these will need to be repeated after heavy rain.
- In areas of tall rank grass or similarly high weed growth, retaining tall grass may help deter rabbits from accessing group-planted natives.

Artificial shelter

- Artificial shelter or individual plant protectors can be effective on some sites to improve growing conditions of planted seedlings on exposed sites and reduce rabbit and hare browsing.
- A range of commercially produced tree guards are on the market including plastic corflute and biodegradable options made of hessian or cardboard; caution is required with plastic guards as they can cause heat stress in hot summers.
- Some tree guards also have the option of a coconut matting or similar inserted within the protector around the base of the planted seedling to reduce weed growth.
- All guards require bamboo stakes or similar to keep them erect and prevent them from being blown away; tree protectors require checking on exposed sites.
- Plastic tree guards can be reused before they deteriorate and eventually removed to reduce plastic waste; cardboard options can attract paper wasps building nests; heavy jute versions can collapse on smaller seedlings as they degrade.
- For small-scale planted areas, there is scope for erecting a 1 m high fence with wind cloth to surround plants on exposed sites.
- Installing artificial shelter, whether as tree guards or as wind cloth fencing, adds significantly to the cost of planting and is not likely to be practical on a large scale. Cost of plant protectors range from \$1-2 each.

Using hydrogel

- Water crystals are sometimes added to the planting hole to help retain moisture, though their effectiveness is unclear.
- Until further research indicates otherwise, use of hydrogels for large-scale planting programmes with natives is not considered necessary.

Fertiliser application

- Fertiliser is not normally needed for planted native trees and shrubs on most sites; effects of fertiliser treatment at time of planting in trials were often confounded by other factors such as degree of weed growth.
- On grossly nutrient-deficient soils or where top soil has been scraped off or eroded away, slow release fertiliser incorporated into the planting hole may stimulate growth; however, many potting mixes will still contain slow release fertiliser pellets at planting anyway.
- If fertiliser is used, then incorporate slow-release fertiliser granules or tablets with the soil at time of planting; slow release fertilisers need to be in contact with moist soil to work.
- Broadcast application of fast-release nitrogen fertiliser after planting is likely to encourage weed growth.



Watering

- Watering should not be necessary after planting if well-conditioned nursery plants are used, they are planted deeply on drought prone soils, and the species selection is appropriate for the site.
- In dry regions, irrigation in the first year may reduce the loss of plants but is generally not practical or cost-effective especially on a large scale.

Mulching

- Mulching plants with a layer of permeable material can retain soil moisture, reduce weed growth and provide soil insulation
- However, even if a low-cost local supply of mulch is available, use in large-scale planting programmes is generally impractical.
- Materials that will degrade naturally are preferred, such as newspaper, fine bark chips (10 cm deep), wool mat or carpet underlay, coconut matting, straw, wood chips or dead vegetation available on site; however, the latter three options may contain weed seeds.
- Synthetic weed mats or old carpet do not decompose readily and are difficult to remove when they are no longer needed.

Replacing plants

- While some scattered mortality (e.g. up to 20%) may occur, replacement of dead plants (blanking) may only be useful to fill in large gaps due to early losses, or where greater losses have occurred.
- Determine likely causes of mortality and where practical address those issues (e.g. greater pest animal control); if drought is a cause then consider switching the species mix to more tolerant species.
- Depending on growth, replanting gaps could be carried out up to near-canopy closure.

How long does it take to plant natives? Depends!

- Time taken to plant native seedlings depends on a wide range of factors including:
 - scale of planting,
 - location of and access to the planting site,
 - size of seedlings and their containers,
 - topography and vegetation cover of the site,
 - quality of site preparation,
 - skills and experience of planters, and
 - whether community groups or contractors are doing the planting.
- In the pine plantation forest industry, experienced contract planters on average plant between 600-800 pines per day. Pine seedlings are typically bare root 25cm high seedlings where 100 can be packed into planter boxes for easy carrying by planters; planting rate per hour for pines is in the order of 100 per hour.
- Most natives are raised in containers and are often laid out across the planting site ahead of planters as a separate operation. Removing and retrieving containers adds further to overall planting times.
- Where native seedlings have been laid out ahead of planters then estimated time taken for planting:
 - Community planters: 10-20 seedlings per hour for small scale revegetation projects.
 - Planting contractors: 30-50 seedlings per hour for large scale planting programmes.
- Note planting rates are highly variable especially for natives. Small plug stock such as used by the manuka honey industry, where seedlings can be carried in large numbers by planters, will be significantly faster.

Information sources

- For detailed information covering all aspects of planting natives including [Tāne's Tree Trust](#), [Trees That Count](#) and [Department of Conservation](#).
- Websites of most Regional Councils and some District and City Councils offer local advice on planting and managing natives to meet a range of objectives and scales of programmes.

Native forest factsheets series

These factsheets on establishing native forest have been compiled by Tāne's Tree Trust with funding from Te Uru Rākau's One Billion Tree Partnership Fund with support from The Tindall Foundation and Trees That Count. Others providing information and undertaking peer review include Scion, Auckland University of Technology, Northland Totara Working Group, iwi, landowners and selected local authorities and government departments.

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