One Billion Trees Programme
Helping New Zealanders plant the right trees, in the right place, at the right time

Te Uru Rākau New Zealand Forest Service

Improving resilience of planted native woody seedlings to drought

This research investigated different techniques that help seedlings survive drought conditions.

Why is drought a problem?

New tree seedlings need water to survive. A lack of water, as happens in droughts, can cause water stress in seedlings.

To avoid water stress, new tree seedlings are planted from autumn to spring. During this time the soil is moist. This allows bigger root systems to develop before the dry summer months.

Tree seedlings planted outside the autumn to spring timeframe, as might happen in a COVID-19 lockdown, are at risk of drier conditions.

What can cause planting delays?

The COVID-19 pandemic caused significant planting delays in the forestry sector. Restoration and revegetation projects were also affected.

Climate change will also have an impact. As the weather changes, the ideal autumn to spring planting time gets shorter. As a result, 'shoulder season' planting will increase. This is planting that takes place on either side of the ideal planting timeframe. Climate change will also increase the time between rainfalls. This increases stress on plants like new seedlings with small root systems.

What we did

We tested ways to lessen the effect of drought on trees planted at 'tough' sites.

These are places where:

- planting has previously failed
- there is water stress
- shoulder season planting happens.

By testing on tough sites, we found a variety of ways to reduce water stress on planted seedlings.

Planted wood waste mulch and unplanted rip-rap rock mulch along overland flow path. Rip-rap is a layer of rock or stone used to prevent erosion.

A windrow of plantation 'slash' protects planted seedlings, retains moisture and fosters regeneration.

5 steps to planting success

All steps rely on the success of each other and must be done well. If one step fails, there's a risk of poor establishment which puts the seedlings at risk.

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SITE ASSESSMENT

A site assessment should happen first. It affects all the steps after it.

Completing a visual soil assessment reveals important factors for:

- root growth
- water behaviour
- depth of mulch (decaying material spread around or over a plant to enrich or insulate the soil)
- depth of thatch (the layer of dead and living plant material that forms between the soil surface and green vegetation).

When looking at the site think about the following:

- Will the direction the land faces affect water stress?
- Is there existing shelter (nurse trees)?
- Are there sections of the site that are better for planting than others?

PLANT ASSESSMENT

When choosing plants, think about species tolerant to drought.

Learn what to look out for with nursery stock:

- Are root to shoot ratios high enough? This varies according to what you're planting. Plants with larger root mass and smaller tops are more drought resistant.
- Is there good root development – ideally with roots throughout the pot without being root bound (spiral roots or a thick mass of roots).
- Are the size and shape of the seedling appropriate to the site?

Ask nurseries if they have added mycorrhizae treatments to seedlings. Mycorrhiza helps plants become less prone to water stress.

Ask how the plants have been hardened off. Hardening off seedlings exposes them to different weather. It prepares them for outdoor conditions.

If you're not sure, ask nursery staff for help.

SITE PREPARATION

The history of your site helps you know what site preparation is needed. When looking at the site, think about the following:

- Is slash (leftover branches, vegetation) available to create rows to plant in?
- Can woody debris be kept on site? This supports the growth of helpful root fungi known as mychorrizae.
- Are nurse plants needed to help the young seedlings you have chosen to grow? Seedlings that are shade tolerant and are vulnerable to damage by wind or sun generally need nurse plants.
- Some seedlings will need lots of sunlight. Can you make canopy gaps to plant in?
- Can you cultivate (break up) soils or debris to help water retention?
- Does the site need weed control before planting?
- Is mulch required or is it available on site? Adding mulch to the surface of soil can stop moisture escaping.

PLANTING

Planting techniques are important for success.

- Pre-soaking plants on site can be valuable, especially if soils are dry. Plants should never be planted when dry.
- Watering after planting removes air gaps from the root ball. Roots can't grow through air gaps, and they stop water travelling through soil.
- To prevent water loss consider adding supplements to soil on tough sites.
- Use plant guards to protect from animals, weeds or maintenance like herbicides.
- Check if plant mulches are available to stop weeds and reduce water stress. Make sure the planting hole is wide enough. In dry sites consider creating a shallow basin to capture rainfall.

MAINTENANCE

Poor maintenance is the reason why many native plants don't survive.

Develop a maintenance plan for your site. Things to think about include:

- managing weeds
- mulching
- protecting the plants from animals
- whether ongoing irrigation is needed in the first summer.
- pre-planting and ongoing pest control.

Five steps to planting success are supported by these guidelines:

www.landcare.org.nz/file/sherryplantingguidelines1109-scion/open

www.nzffa.org.nz/farm-forestry-model/resource-centre/tree-grower-articles/may-2009/nursery-specifications-for-natives

Guides to plant guards and mulches can be found in the **full MPI technical report** and as individual guides on the **Canopy website**.

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Regeneration

Native regeneration can be more cost-effective than planting nursery-raised seedlings when planting tough sites.

Seeding or natural regeneration may be more feasible where:

- the soils are more hostile. Planted seedlings tend to be less drought-resilient than plants established from seed on site.
- sites are extremely harsh, as planted seedlings have low survival in these conditions.

Time and money can be saved if you allow regeneration after making sure stock can't get on to the site and/or weed control.

Regeneration is most likely to work:

- in areas with existing natural canopy
- in some non-native canopies
- next to existing remnants of native forest
- if plantations have been harvested in ways that retain native undergrowth.

In all these cases, natural regeneration can be a low-cost complement to planting.

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For additional information see the Planting delays page on the **Canopy website.**

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