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Technical Note

Update and next treatments for the Accelerator Trial series

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Summary: In the last six months various results have become available from the oldest of the accelerator trials, while new treatments for several of the trials have been developed. In this technical note we will describe a number of recent results and activities undertaken at the Accelerator trials, and identify future treatments at all sites.

Introduction

The Accelerator Trials have been established to support the forestry sector's target of sustainably increasing the productivity of New Zealand's forest estate under a range of current and future limitations[1]. This is to be achieved at each of six trial sites (Fig. 1) through detailed assessments of tree growth and health followed by the application of specific interventions.

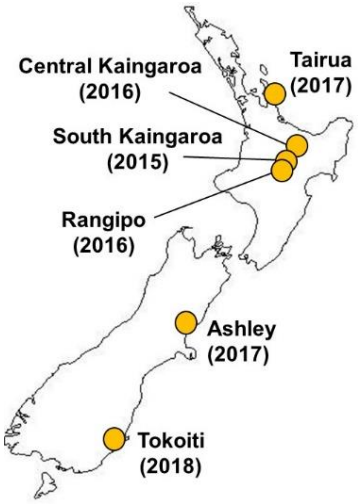

Figure 1 Location of the six Accelerator Trials and year of establishment.

Considerable detail regarding the design, site conditions and initial treatments at each of the trials has been provided in previous technical and file notes[2-4], and will therefore not be reported again. In this technical note focus will be given to activity at each site and the results obtained in the last six months, as well as the next set of interventions planned for each site.

Southern Kaingaroa Trial (est. 2015)

Recent activity and treatments

In November 2019 the site received a further experimental treatment of nitrogen, applied as 8 g nitrogen per tree as biuret, and 50 kg nitrogen ha^{-1} applied as urea. These treatments were applied within an existing treatment framework that is allowing the effect of biuret and urea to be competed over time; control plots that receive no additional nitrogen are also included.

Future Treatments

The addition of nitrogen as biuret has produced various positive outcomes[4]. The addition of urea has resulted in higher foliar N (both %N and fascicle weight) and will also likely generate some growth increases as well. To maximise tree productivity and health, the availability of micronutrients (and the potential differential effect of urea and biuret on this factor) will be assessed through foliar sampling, informing future treatment. In addition, the impact of biuret on dothistroma incidence will continue to be monitored, which may lead to moderation of future copper use across the trial.

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Central Kaingaroa Trial (est. 2016)

Recent activity and treatments
The lupins established at this site through the broadcast application of seed were initially doing well, but during winter appeared to be subjected to intense herbivory and widespread die-off, possibly due to frost. The former was determined based on the results of a series of step-out trials that incorporated cages (Fig. 2) to exclude herbivores. However, in recent weeks, monitoring indicates that perhaps 5% - 10% of the lupins have survived. Those in interrows and on mounds are still quite small (Fig. 3) but those in hollows and windrows are growing vigorously (Fig. 4) and are now generating seed to produce the next crop of lupins at the site. However, given that the initial field test showed significant browsing of seed pods, it remains to be seen if/how many seeds will survive long enough to germinate.

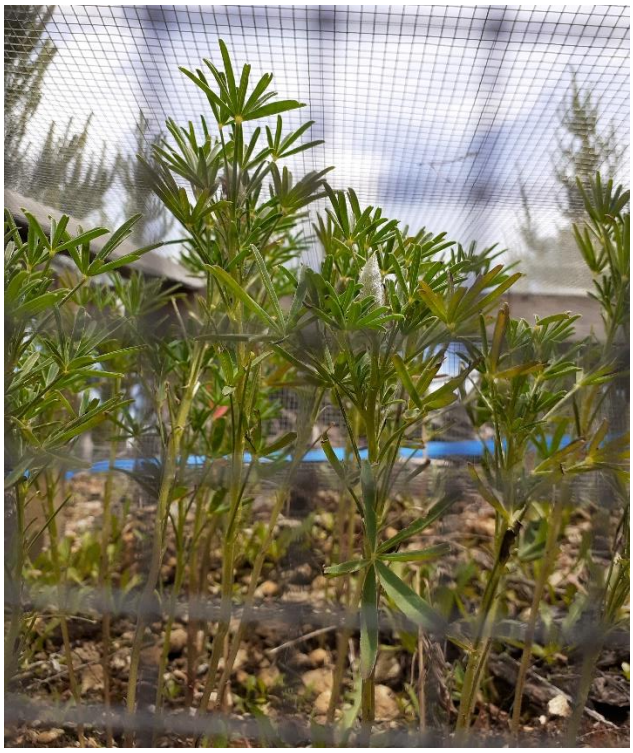

Figure 2 Lupin development in cages

Figure 3 Lupin recovery on a mound

Figure 4 Lupin recovery in a windrow

Future Treatments
Immediate focus for this work is to track the reestablishment of the lupins and to conduct soil and foliar sampling to understand the extent of any impact on tree nutrition. It is also likely that a selection of the lupin plots established as step-out trials will be utilised to test the efficacy of biuret as a weed control agent for these plants, in case the regenerating lupins in the main trial area produces any negative effects for the radiata crop.

Rangipo Trial (est. 2016)

Recent activity and treatments
The Rangipo trial was used to explore various performance enhancement options during the Forest productivity workshop (August 20-21, 2019). The impact of cultivation, stocking and genotype selection at this moderately fertile site were explored. A summary diagram showing the influences of the cultivation and stocking treatments is shown in Fig. 5.

Future Treatments
Given the interest in the results produced at Rangipo, no treatments are immediately planned at this site and monitoring of existing treatments effects will be the focus.

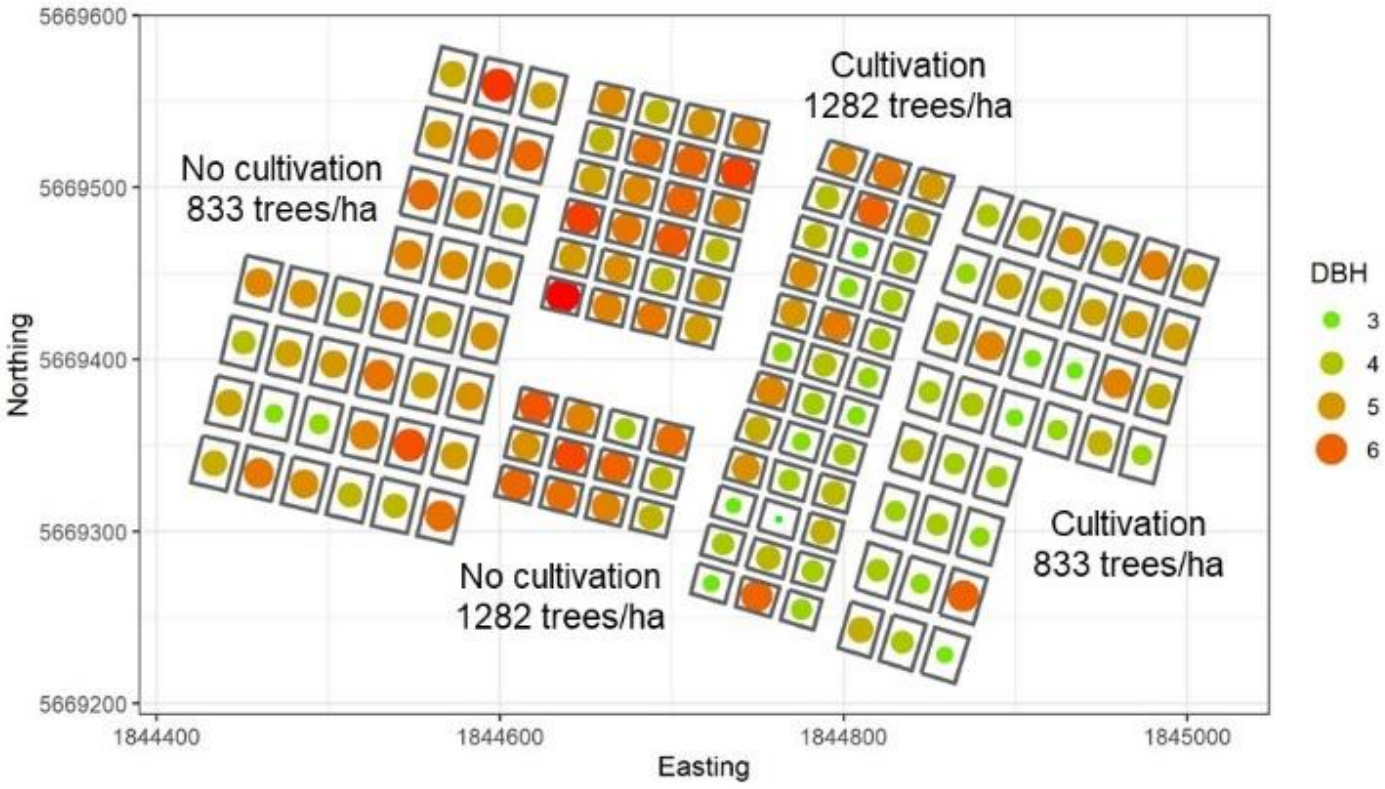

Figure 5 No cultivation and higher stock rates have initially increased mean radiata growth rates at Rangipo

Ashley Trial (est. 2017)

Recent activity and treatments
No treatments have been applied to the Ashley site to date, but considerable research has been undertaken to identify suitable stress enhancement treatments at this drought prone site. Based on past results[5], the ethylene biosynthesis inhibitor aminoethoxyvinyl glycine hydrochloride (AVG) was considered for use, but the cost of reagent grade material is prohibitive. Consequently, a commercial plant growth regulator containing AVG (ReTain) is being explored for use. If this proves unfeasible, pyrazinecarboxamide (PZA) has recently been identified as an alternative option[6]. Given the cost of PZA is 1500 times less than AVG, if this product has the desired results it will likely be cost-effective. In addition, the site has also recently been explored as a potential location for study as part of the "Forest Flows" MBIE programme.

Future Treatments
Deploy either ReTain or PZA to enhance drought stress tolerance; it is possible that both may be deployed to compare these options. A further option is biuret, which was shown to enhance stress tolerance activity through influencing microbial processes, and may provide additional benefits through eliminating weed competition.

Tairua Trial (est. 2017)

Recent activity and treatments
This site was selected due to phosphorus limitation (highly phosphorus retentive soils and low soil phosphorus stocks). A literature review is underway

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to assess the outcome of all phosphorus trials in the local area and on similar soil types.

Future Treatments
Based on examination of available data and various outcomes described in the literature, the following are being considered for Tairua:

- Inorganic phosphorus application:
  a. Apply a standard rate of phosphorus per ha but concentrate the application to the base of the tree, e.g. apply 70 kg per ha, but it is focused to the base of the tree which would come to perhaps 500 kg per ha in treated locations.
  b. Need to consider that nitrogen will also become limited; apply with the phosphorus. Perhaps biuret at 10 g nitrogen per tree. This may also aid phosphorus uptake by the trees.

- Organic phosphorus application:
  a. Chicken manure in pellets – high phosphorus content, and already bound to carbon so less likely to be trapped in soil. Use the same application process as described for inorganic above. i.e. concentrate around the base of the tree.
  b. Sheep manure in pellets – potentially less effective as lower phosphorus content; Use the same application process as chicken manure.

Tokoiti Trial (est. 2018)

Recent activity and treatments
A trip to the site is being planned to assess the performance of the stock in relation to the cultivation treatments applied at site establishment, and to capture soils data to identify the effect on soil moisture content to various depths.

Future Treatments
Given this site is likely to face water stress, the outcomes of the Ashley Trial will inform treatment selection at this site. This impact of the cultivation treatments on soil and tree nutrition will also be characterised to determine future site nutrient amendment treatments.

Ongoing use in the development of remote sensing technologies

All six sites have been characterised through remote data capture from drone overflights. Given the intense level of on-ground monitoring, the sites will continue to be used to ground test and further develop various remote sensing systems. This work is ongoing, and is providing considerable additional value.

Acknowledgements

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References

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