

Phosphite large tree treatment trials: brief report

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1 INTRODUCTION

Forest trials established in 2012, testing phosphite for kauri dieback control, provided promising results with demonstration of a curative effect. But these trials were all carried out with trees in the 'ricker' size class, mostly 15 – 35 cm diameter, with no testing on larger trees. Before any future deployment to treat moderate-sized trees or large iconic trees, and to allow informed decisions to be made, information on safe and effective treatment regimes for large trees is required. Doses based on trunk girth have previously been used to calculate required phosphite volumes. But with giants such as kauri, scaling up from rickers to trees with girths of 5 – 15 m may be difficult. Earlier trials also indicated some problems with phytotoxicity, particularly with higher phosphite rates, so it is very important that effects on larger trees are assessed before widespread release of the treatment. A balance must be struck between rates sufficient to suppress the disease, yet still safe for the tree.

In 2016, new trials were established on large kauri trees to help to determine appropriate treatment regimes, with emphasis on phosphite rates and doses lower than those used in previous trials. This report summarises results of assessments made on all trial trees in October 2018, and supersedes a similar report in March 2018 (Horner 2018 PFR Report No. 16195).

2 METHODS

2.1 Trial sites and tree selection

Three sites were selected for the trials: Puketotara Road, near Kerikeri in Northland; Trounson Park in Northland; and the Cascades in the Waitakere Ranges, Auckland. The Puketotara block is on a private land, and Trounson Park and the Cascades are under Department of Conservation and Auckland Council jurisdiction, respectively.

Trees in the trial are in the mature stage. At Puketotara, trees range in size from 0.4 to 1.1 m trunk diameter. At Trounson, trial trees range from 1.0 to 2.1 m trunk diameter, and trees at the Cascades range from 0.6 to 2.4 m diameter. All trial trees showed symptoms of kauri dieback at the start of the trial, including basal trunk lesions.

2.2 Treatments

1. Untreated control
2. 4% phosphite trunk injection, 20 mL every 40 cm around the trunk circumference
3. 4% phosphite trunk injection, 20 mL every 80 cm around the trunk circumference

Treatments were applied at the Puketotara site in March 2016 and at the Trounson and Cascade sites in November 2016. Treatment 3 applications were repeated at the Puketotara site in March 2018, and will also be repeated in the Trounson and Cascade sites during the summer of 2018/19.

The determination of phosphite concentration and doses for the large trees was difficult. With trunk girth being the main determinant of dose, and with no international experience with treating trees of such size, a very conservative approach was taken. This decision was in part influenced by previous experiences with phytotoxicity. The selected phosphite concentration of 4%, with injector frequency of one every 40 cm, corresponds to the lowest rate and dose used in the concurrent 'Trunk spray and low rate trial' (Horner 2018 PFR report No. 16145). We have also included another treatment with an even lower dose of one injector every 80-cm girth. Although this dose may be too low to provide adequate long-term control, we had the opportunity to observe effects over the first year or two, then make another application if deemed appropriate. This has now been done, as noted above.

2.3 Trial design

There are a total of 42 trial trees (nine at Puketotara, 15 at Trounson and 18 at the Cascades). This is double the number that was proposed in the initial trial outline, but should lead to more robust data. At each site, trees were divided evenly among the three treatments. To ensure a relatively even distribution of disease symptoms across treatments, at each site trees were placed into groupings based on disease parameters such as lesion activity and canopy symptoms, before random assignment of the various treatments within each grouping.

2.4 Initial assessments

Before treatment, baseline assessments were made on various tree growth and health parameters. These included tree girth, canopy health score, canopy colour, plus trunk lesion size and activity. Selected lesion margins were marked for subsequent measurement of expansion, and canopy photographs were taken for later comparison.

2.5 Periodic assessments

Tree health and lesion expansion plus activity has been measured approximately every 6 months. Assessments to date have been in August 2016 for the Puketotara site and February/March 2017, August 2017, March 2018 and October 2018 for all three sites. The later than planned assessment in October 2018 was because of delays in gaining permission to access sites in the Waitakere Ranges with the recent Controlled Area Notice.

3 RESULTS AND DISCUSSION

To date, no phytotoxicity symptoms have been observed in any of the trees. At the Cascade site, one untreated control tree has died, and one more control tree and one of the six trees in each of the injected treatments have shown a substantial decline in canopy health, as has an untreated control tree at Trounson. Otherwise, there are no major changes in canopy density to date, and no sign of yellowing of leaves in any of the treated trees.

It is now two years since treatments were applied at Trounson and the Cascades sites, and 2½ years since the Puketotara treatment, so it is still too early to draw conclusions about treatment efficacy. On average, lesion activity is greater in the untreated controls than in either of the injected treatments (Figure 1), with a drying up and healing of many lesions in the injected trees. However, there was still some lesion activity in more than half the injected trees, indicating that lesion healing is not complete. This was the case in both injection treatments. The amount of activity was greater than that seen at the same stage in earlier trials on rickers, where most lesions were dried up and healed 12 – 18 months post-injection (Horner 2017 PFR Report No. 15425). Phosphite concentrations and doses were greater in those earlier trials, and it seems likely that the rates selected in the current large tree trial are too low for effective control.

The lowest rate of phosphite (i.e. 4% at 80-cm spacings) was not effective at treating lesions on two of the three sites. Overall the mean lesion activity score was similar to that of the untreated control at the Cascade site.

In the 'Trunk spray and low rate trial', a rate of 4% phosphite injected every 40 cm around the trunk has to date been effective at stopping lesion activity in rickers (Horner 2018 PFR report No. 17187). The same dose (based on trunk circumference) in the current large tree trial has not been fully effective, with approximately half the treated trees still having some active lesions 2 to 2½ years after treatment. It is possible that these large trees need a higher dose to facilitate total lesion healing. Given that there have been no obvious phytotoxicity symptoms noted to date, higher dose rates or higher frequency of application should be considered.

In light of the lesion activity in some treated trees, following the March 2018 assessment a 4% phosphite solution was re-applied to the trees in the lowest phosphite treatment ('Treatment 3', injector spacing 80 cm) at the Puketotara site. This was 2 years after the initial treatment application. A similar re-treatment will be done on 'Treatment 3' trees at the Cascade and Trounson sites in January/February 2019, just over two years after their initial treatment. Further application in the higher dose treatment (4% at 40-cm spacings) will be considered in the near future, dependent upon results from the upcoming summer assessments.

4 PLANS

Six-monthly assessments of tree health, lesion activity and spread, and phytotoxicity symptoms will continue for a period of at least 4 years, with a brief report following each assessment.

Re-application of injection treatments as noted above will be done in the lowest-dose trees at the Cascade and Trounson sites in summer 2018/19. Retreatment of other trees will be carried out in future following further lesion activity assessments and discussion with the P&I team and other interested parties. Results to date suggest re-application of phosphite should be considered in all treatments.

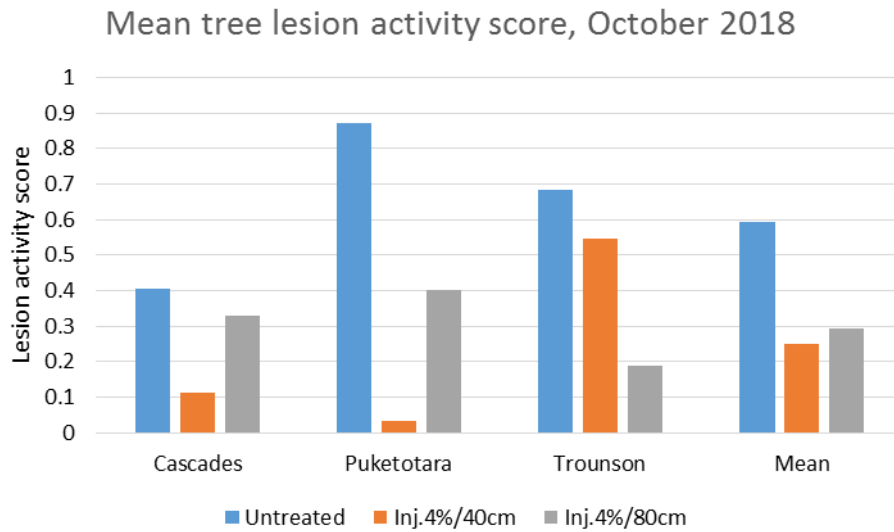


Figure 1. Mean lesion activity in *Phytophthora agathidicida*-infected kauri trees on three sites, assessed in October 2018. Phosphite injections were applied in March 2016 (Puketotara site) or November 2016 (Cascades and Trounson sites). A 4% phosphite solution was applied as one 20-mL injection every 40 cm or one injection every 80 cm around the trunk circumference. Phosphite was re-applied to trees in the low dose (4% injection every 80 cm) in the Puketotara site in March 2018. Lesion activity scoring: 0=not active, 0.2=probably not active, 0.5=probably active, 1=active, 2=very active.

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