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Trunk sprays and lower phosphite injection rates for kauri dieback control – brief update October 2018

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1 INTRODUCTION

Trials evaluating phosphite trunk injection for control of kauri dieback provided promising results, with cessation of lesion expansion in treated trees and evidence for excellent control of *Phytophthora agathidicida* within trees (Horner et al. 2017; Horner et al. 2015). However, there have also been some detrimental effects, with foliar phytotoxicity in some treated trees. In addition, there were some trunk symptoms such as cracking, which appeared to be associated with injection points. Application concentrations in the early trials were probably too high (20% and 7.5% phosphite), and this may have contributed to the observed phytotoxicity, particularly on trees with advanced symptoms.

The current trials have been established to investigate the efficacy of lower concentrations and doses of phosphite, to determine if phytotoxicity symptoms can be reduced, while still providing adequate disease control. In addition, trunk sprays have also been included to determine if topical application and absorption through the bark could provide disease control while avoiding invasive injection. Such treatments have been tried with other species (such as apple, avocado and oak) and, while not always as effective as trunk injection, they still had a positive effect on *Phytophthora* control.

This brief update summarises results from assessments made in October 2018, 2 years + 8 months after initial treatment, and supersedes a similar report presented in March 2018 (Horner 2018).

2 METHODS

The trials are on three sites: Huia Dam (Waitakere Ranges) — adjacent to the previous long-term trial, and two farm blocks at Arapohue, near Dargaville. Trees in the trial are mostly at the advanced ricker and early mature stage, ranging in size from 20–70 cm trunk diameter. All trial trees showed symptoms of kauri dieback at the start of the trial, including basal trunk lesions. Treatments were:

1. Untreated control
2. 7.5% phosphite trunk injection, 20 mL every 20 cm
3. 4% phosphite trunk injection, 20 mL every 20 cm
4. 4% phosphite trunk injection, 20 mL every 40 cm
5. 10% trunk spray with bark penetrant (Pentrabark™)
6. 10% trunk spray without bark penetrant.

All treatments were applied in March 2016. Trunk sprays were applied to the lower 2 m of the trunk, using a hand mister. Volumes were carefully measured, so that equivalent total volumes of phosphite were applied in injection and spray treatments (based on trunk girth). Trunk spray treatments were re-applied in March 2018, but all other trees were left untreated at this time. Agrifos600® was the phosphite formulation used for all applications.

The rationale of the treatment selection was to include the lowest concentration from previous trials (7.5%) as the high injection rate for this trial, to include injections with a lower phosphite concentration (4%), plus the 4% concentration at a lower dose (i.e. one 20-mL injection every 40 cm around the trunk, rather than every 20 cm). The trunk sprays were included to test this application method, with or without the bark penetrant recommended by the phosphite suppliers.

There are a total of 72 trees, 24 on each site. The trial is evenly balanced, with four replicates of each treatment on each site. At each site, trees were placed into groupings based on disease parameters such as lesion activity and canopy symptoms, then within each grouping trees were randomly assigned to the various treatments. This ensured a relatively even distribution of disease symptoms across treatments.

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.

Approximately every 6 months, tree health and lesion expansion plus activity are measured. Assessments to date have been in August 2016, February/March 2017, August 2017, February/March 2018 and October 2018. The later than planned assessment in October 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 canopy phytotoxicity symptoms, such as the leaf yellowing and canopy thinning noted in earlier trials, have been observed in this trial. In assessments made after 12, 18 and 24 months after treatment, minor 'stretch marks' were noted in the trunks of almost half the injected trees, apparently in line with injection points. These were noted with both 7.5% and 4% phosphite concentrations. These marks were less obvious in the 24- and 32-month assessments. Eighteen months after treatment, small bleeds in line with injection points were observed in half the trees in both the 7.5% and 4% injection treatments at the Huia site, and one minor bleed was noted in one of the Arapohue trees injected with 7.5% phosphite. All these bleeds appeared dry and healed in the 24-month and 32-month assessments. All trees will be carefully monitored to see if any substantial cracks develop, such as occurred in some trees in earlier trials.

In some of the 'trunk spray' trees there was prolific peeling of bark in the sprayed zone, first noted in the 6-month assessment. This was not just around lesion margins, but extended to throughout the zone that had been sprayed. In some cases the peeling was of bark that would not normally be expected to peel as rapidly, although there appeared to be healthy bark below. By 18–24 months post-treatment almost all this bark had shed and trunks appeared normal and healthy.

Lesion activity and expansion was substantially lower in all phosphite injection treatments than in untreated controls (Figures 1 and 2). Even the lowest concentration of 4% at the reduced dose of one injector every 40 cm (instead of the standard 20 cm) appeared to provide control. Negative lesion growth reflected lesion peeling in some trees. As yet there is no clear discrimination between the various injection treatments.

After one application, the trunk spray treatment **without** Pentrabark provided some control, although it was inconsistent, with lesions on some trees remaining active and spreading. It was not as effective as injection treatments. The trunk spray treatment **with** Pentrabark was also inconsistent. It reduced average lesion expansion compared with that in the untreated controls (Figure 2), indicating some efficacy. However, two years after the initial application, many lesions remained active in trunk-sprayed trees, with average activity scores similar to those of untreated controls (Figure 1A). Trunk sprays were re-applied to trees at that time (February/March 2018). Eight months later, this second spray appears to have helped heal most lesions (Figure 1B), with average lesion activity scores in spray treatments lower than those observed before the second treatment (Figure 1C), and lesion expansion almost halted (Figure 2C). New information from the Agrifos supplier indicates problems with the Pentrabark surfactant with this particular formulation of phosphite, and that a new surfactant is now available. This new product will be used in any future applications.

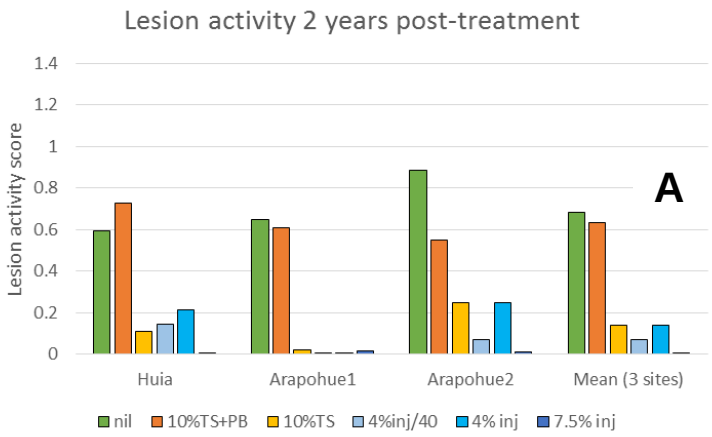
Six-monthly assessments of tree growth, canopy health, lesion activity and spread, and phytotoxicity symptoms will continue for a period of at least 2 years, with a brief report to follow each assessment.

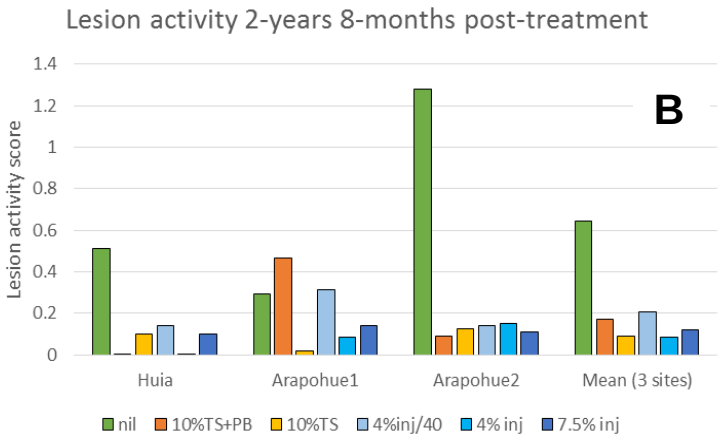
4 REFERENCES

Horner IJ, Hough EG, Horner MB 2015. Forest efficacy trials on phosphite for control of kauri dieback. New Zealand Plant Protection 68: 7-12.

Horner I, Hough E, Horner M. July 2017. Phosphite for control of kauri dieback: final report. A Plant & Food Research report prepared for: Ministry for Primary Industries. Client project no. 17682. Milestone No. 66652. Contract No. 33430. Job code: P/345160/06. SPTS No. 15425.

Horner I. March 2018. Trunk sprays and lower phosphite injection rates for kauri dieback control – brief update March 2018. A Plant & Food Research report prepared for: Ministry for Primary Industries. Milestone No. 66674. Contract No. 33523. Job code: P/345160/04. SPTS No. 16145.





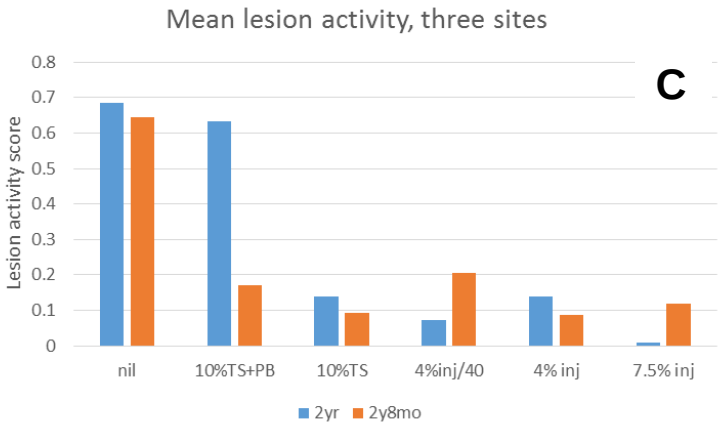
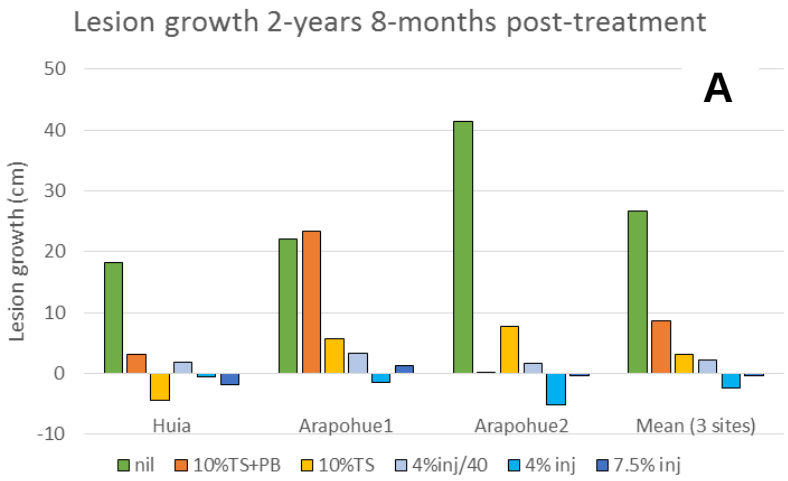
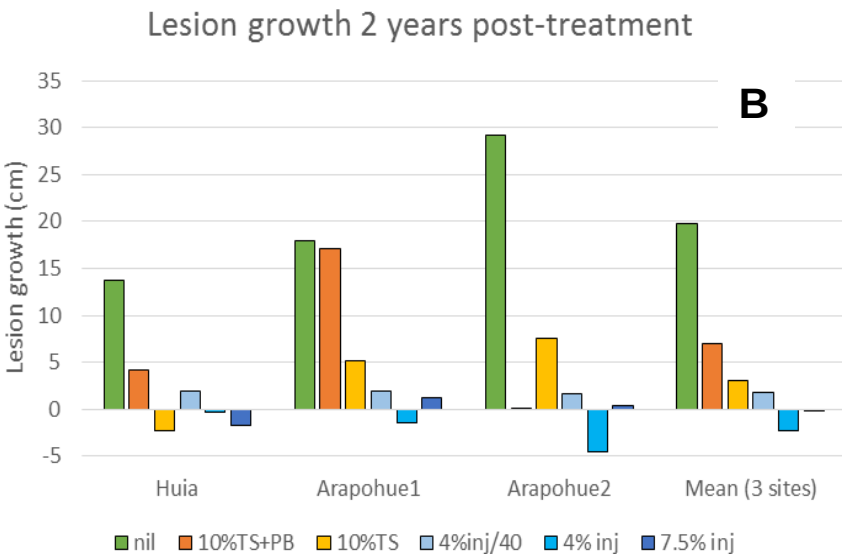


Figure 1. Mean basal trunk lesion activity score, on *Phytophthora agathidicida*-infected kauri trees in three forest sites, assessed 2 years (A) and 2 years + 8 months (B) after initial application of various phosphite treatments in February/March 2016. Lesion data are averaged across all monitored lesions at each site (A&B) and averaged across all sites (C).

Lesion activity was assessed as 0 = not active, 0.2 = probably not active, 0.5 = probably active, 1 = active, 2 = very active. TS = trunk spray, PB = Pentrabark™, inj = trunk injection. Percentage figures are phosphite concentrations. 4%inj/40 = 4% phosphite, 20 mL injected every 40 cm around the trunk. Both other injection treatments were 20 mL every 20 cm. Trunk sprays were re-applied in February/March 2018.





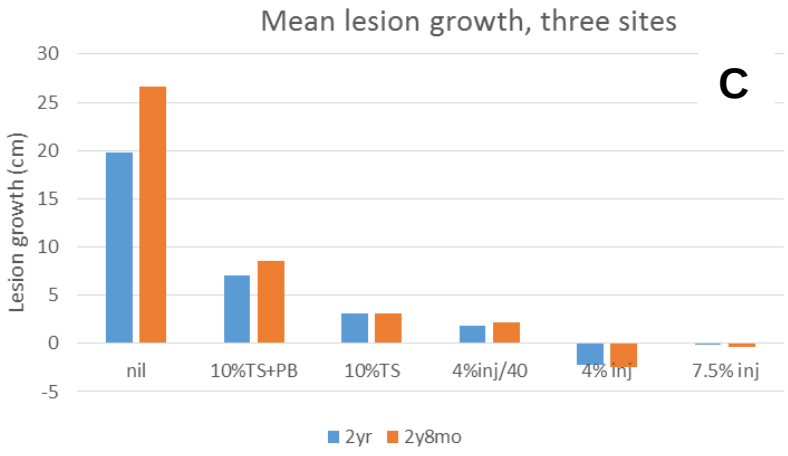


Figure 2. Mean basal trunk lesion expansion, on *Phytophthora agathidicida*-infected kauri trees in three forest sites, assessed 2 years (A) and 2 years 8 months (B) after application of various phosphite treatments in February/March 2016. Lesion data are the average of all marked lesions at each site (A&B) and averaged across all sites (C).

TS = trunk spray, PB = Pentrabark™, inj = trunk injection. Percentage figures are phosphite concentrations. 4%inj/40 = 4% phosphite, 20 mL injected every 40 cm around the trunk. Both other injection treatments were 20 mL every 20 cm. Trunk spray treatments were re-applied in February/March 2018.

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PUBLICATION DATA

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