

Using Phosphonates Effectively to Control Phytophthora Root Rot in Avocados

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Very recently the industry has supported the application for a permit seeking to apply new rates of phosphonate for foliar spraying.

These rates are found following this article.

The development of phosphonate products to control Phytophthora root rot in avocados commenced in the late 1970s. The first phosphonate-based product registered for use in Australia was Aliette© which was foliar-sprayed onto diseased trees. However, it was soon discovered that a much simpler chemical called phosphorous acid (H_3PO_3) was more effective in restoring health of diseased trees when measured amounts were injected directly into tree trunks. Due to the acidic nature of phosphorous acid significant damage occurred around injection sites so a safer formulation of potassium phosphonate was developed and is now commercially available from several companies who market the product in Australia. The knowledge that has accumulated since this time, both on tree physiology and its relationship with movement of the fungicide within the tree is significant. However, it is disappointing that many avocado growers do not correctly apply current technology in the management of root rot today.

Efficient and cost-effective Phytophthora control using phosphonate fungicides is based on understanding and working with the phenology or growth phases of the tree (Fig. 1). When potassium phosphonate is applied to trees it enters the tissues and becomes completely systemic moving within the vascular system to all parts of the tree. However, the quantity found in various organs will depend on the stage of growth at the time of application. This is due to different parts of the tree having stronger or weaker access to resources. For example, small, fast-growing fruit has the highest priority for available nutrients, shoots and leaves the second highest while roots have the lowest priority. If young fruit are developing on the tree at the time of treatment (during October early November in Fig. 1) most phosphonate applied will move

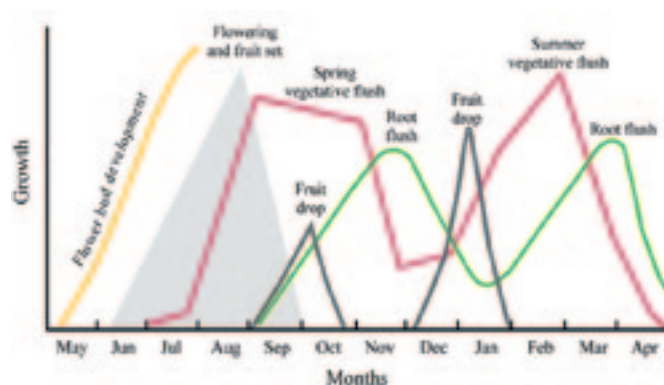


Fig. 1 A phenology model for avocado growth illustrating the interaction between different growth phases within the tree.

to these fruit with very little reaching the roots. Indeed research has shown that fruit may have phosphonate concentrations in excess of 280 mg.kg⁻¹ while roots only finish with 7-10 mg.kg⁻¹. Since we are controlling a root disease, the fungicide needs to be applied when the tree is diverting most of its resources to roots.

As can be seen, there are two distinct times when avocado trees will move phosphonates to roots. These being after the spring and summer shoot flushes. If phosphonates are applied outside these times, a significant percentage will be translocated to the non-target organs. When making an application after the spring flush, there will be reduced competition from leaves. However, in many regions the summer flush follows on very quickly and will compete more strongly for the phosphonate so the amount making it through to the roots may be quite low. Experience supported by phosphonate root analysis has shown the best results are from applications after the summer flush, when competition from other organs is basically non-existent. Recent research by QDPI has shown that elevating the phosphonate levels in the roots prior to a new root flush can reduce final root volume. It is therefore advised to wait for root development to complete prior to applying phosphonates. In most regions and with most varieties, this is late autumn to early winter (May to June).

It should also be remembered that even though phosphorous acid is systemic, moving from roots and leaves to other organs, it does **NOT** move laterally around the tree. This should be remembered when injecting. Many growers are now using concentrated product to reduce the number of injection points. This is truly a false economy as you are overdosing a small area of roots and leaving large areas of roots untreated. Always distribute the injection sites evenly around the tree. To do this effectively, the best practise is to dilute the current 600g. / litre product back to 200g. / litre phosphorous acid. This situation has been clearly demonstrated with phosphorous acid levels in the roots under a single tree varying from 5mg./ kg. to over 200mg./kg.

When phosphonates were first registered as a foliar spray application results were inconsistent. As research continued, it was found that spray volumes were critical. Low volume applications were not lifting root phosphonate levels to the same degree as high volume applications. It has since been found that it is essential to get thorough coverage not only to the leaves, but to branches and trunk as well. In mature orchards the volume needs to be as high as 3000 litres/ha. Younger orchards with smaller trees will require less.

Root Phosphorous Acid Levels

Prior to the development of the test measuring avocado root phosphorous acid concentrations (SGS, Toowoomba, QLD), recommended applications were based on tree response to treatment. There were many unknown variables that made results less predictable. Integrating root phosphonate analysis with application strategies increased confidence in protecting trees and controlling Phytophthora root rot in the orchard. Recommendations are based on maintaining a concentration in excess of 25 mg.kg⁻¹ of phosphorous acid in roots

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to manage the disease. *Phytophthora cinnamomi* will attack avocado roots any time soil temperatures are higher than 15 C providing there is sufficient moisture present to support growth. Hence, there will be times during the year when root protection is required but applications of phosphorous acid will not reach roots in sufficient concentration due to the competition from growth by other plant organs. This includes the critical flowering time when significant stress is imposed on trees and healthy roots are required.

To achieve continuity of root protection for the longer term an elevated concentration of root phosphorous acid is required. Monitoring root concentrations following phosphonate applications has demonstrated that this is best built during the late autumn and early winter months.

Rate Changes

Foliar Sprays

Very recently the industry has supported the application for a permit seeking to apply new rates of phosphonate for foliar spraying. These rates will be published when the permit is granted.

Research commenced in the late 1990s to develop improved foliar phosphonate technology. Recently a permit was been granted for the avocado industry to use new application rates. When using phosphonates, care should be taken to ensure that you are using the correct rate for that formulation as different concentrations are manufactured and sold. The following table is a guide:

Formulation	Concentration/100 litres of spray solution
400 g/litre phosphorous acid	1250 ml
600 g/litre phosphorous acid	830 ml
625 g/litre phosphorous acid	800 ml

Comments:

- Do not add wetters, stickers or other pesticides.
- Thoroughly wet leaves and branches. Apply 2000 – 3000 L/ha-1. Lower volumes produce a poor result.
- Spray when summer leaf and root flush is complete and no later than 6 weeks prior to flowering.
- Spray every 2 – 4 weeks until critical root phosphonate levels are reached.
- Avoid using copper hydroxide fungicides (copper oxychloride and cupric oxide formulations are the safest to use with foliar phosphonate sprays) and allow 10 days between phosphonate and copper application. On occasions severe defoliation has resulted when this has not been observed.
- Ensure the pH of the final tank mix is 7.2. To achieve this, buffer with potassium hydroxide if necessary.
- Sprays are only effective when applied to trees not showing root rot symptoms, i.e. those with good foliage cover for uptake.

Other Management Factors

Fungicide management is only one factor in the control of *Phytophthora* root rot. The integrated management technique as best described in the “Principles of *Phytophthora* root rot management” must also be incorporated in your management program.

In mature trees, the key factors are:

- Irrigation management – water consumption of diseased trees is dramatically reduced compared with healthy ones in the same block. Where diseased trees are present in an otherwise healthy block reduce water application by installing lower volume sprinkler heads.
- Nutrition –strategic use of gypsum while avoiding application of large quantities of fertilisers containing ammonia.
- Use good mulches, which allow “breathing” while maintaining uniform soil moisture within the root zone. Waterlogging of soils will accelerate the development of the disease.

ANVAS ACCREDITED NURSERIES

ANVAS accredited trees can be purchased from the following nurseries:

Anderson’s Nursery Graham & Vivienne Anderson Duranbah Road Duranbah NSW Ph: 02 6677 7229	Avocado Coast Nursery Greg Hopper Schulz Road, Woombye Qld Ph: 07 5442 2424	Birdwood Nursery Peter and Sandra Young 71-83 Blackall Range Rd Nambour Qld Ph: 07 5442 1611	Turkinje Nursery Peter & Pam Lavers 100 Henry Hannam Drive Walkamin Qld Ph: 0419 781 723
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Permit to allow emergency use of a Registered AGVET Chemical Product

Permit No -PER10722

This permit is issued to the Permit Holder in response to an application granted by the APVMA under section 112 of the Agvet Codes of the jurisdictions set out below. This permit allows a person, as stipulated below, to use the product in the manner specified in this permit in the designated jurisdictions. This permit also allows any person to claim that the product can be used in the manner specified in this permit.

**This permit is in force from
10 April 2008 to
30 September 2009.**

Permit Holder:

LIQUID FERTILISER PTY LTD T/A AGRICHEM
2-4 CHETWYND ST
LOGANHOLME QLD 4129

Persons who can use the product under this permit:

Persons generally.

CONDITIONS OF USE:

Products to be used:

All registered products containing either:

400 g/L, 600 g/L, 620 g/L or 625 g/L PHOSPHOROUS ACID as their only active constituent.

Directions for Use:

Crop	Disease	Rate
Avocado	Root rot (Phytophthora cinnamomi)	400 g/L products Apply 1250 mL/100L
		600 g/L products Apply 825 mL/100L
		620 g/L & 625 g/L products Apply 800 mL/100L

Critical Use Comments:

DO NOT apply more than 5 applications per year with a minimum re-treatment interval of 3 weeks between applications.

Apply as a foliar spray by knapsack or air-blast sprayer.

Apply high volume spray to the point of run-off (i.e. 2000-3000 L/ha for mature trees).

Withholding Period:

Not required when used as directed.

Jurisdiction:

ALL States

Additional Conditions:

This Permit provides for the use of a product in a manner other than specified on the approved label of the product. Unless otherwise stated in this permit, the use of the product must be in accordance with instructions on its label.

Persons who wish to prepare for use and/or use products for the purposes specified in this permit must read, or have read to them, the details and conditions of this permit.

RESIDUES:

To allow produce from treated plants to be supplied or otherwise made available for human consumption, the APVMA has established a temporary Maximum Residue Limit of 500 mg/kg for phosphorous acid in avocado. This limit applies only to produce marketed and consumed in Australia. Therefore, if treated produce is to be exported, due account should be taken of the residue definition and residue limits/import tolerances of importing countries and that any residues must not exceed those requirements of the importing country.

Issued by

Delegated Officer