A BRIEF NOTE ABOUT POTASSIUM PHOSPHITE ON PHYTOPHTHORA

By

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INTRODUCTION

Potassium phosphite, which is formulated from neutralized phosphonic acid, has shown great promise in controlling the trees infected by Phytopthora cinnamomi. Depending on how it is applied phosphite can provide protection for vulnerable plant species against the killer disease for up to five years. Phosphite is an environmentally safe, inexpensive chemical that is systemically transmitted throughout treated plants and has a very low toxicity to animals.

What is "PHOSPHATE" and "PHOSPHITE"

The recognized traditional source of phosphorus has long been phosphoric acid. Phosphoric acid, when neutralized with a base, forms a salt or "phosph**ate**".

In contrast "phosphite" fertilizers are derived from phosphorus acid. Phosphor**ous** acid also forms a salt when neutralized with a base. The salt is referred to as "phosph**ite**" as opposed to phosphate.

Phosphite has one less oxygen molecule than phosphate and therefore, has a much higher degree of solubility and mobility. This unique characteristic permits phosphite to be rapidly absorbed or taken up across the membranes of plant foliage and/or roots.

Mode of action

In general, the mode of action of phosphite is not fully understood, but it appears that the progress of infection by Phytophthora cinnamomi is halted when it comes into contact with phosphite in plant tissue. This may be because high phosphite concentrations interfere with the internal phosphorus utilisation cycle essential for survival of the pathogen. The plant self-defense mechanism may also be triggered to wall-off and isolate the invaded root cells. Plants in poor health, which are treated in time, have been shown to fully recover and remain healthy for a number of years. Another literature cited by Smillee et al. (1989) stated that the phosphite has direct effect on the pathogen itself as a fungicide or fungi stat (An antimicrobial used to prevent mold or mildew from growing provided it hasn't already colonized) to either kill or halt its growth. They also opined that in addition to the phosphite, the other chemicals produced by Phytophthora as a result of phosphite's direct action on the pathogen, might mobilize the plant's dynamic mechanism to ward off the invasion of root system. Another school of thought suggested that the potassium phosphate is not a naturally occurring substance and has a mixed mode of action involving direct toxicity to the plant pathogen, aided by natural plant defenses. Therefore, phosphorous acid is not classified as a biochemical. However, these simple inorganic chemicals are amenable to structure-activity relationship analysis and for regulatory purposes

these are subject to a reduced set of data requirements akin to those established for biochemical pesticides. (US EPA Report 1998).

Brief History About Potassium Phosphite usage

Previously called phosphonate, phosphite has been used to protect avocado, pineapple and cocoa crops against Phytophthora disease since the 1970s. In the late 1980s research staff at the Department of Conservation and Land Management's Dwellingup office, led by Dr Bryan Shearer, decided to investigate whether the fungicide provided any additional protection to Western Australian native species. These treatments, where phosphite solution was injected into jarrah (Eucalyptus marginata) and several banksia species, showed considerable promise, slowing and stopping the growth of the pathogen within the plants under attack.

This early success sparked a research effort, partly funded by Environment Australia grants, which was to continue over the next decade and included field trials ranging from the northern sand plain near Eneabba to the Fitzgerald River National Park east of Albany. Aerial application of phosphite to native plant communities was tested for the first time in 1993 in several reserves near Albany and proved a success. Aircraft allow for relatively cheap and rapid treatment of entire plant communities containing rare plant species, and are suitable for areas where ruggedness of the terrain would make ground application prohibitively expensive. One drawback with aerially applied phosphite, however, is that protection normally only lasts for about two years, ***whereas stem injection may provide protection for up to 5 years.***

Over the last ten years more very extensive research works were undertaken and resulted in release of EPA labelled phosphite compounds as fungicides. Few examples of other commercial products available in the current markets are,

1. Mono and di-potassium salts of phosphorus acid is registered in EPA and released as fungicides under the trade name Foli-R-Fos 400 from U.I.M. Agrochemicals (Aust.) Pty.Ltd. Australia.
2. Bio-serum Tree tonic from Bioscape,Inc.
3. NUTRI-PHITE FERTILIZERS from Biagro.com as reported in Forster et al. (1998)
4. pHorus from UAS-Cropmaster, Inc. (McGovern et al. (2002)
5. NutriGrow (0-28-26) as reported by Banko and Hong (2001).

The Future

Research into phosphite and its application is continuing. Among the areas requiring research is the refinement of application rates, times and frequencies for different vegetation types. Phosphite cannot eradicate *Phytophthora cinnamommi* from an area once it has established. However, by enabling us to boost the ability of plants to ward off infection it does provide us with some ability to protect endangered plants that might otherwise become extinct in the wild within a few years. Nevertheless, the major strategy for limiting the environmental damage caused by the pathogen remains, by means of quarantine and the application of high standards of hygiene, the prevention of the transport of infested soil into non-infested areas.