The following article provides some good information about phosphorus acid fungicides. I believe that these materials are an important addition to our grape fungicides for control of Downy Mildew. I would like to thank Dr. Schilder for the use of this note.(Mike Ellis)

Phosphorous Acid Fungicides

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Recently, a number of new fungicides that have phosphorous acid as the active ingredient have come on the market. Other names that you might hear for this are “phosphonates” or “phosphates.” Examples are ProPhyt, Phostrol, and Agri-Fos. Aliette (fosetyl-A1), an older fungicide, is the prototype for this group of fungicides. However, the long standing patent on Aliette had prevented similar fungicides from being developed up to recently. In Australia, where the patent did not apply growers have been using these types of fungicides for over a decade.

This term “phosphorous acid” should not be confused with phosphoric acid or phosphorous (P), a fertilizer component. In fertilizers, P is normally found in the form of phosphoric acid (H3PO4), which readily disassociates to release hydrogen phosphate (HPO42) and dihydrogen phosphate (H2PO4-). Both of these ions may be taken up by the plant and are mobile once inside the plant. Phosphorous acid is H3PO3. A single letter difference in the name of a chemical compound can make a major difference in its properties. Phosphorous acid releases the phosphonate ion (HPO32-; also called phosphite) upon disassociation. Phosphonate is easily taken up and translocated inside the plant. Phosphorous acid does **not** get converted into phosphate, which is the primary source of P for plants.

Because phosphorous acid and its derivatives do not get metabolized in plants, they are fairly stable and probably contribute little or nothing to P nutritional needs of the plants. Some researchers have investigated the ability of phosphorous acid to act as a nutrient source for plant growth and found that P-deficiency symptoms developed with phosphorous acid as a sole source of P. This means that although phosphorous acid can control diseases it is not a substitute for P fertilization. The inverse is also true: phosphate is an excellent source of P for plant growth, but is unable to control diseases other than improving the general health of the crop. So applying high amounts of P fertilizer will not work as a disease control measurer.

Researchers have found that phosphorous acid fungicides are especially effective against Oomycete pathogens, such as *Phytophthora, Phythium*, and Downy mildews in a number of crops. Phosphorous acid has both a direct and indirect effect on these pathogens. It inhibits a particular process (oxidative phosphorylation). In addition, some evidence suggests that phosphorous acid has an indirect effect by stimulating the plants natural defense response against pathogen attack. This probably explains the much broader spectrum of activity observed in fungicide efficacy trials in small fruit crops in Michigan. We found, for instance, that ProPhyt had efficacy against Downy mildew, Phomopsis,

and Black rot (but not much against Powdery mildew) in grapes. We also have evidence of activity of these compounds against Anthracnose in blueberries.

The phosponate ion is highly systemic and fairly stable in plants. The systemic activity allows them to be applied as foliar fungicides for prevention of Phytophthora and Phythium root rots. They also display curative activity. In general, applications every 14 days seem to be effective in grapes, but follow label directions. These fungicides are sold as solutions of potassium and/or sodium salts of phosphorous acid. To compare them, one should look at the "phosphorous acid equivalent," which should be listed on the label. Prices range from about $25-35 per gallon, in the application rate ranges from 2-5 pt/acre (~$6.25-22 per acre, depending on product and rate). Under high disease pressure, higher rates may need to be used in spray intervals tightened. Since these fungicides are actually in salt form, care must be taken not to exceed a certain concentration as crop injury may result. In addition, if the concentration is too high, the pH may become so low that in tank mixes with copper products (particularly copper hydroxide, such as Kocide), too much copper will become available and result in crop injury. (**Source:** *Michigan Fruit Crop Advisory Team Alert,* Vol. 20, No. 5, May 10, 2005)