Phytophthora and Phosphonates

By Joe Grant, Farm Advisor, San Joaquin County

Many orchards, especially walnuts and cherries, have had heavy tree losses this spring and summer. Valley agriculture has reaped many benefits from the heavy rains of 2004-05 and 2005-06. The high rate of tree mortality in our orchards – due most likely to a combination of winter/spring root zone water-logging and increased incidence of *Phytophthora* root and crown rot disease – is certainly a down-side of these recent weather conditions.

The "first fronts" in combating soil saturation and infection by *Phytophthora* have long been and still remain 1) use of Paradox hybrid rootstock, more resistant to Phytophthora than black or English, 2) proper pre-planting site preparation (deep ripping, slip plowing, or backhoeing; grading & leveling of the site; and planting trees on raised berms), and 3) good irrigation system design, construction and operation. Tactics (2) and (3) are both aimed at avoiding prolonged periods of soil saturated conditions which kill roots directly and favor spread and infection by *Phytophthora*.

Phosphonates are a recent addition to the arsenal in the battle against *Phytophthora*. Phosphate fertilizers, which have been available for many years, are derived from phosphoric acid (H_3PO_4) and have no fungicidal activity. In contrast, phosphonates are derived from phosphorous acid (H_3PO_3) and were first found to have disease control properties in the mid – 1980s. When sprayed on foliage, injected into the water conductive xylem tissue, or taken up by roots after chemigation through drip or microsprinkler systems, phosphonates move systemically through treated trees and their root systems.

The mechanism by which phosphonates suppress diseases caused by *Phytophthora* is poorly understood; there is evidence that phosphonates operate by directly suppressing the pathogens as well as by intensifying plant defense responses against the pathogen. Many phosphonate-based products are currently available but only a few companies have undertaken the time and expense to register these products as fungicides with US EPA and California Department of Pesticide Regulation. When choosing a product remember that, to be recommended and used legally, a product applied for the purpose of controlling pests (including diseases) must be registered as a pesticide with US EPA and CDPR.

Research with phosphonates in walnuts and other tree crops is still in the early stages, but there is mounting evidence that phosphonate applications help reduce *Phytophthora* losses in tree crops. Experimental methods used to apply phosphonates have included pressurized trunk injection, application through drip or other localized irrigation systems, and foliar sprays. The results of these tests to date suggest:

- An effectively delivered phosphonate application can provide suppression for disease caused by *Phytophthora* for up to 3 to 5 months after application.

- Foliar phosphonate sprays have been effective in late spring, summer, and early fall, when leaves are in good condition and are actively exporting products of photosynthesis to the tree.

- Effective uptake of phosphonates applied through microsprinkler and drip irrigation systems appears to be limited to periods in summer when trees are using water rapidly.
- Foliar spraying probably is the most effective way to apply phosphonates in orchards especially for single applications.

We will need more testing and commercial orchard experience with phosphonates to improve our understanding of the effectiveness, limitations and best uses of these materials. If we are lucky, perhaps we will be less pressed for a solution in the coming years by a return to more "normal" patterns of winter and spring rainfall less likely to promote *Phytophthora* outbreaks in orchards. In any case, coupled with use of resistant rootstocks and good soil/water management aimed at avoiding saturated conditions that favor *Phytophthora*, phosphonates look to be an effective tool to help reduce *Phytophthora* losses and increase orchard life and profitability.