Early Detection & Treatment

of Phymatotrichum Root Rot in Fruit Trees

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Figure 1. This is a black and white illustration of an aerial infra-red photograph of infected almond trees. Light colored trees at arrows indicate symptom of wilting caused by infection of their roots by Phymatotrichum omnivorum.

The photo on the cover of this issue of P.A. shows young almond trees replanted in fumigated soil following loss of two-year-old trees to Phymatotrichum root rot. Infra-red aerial photography aids in detecting symptoms and losses in orchards to the disease. The black and white photo also demonstrates which trees are infected.

Phymatotrichum omnivorum, the soil-borne fungus widely distributed in soils of southern Arizona, New Mexico, Texas and much of northern Mexico, has been a serious pathogen of vines and fruit- and nut-bearing trees for many decades. The disease is quick-acting, usually fatal to the infected plant and extremely difficult to control. Some current approaches to control of the disease in orchards and vineyards are discussed in this brief progress report.

Nature of the Fungus and Disease

Phymatotrichum root rot, first discovered in Texas in 1888 on cotton plants, causes an estimated $50,000,000 in losses of ornamental trees and shrubs as well as fruit-

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Figure 2. Apparatus for injecting fungicide into soil infested with the fungus, *Phymatotrichum omnivorum*, the cause of root rot among many susceptible fruit trees. Fungicide can be injected into the soil as deep as 36 inches under 200 p.s.i. pressure for control of the fungus.

and nut-bearing trees each year. Roots of trees penetrated by the fungus below the surface of the soil, soon loose their cortical tissue by sloughing. The result may be sudden wilting of the tree and sometimes death within a few weeks. The fungus thrives in alkaline soils of the southwestern deserts. It produces sporemats on the surface of the soil during the summer rainy season. The fungus survives for one year or more as hard-seed-like bodies called sclerotia or as strands of plaited hyphae on roots of cultivated plants and weeds. Strands may follow roots to depths of 10 to 12 feet on large trees. Eradication of strands and sclerotia formed at these depths is difficult and expensive.

Detection and Early Diagnosis

Control of the disease in trees is possible when symptoms are detected in time to allow proper treatment. The temperature of leaves rises on trees whose roots are extensively penetrated by the fungus. Wilting is apparent after a few days. Remote sensing by aerial photography using color infra-red film has provided a method to detect symptoms early in the summer when the fungus begins to attack the roots. Healthy trees appear deep red on infra-red film, whereas trees showing incipient wilt appear pale yellow. Physiologic changes in the foliage, especially temperature, are responsible for the change in color recorded on the film. These differences, when detected as early in infection as possible, may permit the application of effective measures for controlling further invasion by the fungus.

Treatment Following Diagnosis

Significant advances in control of *Phymatotrichum omnivorum* were made following the realization that immediate applications of manure, ammonium sulfate, and sulfur reduce growth and infection by the fungus. In addition, the tree benefits from these chemicals as nutrients and recovers from the infection more rapidly.

Barriers of sulfur poured into narrow trenches have proved effective in preventing the fungus from growing through soil between rows of trees. However, sulfur alone has not proved an effective treatment for trees already infected. Winter cover crops such as sorghum, barley and other cereals, incorporated as green manure in young orchards, are helpful in reducing amounts of the fungus in the soil. Treatments directly remedial for infected trees, however, have been scarce.

Recently, several new fungicides, particularly the benzimidazoles, have proven highly effective in reducing the growth of *P. omnivorum*. Benomyl, (1-butyl-carbamoyl-2-benzimidazole carbamic acid, methyl ester) is showing encouraging results in experimental plots of almonds, pecans, apricots, peaches and cherries for control of Phymatotrichum root rot. Benomyl, 50% wettable powder, at a concentration of 1 gram per liter of water is injected under 200 pounds pressure. The fungicide is applied by means of a 36-inch tube, 3/8" in diameter, with 4, 1/16" holes drilled at the tip. The application of two grams of Benomyl in each of 12 injection sites is followed by deep, flood irrigation. Trees showing incipient wilt and typical symptoms of Phymatotrichum root rot have recovered within one month following this treatment and regained normal color and vigor.

Early Diagnosis, Rapid Treatment Essential

Although this treatment is new and not fully evaluated, the combination of early detection and immediate treatment offers promise for remedial action in confining local infestations of *P. omnivorum* in orchards and reducing losses of trees. When combined with chemical barriers or manure-sulfur-ammonium sulfate treatments, new fungicides with some systemic activity and residual properties may provide control in 3- to 4-year old plantings where fumigation and replant requirements have been more costly.