

8. Tree Fruit Diseases

STUDIES IN THE BIOLOGY AND CONTROL OF OAK ROOT FUNGUS IN CALIFORNIA PEAR ORCHARDS

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Oak root fungus disease caused by the soil borne pathogen *Armillaria mellea* has become increasingly severe in pear orchards on the North Coast of California, particularly along riparian corridors. Since 1996, a number of studies have been conducted which have shown that 1) the increase has likely been hastened by changes in cultural practices, particularly irrigation, 2) the pathogen is spread primarily by rhizomorph growth through the soil, with root to root contact being a minor form of spread, 3) rhizomorphs rarely extend more than 30 cm. into the soil so infection sites are quite localized, 4) the root collar is as likely an infection site as peripheral parts of the root system, and 5) pear trees appear to tolerate infections on peripheral parts of the root system but decline quickly when the root collar becomes infected.

Several management strategies are being attempted as a result of the above findings. Pre- and post-plant fungicides are being tried as a means of preventing infection by rhizomorphs. Materials include metam sodium (Vapam®) (pre-plant only), sodium tetrathiocarbonate (Enzone®) (pre- and pre + post-plant), and propiconazole (Orbit®) (post-plant). Treatments are applied each year as infected trees are removed and replanted. Percent tree survival and trunk caliper 10 cm. above the graft union are recorded yearly.

The second tactic tried was excavating the roots and crowns to a minimum of two meters and minimum depth of one meter using supersonic air blasting to expose them to air. On 7 of the 11 blasted trees with *Armillaria*, the mycelial fans have dried and become discolored; in several cases the fan could not be located one year after exposure. The naturally occurring antagonistic fungus *Trichoderma* sp. has also colonized the dried mycelial fans. Vigor ratings and water status have measurably improved or stabilized on these trees.

Based on the excavation experiment, it is now thought that it is critical to avoid burying the root collar of the trees (many are buried up to 50 cm. below the soil line). Exposing the collar would 1) offset the influence of excessive moisture from frequent and prolonged irrigations, 2) prevent initial infection by rhizomorphs and likewise restrict infection to peripheral root parts, and 3) allow infected tissue to recover.

The final tactic currently being tested is the use of a mustard cover crop (i.e. Cutlass India mustard) to act as a natural fungicide. A replicated field trial was established in September 2000 based on laboratory data that showed that mycelial growth was inhibited 50-80% compared to untreated controls.

Other components in progress by collaborating researchers or being planned are 1) to determine the effects of various irrigation regimes on fungus viability and tree health (i.e. sprinkler vs. flood, application frequency, etc.), and 2) screening of new pear rootstocks for *Armillaria* resistance.

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