

# Epidemiology and Management of Phytophthora Root and Crown Rot of Almond in California

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## PROJECT SUMMARY

### Objectives:

- Evaluate the in vitro toxicity of new fungicides against *P. cactorum* and *P. niederhauseri*
- Evaluate new fungicides for the management of almond root health in greenhouse and field studies and compare to the registered mefenoxam and potassium phosphite.
- Evaluate for phytotoxicity and plant growth improvement

### Background and Discussion:

Phytophthora root rot and crown rot of almond can be caused by several species of *Phytophthora* including *P. cactorum*, *P. cryptogea*, *P. megasperma*, and the recently described *P. niederhauseri* that is present at high incidence at some locations. The disease is widely distributed and may cause high losses in newly planted orchards. The severity and rate of disease development depends in part on the rootstock and the species of *Phytophthora* involved, but the disease is most severe in soils with poor drainage that are waterlogged. Depending on the species, *Phytophthora* species survive as chlamydospores, oospores, and/or hyphae in plant debris in the soil. Under proper conditions, hyphae start growing or chlamydospores and oospores germinate to produce sporangia that contain zoospores - the main infective propagules. The zoospores are motile in water, they are attracted by root exudates, and infect feeder roots.

Management of root rot includes the use of tolerant rootstocks, irrigation management, and the use of mefenoxam or phosphonate (e.g., potassium phosphite, fosetyl-Al) fungicides. Several new fungicides including mandipropamid, fluopicolide, ethaboxam, and oxythiapiprolin with high activity against *Phytophthora* species have recently become

available. These fungicides all have different modes of action (belong to different FRAC groups), and their potential usage on almond will allow for possibly better disease control and fungicide resistance management. Respective registrants are supporting almond registration. The effectiveness of these fungicides for the management of Phytophthora root rot of almond is being evaluated in comparison to mefenoxam and potassium phosphite in greenhouse and field studies.

In initial in vitro assays, activity of the new fungicides against *Phytophthora* species was generally much higher as compared to the previously registered mefenoxam and phosphonate fungicides. Oxythiapiprolin has activity at the parts per billion level. This indicates that low usage rates should provide high activity. Because the fungicides represent new modes of action, rotation of these products in semi-annual applications will be an effective fungicide resistance management program. In other crops, resistance in other *Phytophthora* species to phosphonates has been reported by us. With widespread and indiscriminant usage of phosphite products (fungicides and fertilizer blends), we expect resistance also to occur in *Phytophthora* populations on almond.

Additionally, phosphite residues may remain a problem with some trading partners due to a wide range of residues obtained with different use patterns and differences in regulatory agencies reviews of these fungicides (e.g., exempt in the US but not in the EU). The new fungicides under evaluation will have MRLs established in the EU, and should be commercially available in 2019.

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**Project Cooperators and Personnel:** H. Förster, D. Thompson, W. Hao, and D. Cary, UC Riverside, F. Trouillas (UC-KARE), and D. Doll (UCCE Merced Co.).

### For More Details, Visit

- Poster location 91, Exhibit Hall A + B during the Almond Conference; or on the web (after January 2017) at [Almonds.com/Research Database](http://Almonds.com/Research Database)
- 2015 - 2016 Annual Reports CD (16-PATH3-Adaskaveg); or on the web (after January 2017) at [Almonds.com/Research Database](http://Almonds.com/Research Database)
- Related projects: 16-HORT4-Duncan, 16-HORT16-Aradhya, 16-PATH12-Trouillas