Biology and Management of Almond Scab and Alternaria Leaf Spot

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PROJECT SUMMARY

Objectives:

- Determine population composition of the scab pathogen (*Fusicladium carpophilum*) and if sexual reproduction occurs.
- Evaluate new and registered fungicides for their efficacy in scab and Alternaria management.
- For scab management, evaluate the effect of dormant and in-season applications on sporulation of twig lesions.
- Establish baseline sensitivities, monitor for sensitivity shifts in pathogen populations to different fungicides, and characterize mechanisms for resistance in the SDHI and DMI classes of fungicides.

Background and Discussion:

Scab (caused by *Fusicladium carpophilum,* formerly *Cladosporium carpophilum*) and Alternaria leaf spot (caused by *Alternaria alternata* and *A. arborescens* – recent taxonomic studies indicate that *A. tenuissima* is con-specific with *A. alternata*) are economically important summer diseases of almond. Both diseases occur especially in locations with high humidity and poor air circulation.

We continue to analyze populations of the scab pathogen from different growing areas in the state. Using molecular population approaches, we found no evidence for sexual recombination in *F. carpophilum*. Thus, populations of *Fusicladium* and *Alternaria* spp. appear to only reproduce clonally by asexual reproduction (i.e., conidia) in California.

For pathogens of both diseases, resistant isolates may be selected from random mutants after repeated selective pressure (i.e., application of one FRAC code [FC]). Genetic mutations have been found in *A. alternata* in SDHI subunits B, C, and D that correspond to resistance to some of the succinate dehydrogenase subgroup fungicides, but still other mutations need to be identified. Cross resistance patterns are being evaluated to determine proper rotations among SDHI fungicides (FC 7). Resistance can be managed with properly timed applications of fungicides belonging to different FCs.

Chlorothalonil-oil dormant treatments are in widespread usage and are highly effective for scab management. In-season, fungicide timings for scab were initiated based on overwintering twig lesion sporulation. For Alternaria they were based on the Disease Severity (DSV) model (with sensors on the outer perimeter of the canopy at a height of 10-16 ft) or a calendar-based timing starting in late spring with warm temperatures and dew formation. One to two applications are done in three-week intervals after the first application.

In our trials on Alternaria leaf spot, the new pre-mixture UC-2, as well as Luna Experience (FC 3/7), Merivon (FC 7/11), IL-5412, Fontelis/Aproach (FC 7/11), and the Inspire (FC 3)/Ph-D (FC 19) rotation were highly effective in reducing the incidence and severity of disease. Treatments with pyraziflumid, Ph-D/EXP-1552, and pydiflumetofen/difenoconazole also performed well.

For the management of scab, in-season treatments (two applications starting at the onset of twig sporulation – early April) with the experimental UC-2 (a premixture containing a DMI fungicide) had the lowest incidence. The Bravo/Inspire rotation and all pre-mixtures also were among the most effective treatments. Overall, spring-time treatments that were determined to be very effective include chlorothalonil (proposed label change to 60 days PHI), FC 3 fungicides such as Inspire, the FC U12 Syllit, and compounds containing FC 11 (at locations where the pathogen population has not developed resistance). Fungicides belonging to FC 7 should not be used by themselves but in mixtures with FC 3, 11, or 19. For scab management under high-disease conditions, a three-spray program should include dormant applications with chlorothalonil-oil (or copper-oil) and two petal-fall applications. Under lower disease pressure, a dormant treatment or in-season treatments alone may be considered. Additional benefits of dormant treatments include: 1) inoculum reductions; 2) an anti-resistance strategy (a smaller population is exposed to selection processes); and 3) alignment of in-season treatments for scab, Alternaria leaf spot, and rust.

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