Project No. 93-T19A - Investigations on Epidemiology and Control of Blossom and Foliar Diseases (Brown Rot, Shot Hole, Scab) of Almond

Project Leader: Dr. Jim Adaskaveg
University of California
Department of Plant Pathology
Davis CA 95616
(916) 752-6744

Cooperating Personnel: J.M. Ogawa, D. Gubler, J. Connell and K. Conn

Objectives:

1. To determine the wetness periods and temperature effects on the development of brown rot infections on different almond cultivars using the mist generator and environmental monitoring system (MGEMS) and bagging techniques. Studies will include cultivar evaluations for identifying natural host resistance.

2. To continue to determine if fungicide applications following infection periods of various durations can control blossom blight and to evaluate new formulations of Rovral for brown rot and shot hole control.

3. To evaluate the effect of liquid lime-sulfur, ziram, captan, and sulfur treatments for the control of scab.

Results:

1-3) *Epidemiology and Control of Brown Rot.* **Rovral-Omni oil treatments significantly and dramatically improved the control of brown rot blossom blight compared to Rovral (iprodione) and Rally (myclobutanil) treatments without oil.** Delayed-dormant applications of liquid lime sulfur were not effective in reducing brown rot. No phytotoxicity was observed from Rovral-1% oil mixtures. At 4% oil concentrations mixed with Rovral, however, some marginal leaf necrosis occurred after leaves emerged.

Table 1. Efficacy of fungicides for control of brown rot blossom blight of almond

Treatment	Rate (lbs a.i./A)	Brown Rot Infected Shoots (%)
Check	----	74.38 a
Rally 40W	0.15	63.06 b
Rovral 4F	0.50	52.37 b
Rovral 50WG	0.50	59.12 b
Rovral 50WG + Omni Oil (1%)	0.50	27.83 c

[1] - Fungicides were applied at pink bud and full bloom.

In laboratory studies, suppression of brown rot petal and anther infection of detached almond blossoms was also improved with the use of Rovral-oil mixtures when fungicides were applied after prolonged incubation-wetness periods. In comparative studies to Rovral 50WP alone, Benlate 50DF, and Captan 50WP (applied at labeled rates), Rovral-oil mixtures significantly suppressed anther and petal infection up to a 20-hr inoculation-wetness period prior to fungicide application when compared to the other treatments. Rovral-alone, like Benlate, also suppressed infection compared to the check and captan treatments. The systemic action of iprodione or benomyl was confirmed in these efficacy tests.

In laboratory tests, brown rot blossom blight of Drake increased from 0% to 50%, whereas blossom blight of Nonpareil increased from 0 to 18% in 0 to 36 hour wetness periods after 3 days. Newly opened blossoms (anthers exposed) were inoculated (25,000 conidia/ml) and exposed to wetness periods of 0, 4, 8, 12, 16, 24, and 36 hrs duration. Varietal comparisons were made between inoculated blossoms under increasing wetness periods. Differences in varietal susceptibility to brown rot have been confirmed and comparisons of cultivars and disease incidence were documented in laboratory and field tests. The following varieties were evaluated and are listed from highly susceptible to somewhat resistant: Drake, Carmel, Mission, and Nonpareil. Ideally, the use of resistant cultivars would be the best strategy for developing an effective brown rot control program.

A reduced spray program based on varietal differences in susceptibility to brown rot blossom blight was effective in controlling brown rot and showed no effect on crop yield. In two commercial orchards in Merced county, planted with Nonpareil-Carmel-Nonpareil-Price (Orchard No. 1) or Nonpareil-Carmel-Nonpareil-NePlus (Orchard No. 2), Nonpareil was either sprayed or not sprayed in a brown rot spray program using thiophanate-methyl (Topsin-M 50WP) in the first orchard or iprodione (Rovral 50WP) in the second orchard. **No differences in the incidence of brown rot blossom blight or in crop yield were observed between sprayed or non-sprayed Nonpareil trees. Up to a 50% reduction in brown rot sprays may be a realistic goal under this program.**

4) *Control of Scab and Rust.* **Delayed-dormant applications of liquid lime sulfur treatments suppressed scab lesion expansion and sporulation of the fungus on shoots.** In summer evaluations of leaves and fruit in all plots, disease incidence and severity was significantly lower in the LLS treatments than in check (no-dormant-spray) treatments. By September, however, liquid lime sulfur by itself was not effective in reducing defoliation. In these studies to evaluate the efficacy of dormant applications of liquid lime sulfur (LLS), spring applications of maneb+Zn (Manex), and summer

applications of captan or wettable sulfur, three test plots were established in commercial orchards in two counties (one in Butte and two in Merced). Delayed dormant (early February), air-blast spray applications of LLS were made on Carmel or NePlus Ultra almond in plots in Merced and Butte Counties. These plots were selected because trees had severe perennial, stem infections of scab. Evaluations were made of sporulation of the fungus on perennial infections (April-May), disease incidence and severity on fruits and leaves (July, August, and September), and on defoliation of trees in September.

In addition to the delayed dormant spray, summer applications of captan and sulfur were compared to nontreated trees in all three plots. Spray applications of captan and sulfur were made once in mid-May (Merced Plots) or in mid-May and mid-June (Butte plots). Evaluations were made in July and September. For brown rot control, Benlate was used in the first Merced plot; iprodione was used in the second Merced plot; whereas a 1 spray application of Topsin-1 lb/A/Ziram-6 lb/A, 1/2 spray application of Rovral-1 lb/A, and 1 spray application of ziram-6 lb/A was made in the Butte plot. **In the Merced and Butte plots, percent infection and severity of scab on fruit and leaves of Carmel was reduced significantly by the application of captan and sulfur when compared to the nontreated trees.** In the Butte plot, however, disease incidence and severity on Butte leaves and fruit were low and no differences were observed between any of the treatments.

Currently, the best program for scab control was delayed dormant liquid lime sulfur, followed by spring applications of maneb plus zinc (5-wk-after petal fall), and May or June sprays of captan or sulfur. In the Merced plot, maneb plus zinc reduced rust infection; in the other plot, rust did not occur. Based on labeled procedures, maneb plus zinc was applied 140 days before harvest (approximately 5-wk after petal fall). In summer evaluations of scab on leaves and fruit in all plots, disease incidence and severity was significantly lower in the maneb plus zinc treatments than in check (no-dormant-spray) treatments. Furthermore, by September, maneb plus zinc was very effective in reducing defoliation. Incorporation of this program with the brown rot and shot hole control programs is in progress.

5) ***Detection and distribution of anthracnose.*** **Continued monitoring of anthracnose confirmed our observations of a new occurrence of the disease on almond caused by a species of *Colletotrichum*.** Currently, we have isolated the fungus from Merced, Stanislaus, and Butte counties. Anthracnose was last reported in the early 1970s and since, has not been documented in California. The disease symptoms are observed 2-3 wk after petal fall and occurs primarily on the fruit. Infected fruit shrivel, become light rusty orange, and appear similar to almond blanks. Leaves attached to fruit spurs often wilt and remain attached (similar to leaf blight). Laboratory and field inoculation studies demonstrated pathogenicity of the *Colletotrichum* species. The spread of the disease should be curtailed through appropriate control measures before the disease becomes widespread in California almond orchards.