Deciduous Orchard Diseases—Chemical Control

Control of Alternaria Late Blight of Pistachio Using Multiple Applications of Organic and Other Fungicides

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Late blight of pistachio caused by *Alternaria alternata* affects both leaves and fruits and can result in severe defoliation and/or fruit deterioration during harvest. The disease appears earlier in orchards irrigated by sprinklers or flooding but it is common in all orchards, regardless of irrigation practices. In previous studies we showed that skipping one irrigation during a "critical period" (when *A. alternata* propagules increase) reduced Alternaria blight significantly. The purpose of this study was to understand the disease development in pistachio and develop more efficient control methods. In addition, we studied effects of the disease on the quality of pistachio fruits.

Procedure

Three experimental plots were established, two in Sacramento Valley and one in San Joaquin Valley. The schedule of applying the chemicals was based on patterns of *A. alternata* propagules monitored on fruits and leaves in 1990 and 1991. In previous studies, we showed that mid to late August applications with Kocide 101 increased disease instead of decreasing it. Therefore, efforts were made so that the last application in 1992 was done on July 30. Disease was evaluated on 200 fruits and 100 leaves per each of the four replicated trees. The effects of the treatments on the levels of propagules were also monitored in one of the experimental plots during 1992. We also evaluated fruit for shell staining for certain of the treatments. Infection of pistachio hulls by *A. alternata* results in a dark brown discoloration while infection by *Aspergillus niger* (another pathogen of mature pistachio) results in a characteristic bright yellow staining of shells.

Results and Conclusions

Results of the chemical treatments in all three experimental plots were almost similar, however, because the disease incidence was higher in one of the plots, in Glenn County orchard, treatments were more consistent (Table 1). All the fungicide treatments reduced significantly diseased fruit, infected rachises and leaves, and the severity of the disease (fewer lesions per leaf). Multiple applications of some of the chemicals resulted in equivalent disease control such as that obtained from one application of benomyl. Benomyl and Kocide 101 are the only fungicides registered for two other diseases of pistachio (Botrytis and Botryosphaeria blights). As with results in previous years, Kocide 101 applied once up to four times was effective in reducing the propagules of *A. alternata* on pistachio fruits. The organic fungicides, Kocide 101 (cupric hydroxide) and Nordox (cuprous oxide), and the inorganic Bravo E-825 (at low concentration) significantly reduced staining of fruits by reducing Alternaria fruit infections.

Isolates of *A. alternata* from pistachio showed a great variability in growth, however, all isolates tested had an optimum of 30°C and none grew above 35°C, suggesting that the high temperatures that prevail before and during harvest of pistachio could favor infections by the fungus. In laboratory and field studies, we found that fruit and leaves became more susceptible to infection as they aged.

References

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Table 1. Effect of various chemical treatments on Alternaria late blight of Kerman pistachio in a commercial orchard in Glenn County (sprinkler irrigated; Exp. Plot 1, west).

Treatment[1]	Infected fruit (%)[2]	Blighted fruit (%)[2]	Diseased fruit (%)[2]	Infected rachises (%)[2]	Infected leaves (%)[2]	Disease index[2,3]
Control	54.6a[4]	12.6a	67.3a	67.5a	90.0a	2.44a
Maneb	27.8b	4.8b	32.5b	20.8b	31.0c	0.55bc
Benlate	14.8bc	0.1d	14.9c	3.3d	62.1b	0.98b
Benlate + Maneb	14.3c	1.9bcd	16.1c	7.5cd	25.5c	0.28c
Nordox	9.8c	2.8bcd	12.5c	10.8bcd	31.0c	0.41bc
Benlate + Kocide	9.8c	0.9cd	10.6c	9.2cd	61.5b	0.79bc
Kocide 101	8.3c	2.8bcd	11.0c	17.5bc	40.5bc	0.52bc
Bravo (high)[5]	4.2c	3.5bc	7.7c	3.3d	26.5c	0.29bc
Bravo (low)[5]	4.1c	2.3bcd	6.4c	3.3d	31.5c	0.39bc

[1]All fungicides were applied on 17 April, 22 May, 25 June and 30 July, except Benlate applied only on 17 April and Maneb on 22 May, 25 June and 30 July.
[2]Averages of four replications each of 200 fruits, 30 rachises and 50 leaves.
[3]Based on five (0 to 4) disease severity categories (see text for details).
[4]Significant differences according to LSD at $P<0.05$.
[5]High concentration=5.45 lb and low=3.64 lb product per 100 gal water.