Performance of New Chemistries for Control of Powdery Mildew of Cantaloupe in 1999

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Abstract

Powdery mildew on melons is an annual disease problem in Arizona. Sphaerotheca fuliginea is the plant pathogenic fungus that causes powdery mildew of cucurbits, which include cantaloupe, honeydew, watermelon, cucumber and squash. When environmental conditions are favorable, disease incidence and severity can reach economically significant levels. Factors that favor development of powdery mildew on melons include moderate temperatures and relative humidity, succulent plant growth, and reduced light intensity brought about by a dense plant canopy. Potential new fungicides were evaluated and compared to existing chemicals for control of powdery mildew of cantaloupe in a field trial conducted during the spring of 1999 at the Yuma Agricultural Center. A high level of disease had developed by crop maturity (June 29). On nontreated plants 43% of the upper leaf surface was covered by powdery mildew, whereas the level on the underside of leaves was 78%.. All of the 34 different treatments significantly reduced the level of powdery mildew on both sides of leaves, compared to nontreated plants. The best treatments among those tested with respect to disease control on the underside of leaves, where disease control is more difficult than on the tops of leaves, included Topsin+Trilogy, Benlate, Benlate+Trilogy, Quadris, A815, Topsin+Microthiol, and Topsin. The potential availability of new chemistries for management of powdery mildew of cantaloupe and other cucurbits could help improve overall control of powdery mildew as well as the implementation of fungicide resistance management strategies, which strive to minimize the risk of resistance development by the pathogen to these compounds.

Introduction

Powdery mildew is an annual concern to melon growers in Arizona. The disease on cantaloupes, which is caused by the fungus *Sphaerotheca fuliginea*, first appears as small, white, superficial spots on leaves and stems. These spots will enlarge, become powdery in appearance, increase in number and eventually cover stems and both surfaces of leaves. Young infected leaves may turn chlorotic and die. Severely infected leaves turn brown, desiccate and detach from the plant. Cantaloupe fruit are free of infections; however, fruit on severely infected plants may ripen prematurely, be of poor quality and become sunburned due to the reduced plant canopy. Development of powdery mildew is favored by moderate temperatures and relative humidity, dry soil conditions, reduced light intensity and succulent plant growth. These conditions often exist within the plant canopy of actively growing cantaloupe plantings. The same pathogen causes powdery mildew on watermelons, honeydews, squash and other cucurbits.

When available, effective control of powdery mildew can be achieved by planting cultivars that are tolerant or resistant to the pathogen. If susceptible cultivars are grown, it is extremely important to have fungicidal protection in place

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when environmental conditions become favorable for disease development. The life cycle of the pathogen, going from spore germination on the plant to subsequent release of spores from this infection site, can be as short as 4 to 5 days. By the time initial colonies are visible on plant leaves, numerous additional infection sites are already developing but not yet visible. Sulfur is an excellent powdery mildew fungicide, but can cause serious leaf burn on many melon cultivars in the high temperatures that often occur in desert production areas when environmental and cultural conditions favor disease. Other compounds, such as azoxystrobin (Quadris), benomyl (Benlate), chlorothalonil (Bravo), neem oil (Trilogy), potassium carbonate (Kaligreen), thiophanate-methyl (Topsin M), and trifloxystrobin (Flint), are available for management of powdery mildew on melons as well.

Several new agrochemicals are in development that have activity on fungi related to those that cause powdery mildew. A fungicide trial was initiated in the spring of 1999 to test the potential efficacy of these new chemistries on powdery mildew of cantaloupe.

Materials and Methods

This fungicide study was conducted at the Yuma Valley Agricultural Center. The soil was a silty clay loam (7-56-37 sand-silt-clay, pH 7.2, O.M. 0.7%). Cantaloupe 'Topmark' was seeded and watered March 2 on beds with 80 inches between row centers. Treatments were replicated five times in a randomized complete block design. Each replicate consisted of 25 feet of row with a plant spacing of 12 inches. Treatment beds were separated by single nontreated beds. Fungicide treatments were applied with a tractor-mounted boom sprayer that delivered 50 gal/acre at 100 psi to flat-fan nozzles spaced 12 inches apart. Foliar applications of fungicides were made May 21, June 2 and 18. Maximum and minimum ranges of air temperature (°F) were as follows: Mar, 67-89, 37-60; Apr, 61-100, 41-62; May, 79-102, 43-71; Jun, 78-110, 52-78. Measurable rainfall occurred in Apr (1.01 in.) and June (0.05 in.). Furrow irrigation was used for the duration of the study. Disease severity was determined June 29 and 30 by collecting 10 leaves at random from each plot and recording the percentage of the upper and lower leaf surface infected with the powdery mildew fungus. A rapid escalation of the whitefly population near the end of the trial combined with high daytime temperatures and low humidity lead to a rapid decline of the plants as they approached maturity; therefore, melon yield could not be evaluated in this study.

Results and Discussion

Powdery mildew was not evident at the first or second application of fungicides. Initial signs of powdery mildew were not detected until June 4. A high level of disease developed by June 29 and 30, when disease development among the different treatments was evaluated. On nontreated plants, 43% of the upper leaf surface was covered by powdery mildew, whereas the level on the underside of leaves was 78%. All of the 34 different treatments significantly reduced the level of powdery mildew on both sides of leaves, compared to nontreated plants. The best treatments (with a final percent leaf surface area infected value of 10% or less) among those tested with respect to disease control on the underside of leaves, where disease control is more difficult than on the tops of leaves, included Topsin+Trilogy, Benlate, Benlate+Trilogy, Quadris, A815, Topsin+Microthiol, and Topsin. Other chemistries that demonstrated the ability to significantly reduce powdery mildew on cantaloupe included Quinoxyfen, Flint, Rally, Sovran, BAS 500, Bravo, Rubigan, Trilogy, Serenade, Folicur, and Kaligreen.

Disease control achieved on the upper leaf surface suggests that all tested materials can significantly reduce powdery mildew compared to no treatment at all when the test compound is applied directly to the leaf surface with good coverage. On the other hand, disease control on the underside of leaves, where coverage by the fungicide is less than that achieved on the top of leaves, demonstrates the efficacy of chemistries that have a degree of systemic movement within the leaf.

No symptoms of phytotoxicity were observed with any treatment; however, it should be noted that the cantaloupe cultivar used in this trial (Topmark) is tolerant to sulfur, whereas other melon varieties may not be. Two different genera of fungi are reported to cause powdery mildew on cantaloupe, *Erysiphe cichoracearum* and *Sphaerotheca fuliginea*. Microscopic examination of spores from diseased cantaloupe leaves revealed well-developed fibrosin bodies, which suggests that we were dealing with *Sphaerotheca fuliginea* in this field study.

A fungicide resistance management program, which strives to minimize the risk of a plant pathogen population becoming resistant to one or more fungicides, is imperative for the preservation of fungicide effectiveness. Resistance management is achieved by applying mixtures of fungicides or alternating between different classes of chemistries to prevent or minimize a shift in the pathogen population toward tolerance or insensitivity to one or more disease control compounds. Several of the products registered for use on melons must be alternated with a different chemistry, as directed by the label, to carry out this fungicide resistance management objective. The future registration and subsequent availability of one or more new chemistries for cantaloupe and related crops will facilitate the implementation of an effective fungicide resistance management program.

Table 1. Cantaloupe powdery mildew fungicide trial. Page 1.
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Treatment	Rate (a.i./A)	Applic. dates*	% of leaf surface infected**	
			Upper	Lower
Topsin M 70W + Trilogy 70EC	0.35 lb + 0.35 gal	1,2,3	0.2	2.4
Benlate 50WP	0.25 lb	1,2,3	0.4	2.6
Benlate 50WP + Trilogy 70EC	0.25 lb +0.35 gal	1,2,3	0	2.6
Quadris 2.08F +Latron B-1956	0.25 lb +0.24 pt	1,2,3	0	6.6
A815 50WDG	0.1875 lb	1,2,3	3.2	7.6
Topsin M 70W +Microthiol 80DF	0.35 lb + 4.0 lb	1,2,3	0.6	7.6
Topsin M 70W	0.35 lb	1,2,3	0.2	8.6
A815 50WS	0.1875 lb	1,2,3	1.0	11.8
Quinoxyfen (250 g/l)	0.167 lb	1,2,3	0.2	12.8
Microthiol 80DF	4.0 lb	1,2,3	0.2	13.0
Flint 50WG	0.06 lb	1,2,3	0	17.2
Rally 40WP	0.10 lb	1,2,3	0.6	18.2
Sovran 50WG or Bravo Ultrex 82.5WG	0.10 lb 2.25 lb	1,3 2	0.8	18.2
Flint 50WG or Trilogy 70EC	0.06 lb 0.35 gal	1,3 2	3.0	20.6
BAS 500 2.09EC	0.20 lb	1,2,3	1.2	21.0
Quinoxyfen (250 g/l)	0.083 lb	1,2,3	1.6	21.8

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Table 1 (continued). Cantaloupe powdery mildew fungicide trial. Page 2**.**
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Treatment	Rate (a.i./A)	Applic. dates*	% of leaf surface infected**	
			Upper	Lower
TABLE CONTINUED FROM PRECEDING PAGE				
Rally 40WP or Kaligreen 82WP +Latron B-1956	0.10 lb 2.05 lb + 0.24 pt	1,3 2	0.6	22.2
A815 50WDG	0.125 lb	1,2,3	7.0	22.8
Flint 50WG	0.05 lb	1,2,3	0	23.0
BAS 500 2.09EC	0.15 lb	1,2,3	1.8	24.8
Bravo Weather Stik 720L	2.25 lb	1,2,3	0.6	29.4
Quinoxyfen (250 g/l)	0.04 lb	1,2,3	2.4	33.2
Rubigan	0.09 lb	1,2,3	2.2	36.6
Trilogy 70EC	0.35 gal	1,2,3	6.8	39.6
BAS 500 2.09EC + Bravo Ultrex 82.5WG	0.15 lb + 1.5 lb	1,2,3	0.2	42.0
Serenade WP	8.0 lb	1,2,3	4.8	42.2
Folicur 3.6F +Latron B-1956	0.225 lb + 0.24 pt	1,2,3	2.0	43.0
Serenade AS	1.0 gal	1,2,3	4.6	54.2
Kaligreen 82WP +Latron B-1956	2.05 lb + 0.24 pt	1,2,3	5.4	59.6
Nontreated	-------	-------	43.2	78.0
LSD (Least Significant Difference, $P = 0.05$			6.2	8.2

* Application dates: 1 = May 21; 2 = June 2; 3 = June 18, 1999.

** The average % of leaf surface area infected with powdery mildew on 10 leaves per plot.