CANTALOUPE (*Cucumis melo*)
Downy mildew; *Pseudoperonospora cubensis*

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Evaluation of a fungicide program applied on an IPM schedule to downy mildew susceptible and resistant cultivars of cantaloupe, 2022.

A field experiment was conducted at the Long Island Horticultural Research and Extension Center (LIHREC) in Riverhead, NY, on Haven loam soil. The objective was to determine if downy mildew can be effectively managed with a weekly program of targeted fungicides applied on an IPM schedule (started after observing symptoms) to susceptible or resistant cultivars. Treatments included to achieve this objective were susceptible and resistant cultivars left untreated and treated with a similar fungicide program on the recommended preventive schedule. In previous experiments, two of the three resistant cultivars exhibited moderate suppression of downy mildew (PDMR 16:V104) and excellent suppression of powdery mildew (PDMR 16:V105). Phytophthora blight, caused by *Phytophthora capsici*, was managed through biofumigation and weekly applications of targeted fungicides on a preventive schedule. The field was moldboard plowed, urea fertilizer (46-0-0) was applied at 80 lb/A N, then mustard biofumigant cover crop cv. Rojo Caliente was seeded at 10 lb/A by drilling on 23 Mar. On 8 Jun the mustard was flail chopped, immediately incorporated by disking, and followed by a cultipacker to seal the soil surface; the field could not be irrigated to initiate biofumigation as usually done, but the soil was considered moist enough to obtain activity. Controlled-release fertilizer (N-P-K, 19-10-9) at 525 lb/A (101 lb/A N) was broadcast over the bed area and incorporated on 5 Jul. Beds were formed with drip tape and covered with black plastic mulch on 12 Jul. Cantaloupe seeds were sown on 27 Jun in the greenhouse. A waterwheel transplanter was used to make planting holes in the beds and apply starter fertilizer (9-18-9). Seedlings were placed outdoors to harden for a few days before transplanting on 18 and 19 Jul by hand into the holes in the beds. During the season, water was provided as needed via drip irrigation lines. Weeds were managed between the mulched beds by applying Strategy 3 pt/A, Sandea 0.5 oz/A, and Curbit EC 1 pt/A on 13 Jul with a tractor-sprayer and by hand weeding. The following fungicides were applied to foliage to manage Phytophthora blight: Revus 8 fl oz/A applied on 14 and 26 Jul, and Presidio 4 fl oz/A applied on 19 Jul and 2 Aug. They were selected because they were ineffective against downy mildew in recent seedling bioassays assumed due to fungicide resistance (PDMR 16:V103). No foliar or fruit symptoms of *P. capsici* were seen. Powdery mildew was controlled by applying Procure 6 fl oz/A on 4 Aug, Procure 8 fl oz/A on 15 Aug and 6 Sep, Vivando 15 fl oz/A on 10 and 29 Aug and 12 Sep, and Quintec 6 fl oz/A on 22 Aug. The primary source of initial inoculum of *Pseudoperonospora cubensis* in this area is long-distance wind-dispersed spores from affected plants. Treatments were applied seven times starting on 27 Jul for the preventive treatments and four times starting on 17 Aug for the IPM treatments using a tractor-mounted boom sprayer equipped with twinjet (TJ60-11004VS) nozzles spaced 17 in. apart that delivered 72 gal/A at 55 psi and 2.3 mph. The program was Ranman 2.75 fl oz/A applied on 27 Jul, 17 Aug, and 8 Sep, Previcur Flex 1.2 pt/A on 3 and 25 Aug, and Orondis Ultra 7 fl oz/A on 9 and 30 Aug. Plots were three 10-ft rows spaced 68 in. apart with 10 to 12 plants per plot at 2-ft spacing. The plots were 14 ft apart within the row initially until plants began to vine, partly filling the area. Vines were moved as needed to maintain plot separation. A randomized complete block design with four replications was used. Downy mildew severity was assessed weekly from 17 Aug through 15 Sep by estimating incidence of symptomatic leaves in each plot and rating severity on nine representative affected leaves. Canopy severity was calculated by multiplying incidence by average severity. Area under disease progress curve (AUDPC) values were calculated from 17 Aug through 15 Sep using the formula: $\sum n_{i=1}[(R_{i+1} + R_i)/2]\,[t_{i+1} - t_i]$, where R = disease severity rating (% of leaf surface with symptoms) at the ith observation, t_i = time (days) since the previous rating at the ith observation, and n = total number of observations. Defoliation was assessed by estimating the percent of foliage lost due to downy mildew on 15 and 20 Sep. Ripe fruits were harvested and rotten fruits were counted on 16, 21, and 27 Sep. A refractometer was used to measure sugar content (Brix) of one fruit per plot for some treatments on 16, 21, and 27 Sep. Appearance, taste, texture, and marketability were rated without knowledge of treatment for fruit harvested on each date from fungicide-treated plots and from untreated plots of Ambrosia by LIHREC staff and gardeners on a 1 (poor) to 5 (excellent) scale as interpreted by the rater. Total of 20 ratings were obtained. All remaining fruit were counted on 3 Oct. Average monthly high and low temperatures (°F) were 85.3 and 68.9 in Jul, 85.4 and 68.7 in Aug, and 76.3 and 60.3 in Sep. Rainfall (in.) was 4.1, 2.0, and 4.3 for these months, respectively. Data was analyzed with one-way ANOVA and Tukey's HSD to separate means using JMP statistical software.

Symptoms of downy mildew were first observed on 8 Aug (20 days after transplanting and 12 days after the first preventive application) on one leaf in each of 5 plots. The untreated susceptible cultivar Ambrosia was numerically and usually significantly more severely affected by downy mildew than the untreated resistant cultivar Trifecta. Compared to untreated Ambrosia, untreated Trifecta provided 29% control based on AUDPC values and 72% control based on defoliation. Control of downy mildew was substantially improved with either fungicide program applied to Trifecta (>99%). The IPM fungicide application schedule was as effective as the preventive schedule for managing downy mildew on Ambrosia (98% control) although it was hypothesized that this might only be the case with a resistant cultivar. There usually were more symptoms of downy mildew on Ambrosia treated with fungicides on the IPM schedule than on the three resistant cultivars receiving the same fungicide program, but differences were not significant. There were no significant differences in downy mildew control among the 3 resistant cultivars treated with targeted fungicides on the IPM schedule. Applying fungicides to control downy mildew on Ambrosia resulted in significantly larger fruit (average weight of 3.9 lb versus 4.9 lb) with significantly higher sugar content based on Brix values, which is associated with better flavor. Trifecta had significantly higher sugar content than the other cultivars except Edisto 47. Edisto 47 produced the largest fruit (5.7 lb) and thus, not surprisingly, the fewest fruit. Trifecta received highest average ratings for taste, texture, and internal appearance, and all assessments had yes response for 'would you buy?' (data not shown). Planter's Jumbo received highest average ratings for shape and external appearance. Fruit of Ambrosia from fungicide-treated plots were rated higher than fruit from untreated plots for all variables except size, most notably for taste (3.6 versus 2.4). Photographs are posted at https://blogs.cornell.edu/livegpath/research/cucurbit-downy-mildew/evaluation-of-downy-mildew-resistant-cantaloupe-varieties-in-an-integrated-program-with-fungicides-applied-on-an-ipm-schedule/. This report includes work that is supported by the National Institute of Food and Agriculture, U.S. Department of Agriculture, Hatch under 7000429.

Cultivar [z] (fungicide program)	Downy mildew canopy severity (%) [y]				Defoliation (%) [y]	Yield and fruit quality [y]	
	7 Sep [x]	15 Sep	20 Sep	AUDPC [x]	20 Sep [x]	# Fruit/plant	Brix
Ambrosia (untreated)	48.3 a	27.4 a	ND	452.2 a	98 a	4.3 abc	6.5 c
Ambrosia (preventive)	0.7 b	0.8 c	3.4 bc	9.0 c	4 bc	4.8 a	10.7 b
Ambrosia (IPM)	1.4 b	0.1 c	5.5 b	10.8 c	4 bc	4.8 a	ND
Trifecta (untreated)	37.5 a	14.0 b	28.5 a	320.5 b	27 b	3.7 bc	ND
Trifecta (preventive)	0.1 b	0.0 c	0.7 c	1.0 c	2 c	4.7 ab	ND
Trifecta (IPM)	0.2 b	0.0 c	1.4 bc	1.9 c	1 c	4.3 ab	12.1 a
Edisto 47 (IPM)	0.2 b	0.1 c	3.4 bc	2.4 c	4 bc	3.3 c	10.9 ab
Planter's Jumbo (IPM)	0.9 b	0.0 c	2.4 bc	6.5 c	7 bc	4.5 ab	9.6 b
P-value (treatment)	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	0.0004	<0.0001

[z] Ambrosia is susceptible to downy mildew. Edisto 47, Planter's Jumbo, and Trifecta are marketed as being resistant to downy mildew.
[y] Numbers in each column with a letter in common or no letters are not significantly different from each other (Tukey's HSD, P=0.05). ND = not determined.
[x] Values were square root transformed before analysis because raw data were not distributed normally. Table contains de-transformed values.