

Cantaloupe: *Cucumis melo* L.

THE INTEGRATED USE OF BIOPESTICIDES WITH CONVENTIONAL FUNGICIDES TO CONTROL POWDERY MILDEW ON CANTALOUPE, SPRING 2009.

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Sphaerotheca fuliginea

On 6 Mar. 2009, plots were established at the University of Florida's Gulf Coast Research and Education Center in Balm, FL to assess the effect of several fungicides and biopesticides on the severity of powdery mildew on cantaloupe. Plots consisted of 8 ft bed sections along 300 ft, raised beds with 4 ft center-to-center bed spacing. Beds were covered with black virtually impermeable mulch and irrigated with a drip system. Seeds of the cantaloupe cultivar Hale's Best were planted at 30" spacing along beds skipping a 6 ft section between plots and every third bed as a buffer. Fungicide treatments were applied on 9-Apr, 16-Apr, 23-Apr, 30-Apr, 7-May, 14-May, and 2-Jun with a CO₂ back pack sprayer calibrated to deliver 40 to 100 gal/A at 40 psi. A non-treated control was included to measure disease pressure. Treatments were arranged in a randomized complete block design with each treatment repeated 4 times. Plots were monitored regularly for powdery mildew, and rated 13 May and 28 May after disease reached acceptable levels across the trial. Marketable yield was assessed from two separate harvests of plots on 28 May and 3 June.

Environmental conditions during the beginning of the trial were unusually dry. Only 1.23 and 1.34 inches of rain were recorded for the months of March and April, while 10.86 inches was recorded for the month of May. Symptoms of powdery mildew were first observed in control plots on 30-Apr. Due to the susceptible nature of the cultivar, disease still developed, but at a slower than expected pace. Alternating applications of Previcur Flex (1.2 pt/A) and Curzate 60DF (3.2 oz/A) on 9-Apr, 23-Apr, 7-May, 14-May, and 2-Jun were used to minimize the impact of downy mildew, especially when conducive conditions occurred in May.

The severity of powdery mildew was rated using the Horsfall-Barratt scale on 13 May, 78 days after planting (DAP), and ranged from 0 to 6 corresponding to mid-percentage values of 0 and 62.5%, respectively. By 28 May, 93 DAP, disease severity values ranged from 4 to 9 corresponding to 18.5 and 95.5%, respectively. Significant differences were detected among treatments on both dates (Table 1). Area under disease progress curves (AUDPC) were also calculated using the trapezoidal method and also revealed significant differences among treatments (Table 1).

Based on AUDPC values, all treatments reduced disease significantly relative to the non-treated control and fell into 3 groups. With weekly applications of HMO 736, Companion, Actinovate, BU EXP 1216 (both S & C formulations), and Regalia forming the first group with final disease severity values ranging from 67 to 86% on 28-May. Biweekly applications of Procure (the standard fungicide) alone, weekly applications of KFD 61-04 (2.3 lb rate) alone, Actinovate alternated with Procure, and both BU EXP 1216 formulations alternated with Procure made up the second group with final disease severity ranging from 44 to 56% on 28-May. The final group was composed of Regalia, Companion, and HMO 736 rotated with Procure, and weekly applications of the remaining KFD experimental formulations (70-01 at 2.5 and 5 lb rates & 61-04 at the 4.6 lb rate) with final disease severity ranging from 23 to 38% on 28-May. The effectiveness of all biopesticides was improved by alternating with Procure. More importantly, alternating applications of Regalia, Companion, and HMO 736 improved the activity of Procure alone based on the final disease severity rating on 28-May.

Total number of marketable fruit and total weight was collected for the trial (Table 2). Significant differences were detected for both parameters on the second harvest, 3-Jun. When data from both harvest dates were combined, only differences in total number of marketable fruit were significant. Average fruit weight was calculated from total fruit number and total weight, but differences were not significant (Table 2). The KFD experimental compounds exhibited the best overall disease control, but this did not translate into improved yields; probably due to the minor-moderate levels of phytotoxicity observed in the field. Otherwise, Companion alternated with Procure yielded the most fruit per plot among the biopesticide treatments, better statistically than companion alone but not Procure alone. All the biopesticides typically yielded better in regards to the fresh weight and number of fruit when alternated with Procure, but this trend was usually not significant.

Table 1. Effect of fungicides and biopesticides on the LS Mean (95% confidence interval) severity of powdery mildew on cantaloupe cv. Hale's Best during spring 2009 field trial at GCREC, Wimauma, FL.

Treatment, rate/acre ^y	Disease Severity ^z		
	13-May	28-May	AUDPC
Untreated Control	56.3 (48.6 - 63.9)	93.3 (83.5 - 103.0)	3315 (2952 - 3678)
Procure, 8 oz (2,4,6)	1.5 (0 - 9.1)	56.3 (46.5 - 66.0)	492 (129 - 855)
Regalia, 1% (v/v) (1-7)	3.0 (0 - 10.6)	86.3 (76.5 - 96.0)	786 (423 - 1149)
Actinovate, 3 oz (1-7)	5.6 (0 - 13.2)	81.5 (71.7 - 91.3)	873 (510 - 1236)
HMO 736, 14 oz (1-7)	23.3 (15.6 - 30.9)	72.0 (62.2 - 81.8)	1621 (1258 - 1984)
Companion, 32 floz (1-7)	16.1 (8.5 - 23.7)	67.3 (57.5 - 77.0)	1254 (891 - 1617)
Regalia, 1% (v/v) (1,3,5,7); alt.			
Procure, 8 oz (2,4,6)	1.1 (0 - 8.7)	37.5 (27.7 - 47.3)	334 (0 - 697)
Actinovate, 3 oz (1,3,5,7); alt. Procure, 8 oz (2,4,6)	2.3 (0 - 9.9)	50.0 (40.2 - 59.8)	480 (117 - 843)
HMO 736, 14 oz (1,3,5,7); alt. Procure, 8 oz (2,4,6)	1.5 (0 - 9.1)	32.8 (23.0 - 42.5)	315 (0 - 678)
Companion, 32 floz (1,3,5,7); alt.			
Procure, 8 oz (2,4,6)	1.1 (0 - 8.7)	37.5 (27.7 - 47.3)	334 (0 - 697)
BU EXP 1216S, 3 lb (1-7)	6.0 (0 - 13.6)	76.8 (67.0 - 86.5)	855 (492 - 1218)
BU EXP 1216c, 3 lb (1-7)	2.3 (0 - 9.9)	79.1 (69.4 - 88.9)	698 (335 - 1061)
BU EXP 1216S, 3 lb (1,3,5,7); alt.			
Procure, 8 oz (2,4,6)	0.8 (0 - 8.4)	56.3 (46.5 - 66.0)	457 (94 - 820)
BU EXP 1216c, 3 lb (1,3,5,7); alt.			
Procure, 8 oz (2,4,6)	1.1 (0 - 8.7)	43.8 (34.0 - 53.5)	380 (17 - 743)
KFD 61-04, 2.3 lb (1-7)	1.5 (0 - 9.1)	56.3 (46.5 - 66.0)	492 (129 - 855)
KFD 61-04, 4.6 lb (1-7)	1.5 (0 - 9.1)	28.0 (18.2 - 37.8)	280 (0 - 643)
KFD 70-01, 2.5 lb (1-7)	1.5 (0 - 9.1)	32.8 (23 - 42.5)	315 (0 - 678)
KFD 70-01, 5.0 lb (1-7)	1.5 (0 - 9.1)	23.3 (13.5 - 33.0)	244 (0 - 607)
	<i>P > F</i>	<i>< 0.0001</i>	<i>< 0.0001</i>

^y Treatments (TRT) were applied 9-Apr, 16-Apr, 23-Apr, 30-Apr, 7-May, 14-May, and 2-Jun corresponding with applications 1 to 7, using a backpack sprayer calibrated initially for 40, 60 and then 100 gallons per acre after 30-Apr. Listed treatment rates are on a per acre basis unless noted otherwise. Seeds were planted 6-Mar.

^z The severity of powdery mildew was assessed as the percentage of canopy affected. The Horsfall-Barratt scale was used for all ratings, but values were converted to mid-percentages prior to statistical analyses. Area under disease progress curve (AUDPC) was calculated for each treatment using the trapezoidal method. Values in parentheses represent *t*-type confidence intervals ($\alpha = 0.95$) for each mean.

Table 2. Effect of fungicides and biopesticides on the LS Mean (95% confidence interval) cantaloupe yields during spring 2009 field trial at GCREC, Wimauma, FL.

Treatment, rate/A ^z	Marketable fruit (no./trt)			Marketable weight (lbs/trt)			Average fruit size (lbs/fruit)		
	28-May	3-Jun	Total	28-May	3-Jun	Total	28-May	3-Jun	Total
Untreated Control	5 (2 - 8)	5 (0 - 11)	10 (3 - 17)	18.5 (8.2 - 28.9)	11.6 (0 - 25.9)	30.1 (10.2 - 50)	1.6 (0.4 - 2.8)	2.5 (2.0 - 3.0)	3.1 (2.6 - 3.5)
Procure, 8 oz (2,4,6)	6 (4 - 9)	10 (4 - 16)	17 (9 - 24)	23.8 (13.4 - 34.1)	25.6 (11.2 - 39.9)	49.3 (29.4 - 69.3)	2.7 (1.5 - 3.8)	2.4 (1.9 - 2.9)	3.2 (2.7 - 3.6)
Regalia, 1% (v/v) (1-7)	6 (3 - 8)	8 (2 - 14)	14 (7 - 21)	22.4 (12.1 - 32.8)	18.5 (4.2 - 32.8)	40.9 (21.0 - 60.9)	1.2 (0.1 - 2.4)	2.3 (1.8 - 2.8)	2.9 (2.4 - 3.3)
Actinovate, 3 oz (1-7)	5 (2 - 7)	7 (1 - 13)	12 (4 - 19)	18.9 (8.5 - 29.2)	17.6 (3.2 - 31.9)	36.5 (16.6 - 56.4)	1.1 (0 - 2.3)	2.6 (2.1 - 3.1)	3.1 (2.7 - 3.6)
HMO 736, 14 oz (1-7)	3 (0 - 6)	7 (0 - 13)	10 (2 - 17)	13.3 (3.0 - 23.7)	16.4 (2.1 - 30.8)	29.8 (9.8 - 49.7)	0.9 (0 - 2.1)	2.6 (2.1 - 3.0)	3.1 (2.7 - 3.6)
Companion, 32 floz (1-7)	6 (3 - 8)	8 (2 - 14)	14 (6 - 21)	20.8 (10.4 - 31.1)	20.0 (5.7 - 34.3)	40.8 (20.9 - 60.7)	1.7 (0.5 - 2.9)	2.4 (2.0 - 2.9)	3.0 (2.5 - 3.4)
Regalia, 1% (v/v) (1,3,5,7); alt. Procure, 8 oz (2,4,6)	5 (2 - 7)	13 (7 - 19)	18 (10 - 25)	18.7 (8.4 - 29.1)	32.7 (18.3 - 47.0)	51.4 (31.5 - 71.3)	0.6 (0 - 1.8)	2.6 (2.1 - 3.1)	3.0 (2.5 - 3.4)
Actinovate, 3 oz (1,3,5,7); alt. Procure, 8 oz (2,4,6)	6 (3 - 8)	8 (2 - 14)	14 (6 - 21)	23.7 (13.3 - 34.0)	17.8 (3.4 - 32.1)	41.4 (21.5 - 61.3)	2.8 (1.6 - 4.0)	2.3 (1.8 - 2.8)	3.3 (2.8 - 3.7)
HMO 736, 14 oz (1,3,5,7); alt. Procure, 8 oz (2,4,6)	5 (2 - 8)	12 (6 - 18)	17 (9 - 24)	18.6 (8.3 - 29.0)	30.2 (15.9 - 44.6)	48.8 (28.9 - 68.8)	0.7 (0 - 1.9)	2.6 (2.1 - 3.0)	2.9 (2.5 - 3.4)
Companion, 32 floz (1,3,5,7); alt. Procure, 8 oz (2,4,6)	6 (4 - 9)	14 (8 - 20)	20 (13 - 27)	26.6 (16.2 - 37.0)	29.2 (14.8 - 43.5)	55.8 (35.9 - 75.7)	0.9 (0 - 2.1)	2.1 (1.7 - 2.6)	2.8 (2.3 - 3.3)
BU EXP 1216S, 3 lb (1-7)	6 (3 - 8)	8 (2 - 14)	13 (6 - 21)	22.0 (11.6 - 32.4)	17.0 (2.7 - 31.4)	39.0 (19.1 - 58.9)	1.6 (0.5 - 2.8)	2.3 (1.9 - 2.8)	3.0 (2.5 - 3.5)
BU EXP 1216c, 3 lb (1-7)	5 (3 - 8)	10 (4 - 16)	15 (8 - 22)	20.4 (10.1 - 30.8)	24.6 (10.2 - 38.9)	45.0 (25.1 - 64.9)	1.3 (0.1 - 2.5)	2.7 (2.2 - 3.1)	3.1 (2.6 - 3.6)
BU EXP 1216S, 3 lb (1,3,5,7); alt. Procure, 8 oz (2,4,6)	6 (3 - 9)	12 (5 - 18)	18 (10 - 25)	23.2 (12.8 - 33.5)	25.6 (11.2 - 39.9)	48.8 (28.8 - 68.7)	0.9 (0 - 2.1)	2.3 (1.8 - 2.8)	2.9 (2.4 - 3.3)
BU EXP 1216c, 3 lb (1,3,5,7); alt. Procure, 8 oz (2,4,6)	7 (4 - 9)	13 (6 - 19)	19 (12 - 26)	24.1 (13.7 - 34.4)	30.9 (16.5 - 45.2)	54.9 (35 - 74.9)	0.8 (0 - 2.0)	2.3 (1.9 - 2.8)	2.7 (2.3 - 3.2)
KFD 61-04, 2.3 lb (1-7)	5 (3 - 8)	18 (11 - 24)	23 (15 - 30)	18.5 (8.1 - 28.8)	35.8 (21.5 - 50.2)	54.3 (34.4 - 74.2)	0.7 (0 - 1.8)	2.2 (1.7 - 2.6)	2.4 (2.0 - 2.9)
KFD 61-04, 4.6 lb (1-7)	4 (1 - 6)	14 (7 - 20)	17 (10 - 25)	14.4 (4.0 - 24.8)	32.9 (18.6 - 47.3)	47.3 (27.4 - 67.3)	0.5 (0 - 1.7)	2.5 (2.0 - 2.9)	2.8 (2.3 - 3.3)
KFD 70-01, 2.5 lb (1-7)	4 (2 - 7)	16 (9 - 22)	20 (12 - 27)	18.0 (7.7 - 28.4)	38.2 (23.8 - 52.5)	56.2 (36.3 - 76.1)	0.6 (0 - 1.8)	2.5 (2.1 - 3.0)	2.9 (2.5 - 3.4)
KFD 70-01, 5.0 lb (1-7)	3 (1 - 6)	10 (4 - 16)	13 (6 - 21)	13.6 (3.2 - 23.9)	25.2 (10.9 - 39.6)	38.8 (18.9 - 58.7)	0.5 (0 - 1.7)	2.6 (2.2 - 3.1)	2.9 (2.5 - 3.4)
<i>P > F</i>	0.6370	0.0401	0.0435	0.7020	0.0509	0.1414	0.1301	0.9562	0.6553

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