

### **Integrated programs with biopesticides and a resistant cultivar evaluated for powdery mildew in pumpkin, 2009.**

The objective of this experiment was to evaluate on pumpkin integrated management programs with two biopesticides, Organocide (5% sesame oil) and Milstop (85% potassium bicarbonate). This experiment was part of a study that included two parallel, adjacent field experiments conducted with muskmelon and butternut squash. Biopesticides were evaluated alone and in integrated programs with powdery mildew-resistant cultivars and/or conventional, mobile fungicides (Quintec, Pristine, and Procure). The integrated programs evaluated consisted of biopesticides plus conventional fungicides applied on a 7-day spray interval to a susceptible cultivar and to a cultivar with resistance to powdery mildew. The experiment was conducted in a field with Haven loam soil. The field was plowed on 28 Apr and tilled on 14 May, 21 May, and 1 Jun. Fertilizer (500 lb/A of 10-20-20) was applied on 19 May. Black plastic mulch and drip tape were laid on 27 May. Additional fertilizer (N-P-K 46-0-0) at 30 lb/A was injected through the drip irrigation system on 21 Jul and 11 Aug. Water was provided as needed through drip irrigation. Seeds were hand-planted on 10 Jun into holes cut into the plastic. Plots consisted of 3, 12-ft rows of 5 plants each and were separated by 18 ft in the row. Plants within each plot were at 24-in. in-row spacing and rows were at 68-in. spacing. Weeds were controlled between plastic mulch strips by applying Strategy (3 pt/A) and Sandea (0.5 oz/A) on 3 Jun and hand weeding. Cucumber beetles were managed with Admire 2F applied after plant emergence as a soil drench around seedlings (0.0007 fl oz/plant) on 24 Jun and with Asana XL (9.6 oz/A) applied to foliage on 24 Jun and 1 Jul. The following fungicides were applied preventively for downy mildew (*Pseudoperonospora cubensis*) and Phytophthora blight (*Phytophthora capsici*): Fosphite (3 qt/A) on 24 Jun; Forum 4.16SC (6 oz/A) on 27 Jul, 8 Aug, 27 Aug, 12 Sep, and 23 Sep; and Ranman 400 SC (2.75 fl oz/A) on 17 Jul, 1 Aug, 15 Aug, 3 Sep, 17 Sep, and 30 Sep. Neither disease was detected before the end of this experiment. Treatment applications were made with a tractor-mounted boom sprayer operated at 100 psi and 96 gpa (D5-25 hollow cone nozzles spaced 17 in. apart). Upper and lower surfaces of 10 to 30 leaves in each plot were examined weekly for powdery mildew beginning on 13 Jul, which was the start of flowering. Initially the examined leaves were selected from the oldest third of the foliage based on leaf appearance and position in the canopy. As disease progressed mid-aged and young leaves also were examined. Powdery mildew colonies were counted; severity was assessed when colonies could not be counted accurately because they had coalesced and/or were too numerous. Average severity for the entire canopy was calculated from the individual leaf assessments. Area under Disease Progress Curve (AUDPC) was calculated for severity from 5 Aug through 9 Sep. Canopy condition including defoliation was assessed on 17 and 24 Sep. Pumpkin fruit quality was evaluated in terms of handle (peduncle) condition for mature fruit without rot on 5, 17, and 20 Sep. Handles were considered good if they were solid and not rotting. Average monthly high and low temperatures (°F) were 73/58 in Jun, 80/64 in Jul, 83/68 in Aug, and 74/58 in Sep. Rainfall (in.) was 6.43, 4.82, 2.01, and 2.39 for these months, respectively.

Powdery mildew was found in almost all plots on 30 Jul. No symptoms were found on 20 Jul. The first treatment applications were made on 31 Jul and re-applied on 3 Aug because conditions became windy and rainy on 31 Jul. The resistant cultivar provided suppression of powdery mildew until the last assessment on 8 Sep, when severity did not differ significantly between the two cultivars not treated with fungicides. Both biopesticides effectively controlled powdery mildew on upper leaf surfaces in both cultivars. Control was achieved through the last assessment on 8 Sep for the resistant cultivar but not the susceptible cultivar. Milstop and Organocide did not differ significantly for most assessments. They provided 39% and 57% control, respectively, based on AUDPC values in the susceptible cultivar and 93% and 73% control in the resistant cultivar. Milstop effectively controlled powdery mildew on lower leaf surfaces in the resistant cultivar based on AUDPC values. Three treatments included mobile fungicides (Quintec, Procure, and Pristine) for controlling powdery mildew on lower leaf surfaces plus Organocide applied weekly. Mobile fungicides did improve control significantly. Two of these treatments with just one application each of Quintec and Procure provided control of powdery mildew through 27 Aug, 17 days after the last application. Disease severity on 8 Sep, however, did not differ significantly from that achieved with Organocide alone. Powdery mildew was controlled more effectively on both leaf surfaces at the last assessment where mobile fungicides were applied every week. Degree of powdery mildew control influenced canopy condition, expressed as percentage of leaves that died, and fruit quality. Proportion of fruit with good, solid handles was 64-92% for pumpkins receiving one of the 3 fungicide programs and 59% for nontreated Sorcerer (data not shown).

Cultivar; Fungicide treatment (application date) <sup>z</sup>	Powdery mildew severity (%) <sup>z,y</sup>						Defoliation	
	Upper leaf surface			Lower leaf surface				
	27 Aug	8 Sep	AUDPC	27 Aug	AUDPC	17 Sep	24 Sep	
<b>Sorcerer (susceptible cultivar)</b>								
Organocide (1-6), Quintec 4 oz/A (1,3,5), Procure 8 oz/A (2,6), Pristine 18.5 oz/A (4)...	2.3 cd <sup>w</sup>	1 d	36 f	33 b	488 cd	31 e	55 c	
Organocide (1-6), Quintec (1), Procure (2)...	5.4 c	35 ab	278 d	41 b	768 b	58 b	70 bc	
Organocide 2 fl oz/gal (1-6).....	6.6 c	39 a	321 cd	64 a	1106 a	76 a	86 a	
Milstop 3 lb/A (1-6).....	18.9 b	38 a	454 bc	72 a	1189 a	56 b	78 ab	
Nontreated.....	40.6 a	48 a	741 a	69 a	1205 a	75 a	88 a	
<b>Magic Lantern (mildew resistant cultivar)</b>								
Organocide (1-6), Quintec (1), Procure (2)...	2.8 cd	16 cd	127 ef	14 c	389 cd	34 de	55 c	
Organocide 2 fl oz/gal (1-6).....	5.3 c	20 bc	203 de	43 b	783 b	50 bcd	63 bc	
Milstop 3 lb/A (1-6).....	0.6 d	6 cd	49 f	12 c	330 d	39 cde	55 c	
Nontreated.....	18.8 b	50 a	527 b	29 bc	595 bc	54 bc	68 bc	
<i>P</i> -value	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	0.0005	

<sup>z</sup> Exact colony counts were made when possible and severity was estimated using the conversion factor of 30 colonies/leaf = 1%.

<sup>y</sup> Data were transformed from percentages by a square root transformation when needed to obtain normality of variance before analysis of variance was performed. The table has back-transformed means.

<sup>x</sup> Fungicides used in the programs were Organocide 2 oz/gal, Quintec 2.08SC 4 fl oz/A, Procure 480SC 8 fl oz/A, and Pristine 38WG 18.5 oz/A. Application dates were 1=31 Jul and 3 Aug, 2=10 Aug, 3=17 Aug, 4=24 Aug, 5=31 Aug and 6=9 Sep.

<sup>w</sup> Means in each column followed by the same letter are not statistically different from each other (Tukey's HSD, *P*=0.05).