

Efficacy of fungicides for managing powdery mildew in pumpkin, 2015.

The primary objective of this study was to evaluate the efficacy of several fungicides with mobility that enables them to move to the lower surface of leaves where powdery mildew develops best. They have single-site mode of action which puts them at risk for resistance development. Both new and currently registered products were tested in an area where in previous years strains of the pathogen were detected with resistance to FRAC code 1, 7, and 11 fungicides and moderate resistance to FRAC code 3 fungicides. An experiment was conducted in a field with Haven loam soil at the Long Island Horticultural Research and Extension Center in Riverhead, NY. On 30 Jun pumpkin seeds were planted at approximately 24-in. plant spacing within rows with a vacuum seeder. Plots were three 15-ft rows spaced 68 in. apart. The 20-ft area between plots was also planted to pumpkin. A randomized complete block design with four replications was used. Treatments were applied six times on a 7-day IPM schedule (starting after disease detection) beginning on 29 Jul using a tractor-mounted boom sprayer equipped with twinjet (TJ60-11004VS) nozzles spaced 17 in. apart that delivered 68 gal/A at 65 psi and 2.3 mph. Plots were inspected for powdery mildew symptoms on upper and lower leaf surfaces on 28 Jul; 4, 10, 17, and 25 Aug; and 1, 14 and 23 Sep. At each assessment, nine young, nine mid-aged, and nine old leaves (selected based on leaf physiological appearance and position in the canopy) were rated in each plot, except at the last two assessments when five leaves were rated. Powdery mildew colonies were counted; severity was assessed by visual estimation of percent leaf area affected when colonies could not be counted accurately because they had coalesced and/or were too numerous. Colony counts were converted to severity values using the conversion factor of 30 colonies/leaf = 1% severity. Average severity for the entire canopy was calculated from the individual leaf assessments. Area Under Disease Progress Curve (AUDPC) values were calculated from 10 Aug through 14 Sep. Defoliation was assessed on 14 and 23 Sep. Fruit quality was evaluated in terms of handle (peduncle) condition for mature fruit without rot on 6, 13, and 16 Oct. Handles were considered good if they were green, solid, and not rotting. Average monthly high and low temperatures (°F) were 77/61 in Jun, 83/68 in Jul, 84/67 in Aug, 81/63 in Sep, and 65/49 in Oct. Rainfall (in.) was 5.02, 1.24, 2.14, 2.84, and 3.27 for these months, respectively.

Powdery mildew was first observed in this experiment on 28 Jul in 10 of the 52 plots; 1.3% of the leaves examined had symptoms. Treatments were started the next day. All treatments effectively managed powdery mildew. They were providing 94.7 to 99.5% control on upper leaf surfaces and 70 to 95% control on lower surfaces on 1 Sep, which was one day before the last treatment applications. Controlling powdery mildew resulted in longer leaf retention and improved fruit quality, measured in terms of handle quality, through mid-Oct, which is especially important for Pick-Your-Own Halloween pumpkins. Death of leaves and vines leads to handles shriveling and rotting. Five treatments consisted of individual products evaluated alone. This is neither a labeled nor recommended use pattern for growers. Such evaluations, however, identify appropriate rates for new products and monitor efficacy of registered fungicides at risk for resistance development in order to develop management recommendations for growers. Pristine (FRAC Code 7 and 11) applied at its highest label rate has exhibited poor control in some previous experiments at this location. Grower standard was the alternation of Vivando, Quintec, and Torino; however, recommended tank mix with a protectant fungicide was not done to be able to assess the target fungicides alone. This treatment was not significantly better than a similar treatment that differed by starting with 2 applications of Procure. The two Vivando treatments were the only ones with significantly less severe powdery mildew than the nontreated control on upper leaf surfaces on 23 Sep, which was 21 days after the last fungicide application (data not shown). Disease severity for these treatments on lower surfaces was numerically the lowest on 23 Sep. Applying Vivando with Silwet, a nonionic organosilicone surfactant, did not improve control significantly; however, severity on lower leaf surface on 14 Sep and defoliation on 23 Sep were numerically lower, and percent fruit with good handles was always higher than Vivando applied without a surfactant.

Treatment and rate/A (application dates) ^y	Powdery mildew severity (%) ^z						Fruit quality	
	Upper leaf surface		Lower leaf surface		Defoliation (%) ^z		(% good handles) ^z	
	1 Sep ^x	AUDPC ^x	1 Sep	AUDPC	14 Sep ^x	23 Sep	6 Oct	16 Oct
Untreated Control	56.58 a	832 a	43.6 a	849 a	81.3 a	92.0 a	19.7 c	11.1 c
Pristine 18.5 oz (1-6)	2.90 b	70 b	4.7 bc	228 bc	37.5 b	68.8 ab	67.5 ab	46.7 ab
Quintec 6 fl oz (1-6)	1.33 b	40 b	2.8 bc	260 bc	23.8 b	63.8 abc	67.8 ab	49.9 ab
Vivando 15.4 oz (1-6)	1.05 b	20 b	9.9 bc	255 bc	18.8 b	40.0 bc	70.7 ab	58.1 ab
Vivando 15.4 oz + Silwet (1-6)	0.65 b	5 b	6.6 bc	119 c	16.3 b	32.5 c	86.5 a	72.7 a
Luna Experience 6 fl oz (1-6)	0.28 b	19 b	2.2 c	183 bc	16.3 b	57.5 bc	71.5 ab	43.5 ab
Vivando 15.4 oz (1,4), Quintec 4 fl oz (2,5), Torino 3.4 oz (3,6)	3.03 b	35 b	2.6 bc	183 bc	16.3 b	45.0 bc	74.2 ab	60.9 ab
Procure 8 fl oz (1,2), Vivando 15.4 oz (4), Quintec 4 fl oz (5), Torino 3.4 oz (3,6)	0.23 b	7 b	4.9 bc	186 bc	15.5 b	46.3 bc	74.8 ab	49.0 ab
Fontelis 16 oz (1,3,5); Quintec 4 fl oz (2,4,6)	0.48 b	8 b	3.9 bc	141 bc	18.8 b	47.5 bc	64.6 ab	57.7 ab
Bravo WeatherStik 32 fl oz (1), Aprovia TOP 8.5 fl oz (2,4), Quintec 4 fl oz (3,5), Inspire Super 20 fl oz (6) ^w	1.93 b	14 b	5.0 bc	354 bc	25.0 b	53.8 bc	58.8 ab	52.8 ab
Bravo WeatherStik 32 fl oz (1,4), Aprovia TOP 8.5 fl oz (2,5), Quintec 4 fl oz (3), Inspire Super 20 fl oz (6) ^w	0.25 b	35 b	12.9 b	176 bc	23.8 b	53.8 bc	59.4 ab	40.4 bc
Bravo WeatherStik 32 fl oz (1,2,4,6), Aprovia TOP 8.5 fl oz (3,5) ^w	1.15 b	16 b	10.2 bc	298 b	28.8 b	56.3 bc	70.8 ab	43.8 ab
Bravo WeatherStik 32 fl oz (1,3,5), Luna Experience 6 fl oz (2,4), Inspire Super 20 fl oz (6) ^w	0.80 b	8 b	10.0 bc	226 bc	30.0 b	58.8 bc	55.0 b	40.3 bc
<i>P-value (treatment)</i>	<0.0001	<0.0001	0.0083	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001

^z Numbers in each column with a letter in common are not significantly different from each other (Tukey's HSD, $P=0.05$).

^y Rate of formulated product/A. Application dates were 1=29 Jul, 2=5 Aug, 3=14 Aug, 4=19 Aug, 5=26 Aug, and 6=2 Sep.

^x Values were square root transformed before analysis. Table contains de-transformed values.

^w Aprovia TOP, Quintec, and Inspire Super applied with Kinetic 0.125% v/v (non-ionic surfactant) as well as for the rotational program that included Luna Experience.