

Fungicide sensitivity of cucurbit powdery mildew pathogen population on Long Island, NY, determined with seedling bioassay, 2017.

The objective for using a bioassay to examine fungicide sensitivity was to detect resistance or reduced sensitivity in *Podosphaera xanthii*. Pumpkins (cv. Gold Challenger) were seeded in a growth chamber on 22 Aug and transferred to pots in a greenhouse at the cotyledon stage. The pumpkin seedlings were treated on 11 Sep when they had two fully expanded leaves. The growing tip was removed. Fungicides were tested at the highest or only label rate, except for Bravo Ultrex. Some products were tested at lower doses. The control treatment was water. Applications were made to leaf coverage with a backpack sprayer using a handheld boom with a single Twin-jet nozzle delivering 50 gal/A operated at 55 psi. Seedlings were placed outdoors on 12 Sep near field-grown plants with powdery mildew for about 6 h. There were four groups of 21 seedlings that each contained one seedling from each of the fungicide treatments plus two seedlings treated with water. Two control seedlings were used to insure that severity data from this treatment, which is essential for interpreting results with treated plants, was available. A randomized block design was used to organize the groups into replicates that were placed next to plants in a field experiment (labeled Experiment 1 in the table) being conducted to evaluate powdery mildew resistant pumpkin cultivars that had been sprayed weekly with single-site mode of action fungicides targeting powdery mildew (7 Aug Vivando 15 oz/A, 14 Aug Torino 3.4 oz/A, 21 Aug Procure 8 oz/A, 28 Aug Vivando 15 oz/A, 5 Sep Procure 8 oz/A, and 11 Sep Quintec 6 oz/A)(PDMR 12:V068). This location was chosen because of the selection pressure for resistant pathogen isolates. The bioassay was also used to obtain observational information about fungicide sensitivity of the pathogen in other field plantings. A group of nine seedlings with select, non-replicated treatments was placed in Experiment 3 that received a similar fungicide program to that used in Experiment 1. Another nonreplicated group of seedlings was placed in Experiment 2 being conducted to evaluate powdery mildew resistant pumpkin cultivars not treated with targeted fungicides for powdery mildew (PDMR 12:V068). Experiments 1 and 2 were in the same research field. Following daytime exposure to wind-dispersed spores of *Podosphaera xanthii*, all of the bioassay plants were returned to the greenhouse. They were assessed for disease severity on 21 Sep by estimating percent coverage with visible symptoms on the upper surface of each leaf. Data was analyzed with one-way ANOVA and Tukey's HSD to separate means using JMP statistical software.

Disease severity was much lower on the water control plants placed in Experiment 1, where powdery mildew was being very effectively controlled in the surrounding plants, compared to the control plants placed in Experiments 2 and 3 (mean of 7% versus 75% disease severity), reflecting a low inoculum level in Experiment 1. Consequently, results from the replicated bioassay are less definitive. Severity on 13 Sep in the resistant cultivar evaluation experiments averaged 0.01/0.7% and 40/57% on upper/lower leaf surfaces in fungicide-treated Experiment 1 and nontreated Experiment 2, respectively (PDMR 12:V068). This suggests a longer exposure period is needed when source plants have low severity or bioassays should be conducted where source plants are more severely affected. Despite the impact of low inoculum level, bioassay results were similar for all experiments. Topsin M (FRAC 1), Flint (FRAC 11), and Endura (FRAC 7) were ineffective based on severity for the highest rate tested not being significantly different from that of both controls for the replicated bioassay and severity being greater than 50% of the control severity for the nonreplicated bioassays. This suggests the pathogen population was insensitive to these chemistries. Resistance to FRAC 1, 11, and pyridine-carboxamide chemistry was previously documented for *Podosphaera xanthii*. Rally (FRAC 3), Vivando (FRAC U8), Torino (FRAC U6), and Luna Privilege (FRAC 7) appeared to be effective in all bioassays (based on most severity values being significantly lower than those of control 1 in the replicated bioassay) indicating the pathogen populations examined were sensitive to these fungicide chemistries. However, pathogen insensitivity was shown to be the reason Torino and Luna Sensation (FRAC 7 + 11) exhibited poor control when applied alone weekly in a fungicide evaluation on field-grown pumpkin in another experiment that was next to Experiment 2 (PDMR 12:V067). It appears that bioassay results reflect sensitivity of the pathogen population on close by plants and might not detect resistant isolates selected elsewhere in a field. Quintec at all rates tested (6, 3, and 1.5 oz/A) was phytotoxic on the bioassay seedlings causing leaves to turn yellow and then die; thus, sensitivity could not be assessed.

Powdery mildew severity on upper leaf surface for seedlings placed in three locations (%)

Treatment and Rate/A	Treated resistant cultivar evaluation Experiment 1		Nontreated resistant cultivar evaluation ^x Experiment 2		Treated cucurbit field ^x Experiment 3	
	First leaf ^{zy}	Second leaf ^{zy}	First leaf	Second leaf	First leaf	Second leaf
Water Control 1	13.06 a	4.45 a	75	80	70	75
Water Control 2	7.13 abc	3.18 ab				
Bravo Ultrex 2 lb/A	0.56 de	0.75 abc	60	80	40	40
Topsin M 8 oz/A	10.92 ab	2.17 abc	70	90	70	80
Flint 2 oz/A	4.12 abcd	0.73 abc	80	95	80	60
Endura 6.5 oz/A	4.13 abcd	2.62 abc	80	70	40	50
Endura 3.25 oz/A	2.81 bcde	0.83 abc				
Rally 5 oz/A	0.73 cde	0.37 abc	3	0.5	0.5	0.5
Rally 2.5 oz/A	1.79 cde	0.00 c				
Vivando 15.4 fl oz/A	0.25 de	0.13 bc				
Vivando 7.7 fl oz/A	1.00 cde	0.25 abc	1	0.5	1	0.5
Vivando 3.85 fl oz/A	0.61 cde	0.03 bc				
Torino 3.4 fl oz/A	0.19 de	0.06 bc				
Torino 1.7 fl oz/A	0.25 de	0.13 bc	5	15	30	10
Torino 0.85 fl oz/A	0.25 de	0.73 abc				
Luna Privilege 6.84 fl oz/A	0.00 e	0.00 c				
Luna Privilege 3.42 fl oz/A	0.00 e	0.00 c	0	0	0.5	0
Luna Privilege 1.71 fl oz/A	0.00 e	0.03 bc				
<i>P</i> -value (treatment)	<0.0001	<0.0001				

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

^y Values were square root transformed before analysis to achieve constancy of variance. Table contains de-transformed values.

^x Location was not replicated, raw data is presented.