PUMPKIN (*Cucurbita pepo*)
Powdery mildew; *Podosphaera xanthii*

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Evaluation of pumpkin cultivars resistant to powdery mildew, 2017.

Two experiments with field-grown pumpkins were conducted at the Long Island Horticultural Research and Extension Center (LIHREC) in Riverhead, NY, in a field with Haven loam soil. The purpose of this experiment was to evaluate various pumpkin cultivars for their resistance to powdery mildew, both alone and with a fungicide spray program. The field was plowed on 11 Apr. Urea fertilizer (46-0-0) was applied on 14 Apr at 163 lb/A. Mustard biofumigant cover crop (Caliente 199 and Caliente Rojo) was seeded at 10 lb/A by drilling on 14 Apr. On 15 Jun the mustard was flail chopped, immediately incorporated by disking, and followed by a cultipacker to seal the soil surface. Pumpkins were seeded by hand on 5 Jul. Controlled-release fertilizer (N-P-K, 15-5-15) was applied at 675 lb/A prior to seeding. Strategy 3 pt/A, Sandea 0.5 oz/A, and Roundup PowerMax 22 oz/A were applied prior to seedling emergence for weed control on 7 Jul using a tractor-mounted sprayer. During the season, hand weeding was done as needed. Water was provided as needed via drip irrigation lines. The following fungicides were applied throughout the season to manage Phytophthora blight (caused by *Phytophthora capsici*): Presidio 4 fl oz/A and K-Phite 1 qt/A on 27 Jul, Omega 1 pt/A and K-Phite 1 qt/A on 3 Aug, Omega 1 pt/A on 14 Aug, Forum 6 fl oz/A on 21 Aug, Ranman 2.75 oz/A on 28 Aug, Presidio 4 fl oz/A on 4 Sep, Forum 6 oz/A on 11 Sep, Ranman 2.75 fl oz/A on 18 Sep, Omega 1 pt/A on 25 Sep, and Ranman 2.75 fl oz/A on 2 Oct. The primary source of initial inoculum of powdery mildew in this area is considered to be long-distance wind-dispersed spores from affected plants. Plots were three adjacent rows each with three plants spaced 48 in. apart. Rows were spaced 68 in. apart. To separate plots and provide a source of inoculum, two plants of a powdery mildew-susceptible zucchini squash cultivar (Spineless Beauty) were planted between each plot in each row. The experiment that received a fungicide program for the control of powdery mildew was sprayed with a tractor-mounted sprayer at weekly intervals starting on 7 Aug. Treatments include: Vivando 15 oz/A on 7 Aug, Torino 3.4 oz/A on 14 Aug, Procure 8 oz/A on 21 Aug, Vivando 15 oz/A on 28 Aug, Procure 8 oz/A on 5 Sep, Quintec 6 oz/A on 11 Sep, and Vivando 15 oz/A on 18 Sep. Plots were inspected for powdery mildew symptoms on upper and lower leaf surfaces on 10, 15, 22 and 30 Aug, and 7, 13, and 22 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 assessment 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 30 Aug through 22 Sep. Defoliation was assessed 20 and 26 Sep, and 3 Oct. Fruit quality was evaluated in terms of handle (peduncle) condition for mature fruit without rot on 2, 9, and 17 Oct. Handles were considered good if they were green, solid, and not rotting. Pumpkin weights were taken on 17 Oct by weighing 5 pumpkins per plot and averaging results. Average monthly high and low temperatures (^{o}F) were 83/69 in Jul, 81/66 in Aug, and 77/64 in Sep. Rainfall (in.) was 3.45, 4.95, and 3.00 for these months, respectively.

Powdery mildew was first observed on Aug 10 in all plots in both experiments, on 1% of leaves sampled. As expected, disease pressure was higher in the cultivar assessment with no fungicides applied for powdery mildew control. In the absence of fungicide applications for powdery mildew, Progress was the only pumpkin cultivar able to significantly reduce powdery mildew severity on both leaf surfaces based on AUDPC values when compared to the susceptible cultivar Gold Challenger. Skidoo Gold, Eureka F1, and Magnum F1 were able to outperform Gold Challenger on the lower leaf surface only. No cultivar was significantly distinguishable from other cultivars in % defoliation, pumpkin weight, or fruit quality, with the exception of Millionaire having less defoliation than Magnum F1. In the second experiment, the same pumpkin cultivars were assessed for powdery mildew resistance with a fungicide program for powdery mildew. Disease levels were very low, as expected, especially on the upper leaf surface. Due to the low levels of disease on the upper leaf surface there were no significant differences between any of the cultivars in those measurements. Powdery mildew was more severe on the lower leaf surface where Progress, Millionaire, Magnum F1, and Eureka F1 all performed significantly better than the susceptible cultivar Gold Challenger. It should be noted that Progress and Millionaire were expected to produce smaller fruit than the other cultivars. Overall larger fruit size in the second experiment may be due to the fungicide program improving powdery mildew control. Overall, no cultivar was able to significantly outperform Gold Challenger in % defoliation or fruit quality. In each table, cultivars are organized based on AUDPC values for lower leaf surfaces. This material is based upon work that is supported by the National Institute of Food and Agriculture, U.S. Department of Agriculture, Hatch under NYC-153409.

Cultivar assessment without fungicide program

Cultivar (powdery mildew resistance) [x]	Powdery mildew severity (%) [z,y]				Defoliation [z,y] (%)	Pumpkin wt.[z,y]	Fruit quality [z,y] (% good handles)	
	Upper leaf surface		Lower leaf surface					
	13 Sep	AUDPC	13 Sep	AUDPC	26 Sep	(lb/fruit)	9 Oct	17 Oct
Progress (PMRR)	31.5 bc	231.8 c	38.5 c	344.3 d	80.0 ab	10.6	63.2	49.2
Skidoo Gold (IR)	34.3 abc	253.7 bc	45.7 bc	362.3 d	67.5 ab	14.2	63.3	31.3
Eureka F1 (PMRR)	27.8 c	265.2 abc	44.7 bc	404.4 cd	72.5 ab	7.1	56.3	22.9
Magnum F1 (PMRR)	33.1 bc	279.0 abc	53.4 abc	507.5 bcd	65.0 b	7.5	51.4	16.7
Millionaire (PMRR)	45.9 abc	341.0 abc	65.1 ab	553.8 abc	94.5 a	4.3	84.2	74.8
Bayhorse Gold (IR)	45.8 abc	357.2 ab	68.1 a	591.1 ab	85.0 ab	13.5	79.2	58.3
Eagle City Gold (IR)	51.9 a	383.5 a	69.3 a	607.9 ab	80.0 ab	12.6	45.1	22.2
Gold Challenger (S)	46.9 ab	370.6 ab	70.6 a	707.2 a	80.0 ab	11.1	40.2	20.5
P-value (cultivar)	0.001	0.0011	<0.0001	<0.0001	0.0099	0.0609	0.4977	0.0453

[z] Numbers in each column with a letter in common or no letter are not significantly different from each other (Tukey's HSD, *P*=0.05).
[y] When data were not distributed normally, values were square root transformed before analysis. Table contains de-transformed values.
[x] PMRR = homozygous resistance. IR = intermediate resistance. S = susceptible. PMRR varieties from Outstanding Seed Company; rest are from Rupp Seeds.

Cultivar assessment with fungicide program

Cultivar (powdery mildew resistance) [x]	Powdery mildew severity (%) [z,y]				Defoliation [z,y] (%)	Pumpkin wt.[z],[y]	Fruit quality [z,y] (% good handles)
	Upper leaf surface		Lower leaf surface				
	22 Sep	AUDPC	22 Sep	AUDPC	3 Oct	(lb/fruit)	17 Oct
Progress (PMRR)	0.00	0.01	0.0 c	1.0 c	22.5 ab	11.9 c	100.0
Millionaire (PMRR)	0.02	0.11	0.5 bc	4.6 bc	15.0 b	4.5 d	100.0
Magnum F1 (PMRR)	0.00	0.07	0.4 bc	4.7 bc	16.3 b	15.8 bc	96.5
Eureka F1 (PMRR)	0.02	0.10	0.4 bc	4.9 bc	12.5 b	22.2 a	100.0
Skidoo Gold (IR)	0.00	0.11	2.7 ab	20.0 ab	12.5 b	18.6 ab	100.0
Eagle City Gold (IR)	0.01	0.14	2.4 ab	21.8 ab	13.5 b	21.2 a	100.0
Bayhorse Gold (IR)	0.03	0.69	3.3 ab	29.5 a	32.5 a	20.1 ab	90.3
Gold Challenger (S)	0.09	0.73	4.8 a	38.9 a	25.0 ab	18.9 ab	97.7
P-value (cultivar)	0.368	0.0769	0.0004	<0.0001	0.0014	<0.0001	0.0961

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