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

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Evaluation of Halloween pumpkin cultivars resistant to powdery mildew, 2016.

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 pumpkin cultivars for their ability to suppress powdery mildew when used as the sole management program and also combined with a fungicide program for powdery mildew. Focus was on recently released cultivars. Controlled release fertilizer (N-P-K, 19-10-9) at 525 lb/A (101 lb/A of N) was broadcast over the bed area and incorporated on 20 Jun. Beds were formed, drip tape was laid, and beds were covered with black plastic mulch on 21 Jun. A waterwheel transplanter was used to make planting holes in the plastic and apply starter fertilizer plus insecticide (Admire Pro) on 22 Jun. Two pumpkin seeds were placed by hand into the soil for each hole on 22 Jun. After emergence plants were thinned to 1 plant per hole. Plots were three adjacent rows each with four 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. Weeds were managed by applying Strategy 3 pt/A, Sandea 0.5 oz/A and Roundup PowerMax 22 oz/A to soil between the mulched beds on 21 Jun using a tractor-mounted sprayer. Additionally, landscape cloth was laid over soil between the mulched beds and hand weeding was done as needed. During the season, water was provided as needed via drip irrigation. The following fungicides were applied to control Phytophthora blight (caused by *Phytophthora capsici*): Ranman 2.75 oz/A on 20 Aug and 3 Sep, Revus 8 oz/A on 29 Aug, Forum 6 oz/A on 12 Sep, and Presidio 2 oz/A on 21 Sep. The experiment that received a fungicide program for additional control of powdery mildew was sprayed with a tractor-drawn sprayer at weekly intervals starting at first observation of symptoms. The program was: Vivando 15 oz/A on 8 and 31 Aug and 14 Sep, Torino 3.4 oz/A on 18 Aug and 7 Sep, and Procure 8 oz/A on 24 Aug. Plots were inspected for powdery mildew symptoms on upper and lower leaf surfaces on 8, 17 and 25 Aug, and 2 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. The primary source of initial inoculum in this area is considered to be long-distance wind-dispersed spores from affected plants. 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 8 Aug through 2 Sep. Defoliation was assessed on 26 Sep. Fruit quality was evaluated in terms of handle (peduncle) condition for mature fruit without rot on 5, 14, and 20 Oct. Handles were considered good if they were green, solid, and not rotting. Average monthly high and low temperatures (^{o}F) were 86/70 in Jul, 86/71 in Aug, and 77/61 in Sep. Rainfall (in.) was 2.93, 2.19, and 3.23 for these months, respectively.

Powdery mildew was first observed in both experiments on 8 Aug in all plots, on 30% of leaves sampled. In the cultivar assessment with no fungicides applied for powdery mildew control, disease pressure was high in general, especially on the upper leaf surface. Only two powdery mildew-resistant pumpkin cultivars, Progress and Rhea, were able to significantly reduce powdery mildew severity when compared to the susceptible cultivar Gold Challenger (Rhea was only significantly different on the lower leaf surface). No cultivar was significantly distinguishable from other cultivars in % defoliation or fruit quality. In the second experiment, the same pumpkin cultivars were evaluated for ability to suppress powdery mildew when treated with targeted fungicides for this disease. Severity was generally 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. Based on powdery mildew severity on the lower leaf surface, cultivars Ares, Rhea, Superior, and Progress performed significantly better than the susceptible cultivar Gold Challenger. Progress performed especially well with 73% control relative to Gold Challenger. Progress produced smaller pumpkins then the other cultivars. Kratos produced the largest fruit. Overall, no cultivar was able to significantly outperform Gold Challenger in % defoliation or fruit quality. In the tables, cultivars are organized based on sum of the four AUDPC values.

Cultivar assessment without fungicide program

Cultivar (powdery mildew resistance) [w]	Powdery mildew severity (%) [y,z]				Defoliation (%)	Pumpkin weight [x,z]	Fruit quality (% good handles)	
	Upper leaf surface		Lower leaf surface					
	2 Sep	AUDPC	2 Sep	AUDPC	26 Sep	lb/fruit	14 Oct	20 Oct
Progress (PMRR)	32.3 a	150.3 b	43.2 a	183.4 b	77.5	8.6 c	56.7	27.9
Superior (PMRR)	40.7 a	181.8 ab	54.9 a	231.7 ab	83.8	13.1 ab	37.0	14.8
Rhea (IR)	36.0 a	188.0 ab	45.9 a	208.6 b	68.8	13.9 ab	61.0	32.9
Ares (IR)	40.6 a	181.3 ab	59.5 a	259.8 ab	76.3	14.2 ab	67.6	42.9
Bayhorse Gold (IR)	50.6 a	233.7 ab	58.8 a	268.9 ab	76.3	12.9 ab	69.2	50.4
Eagle City Gold (IR)	56.8 a	267.8 ab	65.4 a	293.8 ab	83.8	11.4 bc	65.1	49.2
Kratos (IR)	53.9 a	264.2 ab	66.2 a	311.1 ab	85.0	15.6 a	68.1	46.5
Gold Challenger (S)	56.0 a	287.5 a	66.4 a	361.4 a	86.3	12.5 ab	33.1	23.7
P-value (cultivar)	0.018	0.0106	0.0207	0.0061	0.4602	<0.0001	0.2636	0.4082

[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 needed, values were square root transformed before analysis. Table contains de-transformed values.
[x] Pumpkin weights were determined on 17 Oct by averaging the weights of 5 pumpkins randomly selected per plot.
[w] PMRR = homozygous resistance. IR = intermediate resistance. S = susceptible.

Cultivar assessment with fungicide program

Cultivar (powdery mildew resistance) [w]	Powdery mildew severity (%) [z,y]				Defoliation (%)	Pumpkin weight [x]	Fruit quality (% good handles)	
	Upper leaf surface		Lower leaf surface					
	2 Sep	AUDPC	2 Sep	AUDPC	26 Sep	lb/fruit	14 Oct	20 Oct
Progress (PMRR)	2.27	11.2	14.8 c	62.6 c	80.0	8.4 c	82.4	45.8 b
Superior (PMRR)	2.60	13.0	24.5 bc	104.0 bc	62.5	12.8 b	96.0	80.3 ab
Rhea (IR)	1.83	12.3	25.4 bc	110.7 bc	71.3	13.7 ab	89.8	64.1 ab
Ares (IR)	4.25	19.0	26.0 bc	111.5 bc	73.8	15.0 ab	91.7	83.8 ab
Bayhorse Gold (IR)	6.93	30.5	37.2 ab	162.5 ab	67.5	12.8 b	94.8	74.8 ab
Eagle City Gold (IR)	3.89	20.8	36.3 ab	161.6 ab	67.5	13.7 ab	84.2	79.4 ab
Kratos (IR)	5.19	24.3	35.2 abc	151.0 ab	65.0	16.0 a	100.0	95.0 a
Gold Challenger (S)	10.45	47.2	48.9 a	228.2 a	80.0	12.4 b	84.7	67.7 ab
P-value (cultivar)	0.1596	0.1512	0.0002	<0.0001	0.3737	<0.0001	0.2667	0.0338

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