

### Evaluation of powdery mildew resistant cultivars of butternut squash, 2019.

An experiment with butternut squash was conducted at the Long Island Horticultural Research and Extension Center (LIHREC) in Riverhead, NY, in a field with Haven loam soil. The main objective of this experiment was to evaluate a new butternut squash cultivar, Gabrielle, for powdery mildew resistance, yield, and fruit quality. The field was plowed on 20 Apr. For management of Phytophthora blight (caused by *Phytophthora capsici*), a mustard biofumigant cover crop (Caliente 199) was seeded at 10 lb/A by drilling on 25 Apr after applying urea fertilizer (46-0-0) at 163 lb/A (75 lb/A N) on 23 Apr. On 12 Jun the mustard was flail chopped, immediately incorporated by disking, and followed by a cultipacker to seal the soil surface; the field was not irrigated to initiate biofumigation because soil was moist and rain was forecast. Controlled-release fertilizer (N-P-K, 15-5-15) at 675 lb/A (101 lb/A N) was broadcast over the bed area and incorporated on 24 Jun. Beds were formed with drip tape and covered with black plastic mulch also on 24 Jun. A waterwheel transplanter was used to make planting holes in the beds and apply starter fertilizer. Two seeds were placed by hand in each opening on 28 Jun, plots were thinned to one plant per hole or missing plants replaced with transplants on 5 Jul so that each plot consisted of 12 plants. To separate plots and provide a source of inoculum, there was a single powdery mildew-susceptible zucchini squash plant (cv. Spineless Beauty) between each plot in each row. Weeds were managed between the mulched beds by applying Strategy 3 pt/A, Sandea 0.5 oz/A, and Roundup PowerMax 22 oz/A prior to seedling emergence on 2 Jul using a tractor mounted sprayer. During the season, weeds were managed by cultivating and hand weeding as needed. The following fungicides were applied throughout the season to manage Phytophthora blight: Omega 1 pt/A on 17 Jul, Orondis Ultra 7 fl oz/A on 26 Jul, 23 Aug and 6 Sep, Ranman 2.75 fl oz/A on 1, 29 Aug and 15 Sep, and Presidio 4 fl oz/A on 8 and 16 Aug. In this area, the primary source of initial inoculum of *Podosphaera xanthii* is considered to be long-distance wind-dispersed spores from affected plants. Plots were three 15-ft rows spaced 68 in. apart with 12 plants per plot. There were two duplicate adjacent experiments. In one experiment, powdery mildew was not managed while in the second experiment, it was treated with fungicides to evaluate the resistant cultivars as part of an integrated management program: Procure 8 fl oz/A on 9 Aug and 2 Sep, Quintec 6 fl oz/A on 16 Aug and Sep 6, and Vivando 15 fl oz/A on 23 Aug. A randomized complete block design with four replications was used. Plots were inspected for powdery mildew symptoms on upper and lower leaf surfaces on 15, 22 and 29 Aug; 4, 9, and 17 Sep. For each assessment five old leaves, five middle age leaves, and five young leaves were evaluated per plot. 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 15 Aug through 17 Sep. Ten mature fruit in each plot were harvested on 1 Oct, weighed and measured for size and shape. Flesh samples were taken from two representative fruit from each plot, frozen, then thawed to obtain juice to analyze for sugar content using a refractometer to obtain a Brix reading. Data were analyzed with one-way ANOVA and Tukey's HSD to separate means using JMP statistical software. Average monthly high and low temperatures (°F) were 86.3/71.3 in Jul, 82/68.8 in Aug, and 76/66.1 in Sep. Rainfall (in.) was 3.00, 1.52, and 1.83 for Jul, Aug, and Sep, respectively.

Powdery mildew was first observed in these experiments on 15 Aug at low levels, and not in all plots. The fungicide program was very effective in the treated portion of the experiment. Due to low disease severity, there were no expected differences between cultivars, so further assessments focused on the untreated experiment. Disease data presented in the table is only from the untreated experiment. Both resistant cultivars, Quantum and Gabrielle, were significantly less severely affected by powdery mildew on both upper and lower leaf surfaces than the susceptible cultivar, Waltham, based on AUDPC values. However, by the last assessment on 17 Sep, resistance was no longer effectively suppressing powdery mildew on lower leaf surfaces indicating the value of an integrated management program for powdery mildew under high disease pressure. The powdery mildew resistant cultivars produced significantly larger fruit in both experiments. No differences in fruit sugar content was observed between cultivars. This report includes work that is supported by the National Institute of Food and Agriculture, U.S. Department of Agriculture, Hatch under NYC-153409.

Cultivar (reaction to powdery mildew)	Powdery mildew severity (%) *							
	Upper leaf surface				Lower leaf surface			
	4 Sep	9 Sep	17 Sep **	AUDPC	4 Sep	9 Sep	17 Sep	AUDPC
Waltham (susceptible)	33.9 a	68.5 a	77.7 a	1065 a	57.2 a	80.6 a	91.2	1456 a
Quantum (resistant)	8.5 b	22.0 b	38.0 b	349 b	20.3 b	42.5 b	64.4	683 b
Gabrielle (resistant)	11.8 b	35.5 b	55.4 ab	542 b	30.0 b	54.7 b	76.5	900 b
<i>P-value (cultivar)</i>	0.0017	<0.0001	0.0125	<0.0001	0.0011	0.0046	0.0811	0.0021

Cultivar	Untreated plant yield *		Treated plant yield *	
	Fruit wt (lb/fruit)	Brix	Fruit wt (lb/fruit)	Brix
Waltham	3.0 b	8.7	3.1 b	7.6
Quantum	3.9 a	7.5	4.5 a	7.8
Gabrielle	4.2 a	8.1	4.9 a	7.9
<i>P-value (cultivar)</i>	0.0002	0.088	0.0002	0.9147

\*Numbers in each column with a letter in common or no letter are not significantly different from each other (Tukey's HSD,  $P=0.05$ ).

\*\* Values were square root transformed before analysis because raw data were not distributed normally.