

Powdery mildew-resistant acorn-type winter squash cultivar evaluation, 2008.

The goals of this experiment were 1) to determine whether winter squash cultivars with homozygous resistance (e.g. two copies of the powdery mildew resistance gene; PMRR) are better protected against powdery mildew than cultivars with heterozygous resistance (PMR) and 2) to determine whether striped acorn-types with PMRR are not as effective at suppressing powdery mildew as solid green acorn-types with PMRR. These were the results obtained in a similar experiment conducted in 2007. Ability of these cultivars to resist powdery mildew as well as their yields were determined relative to Table Ace, a standard cultivar lacking powdery mildew resistance that is commonly grown. This field experiment was conducted at the Long Island Horticultural Research and Extension Center in Riverhead on Haven loam soil. Fertilizer (N-P-K 10-10-10) at 500 lb/A was broadcast and incorporated on 5 May. Black plastic mulch and drip tape were laid on 6 May. Seeds were sown on 30 May in the greenhouse. Seedlings were transplanted into beds covered with black plastic mulch on 16 Jun. Water was provided as needed through drip irrigation lines located beneath the mulch. Additional fertilizer (N-P-K 46-0-0) at 30 lb/A was injected through the drip irrigation system on 2 and 17 Jul. Weeds were controlled between the rows of black plastic mulch by seeding white clover for a living mulch on 13 May after roto-tilling to prepare a seed bed and manage weeds that had already germinated. During the season, weeds were managed by mowing, hand weeding, and applying Select 2E (8 oz/A) with 1% COC on 8 Aug. Cucumber beetles were managed with Admire 2F applied after transplanting as a soil drench around transplants (0.0007 fl oz/plant) on 21 Jun and Asana XL (9.6 oz/A) applied to foliage on 30 Jul and 14 Aug. No fungicides were applied to control powdery mildew. The following fungicides were applied preventively for downy mildew (*Pseudoperonospora cubensis*) and Phytophthora blight (*Phytophthora capsici*): Curzate 60 DF (3.2 oz/A) on 30 Jul and Ranman 400 SC (2.75 fl oz/A) on 19 Jul and 14, 23, and 30 Aug. Plots were three adjacent rows each with three plants spaced 24 in. apart. Rows were spaced 68 in. apart. A plant of Multipik summer squash, a susceptible cultivar, was planted between each plot in each row to separate plots and provide a source of inoculum. A randomized complete block design with four replications was used. Upper and lower leaf surfaces were assessed for powdery mildew on 16 and 31 Jul, and on 8, 15, and 26 Aug. Initially 20-50 older leaves were examined in each plot, with the quantity adjusted based on the incidence of symptomatic leaves. Mid-aged and young leaves were also assessed when powdery mildew had progressed to these age groups. Powdery mildew colonies (spots) were counted; severity was estimated when colonies had coalesced or were too numerous to count. Colony counts were converted to severity values using the conversion factor of 30 colonies/leaf = 1%. Average severity for the entire canopy was calculated from the individual leaf assessments. These canopy severity values were used to calculate area under disease progress curves (AUDPC) to obtain a measure of severity over the entire assessment period (15 Jul – 15 Aug). Powdery mildew control was calculated for upper and lower leaf surfaces using AUDPC values relative to the average AUDPC value for Table Ace. Squash fruit were harvested, weighed, and measured on 10 and 18 Sep. Two representative fruit per plot were selected for measuring fruit width, fruit length, and cavity width and for assessing sugar content, which was done with a hand-held refractometer using fruit samples that were frozen and then thawed. Fruit characteristics were also evaluated and overall appearance was rated on a scale of 1 to 5 with 1= poor and 5 = best. Average monthly high and low temperatures (°F) were 80/63 in Jun, 84/67 in Jul, 79/63 in Aug, and 75/61 in Sep. Rainfall (in.) was 3.88, 3.67, 3.76, and 8.34 for these months, respectively.

Symptoms of powdery mildew were first seen on 15 Jul on Table Ace, the susceptible cultivar. All cultivars and almost all plots had symptoms on 23 Aug. The table contains the 4 solid green PMRR cultivars, followed by the 2 green PMR cultivars, the 2 striped PMRR cultivars, and last the susceptible standard check. Cultivars within these groups are organized by AUDPC value for lower leaf surface. Solid green acorn-type cultivars with PMRR were not significantly less severely affected by powdery mildew than cultivars with PMR. There was one exception to this conclusion: AUDPC for severity on upper leaf surfaces for Tay Belle PM (PMR) was significantly greater than for Sweet Reba (PMRR). The level of powdery mildew suppression achieved based on AUDPC values was 70-86% and 91-95% for upper and lower leaf surfaces, respectively, for the PMRR cultivars and 60-82% and 83-89% for the PMR cultivars. In 2007, when powdery mildew was more severe, lower leaf surface AUDPC value for Autumn Delight was significantly lower than for Table Star. In 2008, powdery mildew severity was numerically higher for the 2 striped acorn-type cultivars with PMRR than the solid green acorn-types with PMRR; this was a significant difference only for severity on lower leaf surfaces on 15 Aug. Level of suppression for Celebration and Sugar Dumpling was 71% and 76% for lower leaf surfaces. Celebration did not suppress powdery mildew on upper leaf surfaces based on AUDPC values. Neither AUDPC value for Celebration in 2007 was significantly lower than Table Ace. Celebration, Sweet Reba, and Royal Ace PM produced the greatest number and weight of marketable fruit per plant. These values were significantly greater than those for Tay Belle PM, which were the lowest and also Table Ace, which had the next lowest yield values. Yielding ability of Table Ace may have been affected by powdery mildew. Autumn Delight, Tay Belle PM and Table Ace produced the largest fruit by weight, while average fruit weight was lowest for Honey Bear, which was as expected because this variety was bred to produce a personal-sized fruit. Fruit of all varieties were rated 4 or 5 for color, appearance, and overall marketability.

Cultivar (resistance) ^y	Powdery mildew severity (%) ^z								Marketable fruit					
	Upper leaf surface				Lower leaf surface				Number/ plant	Weight/ plant (lb)		Weight/ fruit (lb)		
	15-Aug		AUDPC		15-Aug		AUDPC							
Sweet Reba (PMRR)	1.8	cd ^x	9.3	e	1.9	c	8.8	c	2.53	ab	2.98	ab	1.18	de
Autumn Delight (PMRR)	1.8	cd	12.0	de	2.0	c	11.5	bc	1.69	cd	2.66	abcd	1.57	a
Honey Bear (PMRR)	2.0	cd	13.1	cde	2.9	c	13.4	bc	2.14	bc	2.02	cd	0.94	g
Royal Ace PM (PMRR)	2.7	bcd	19.5	cde	2.8	c	15.7	bc	2.19	abc	2.92	ab	1.33	c
Table Star (PMR)	1.3	d	12.0	de	3.3	bc	18.8	bc	2.11	bc	2.70	abc	1.29	cd
Tay Belle PM (PMR)	3.5	bc	25.6	cd	5.5	bc	29.3	bc	0.64	e	0.91	e	1.45	b
Sugar Dumpling (PMRR)	4.9	ab	29.4	bc	8.9	b	41.4	bc	2.17	bc	2.30	bcd	1.06	f
Celebration (PMRR)	6.8	a	49.9	ab	8.3	b	53.1	b	2.75	a	3.19	a	1.16	ef
Table Ace (Susceptible)	7.2	a	64.7	a	21.8	a	174.6	a	1.31	d	1.93	d	1.48	ab
<i>P</i> -value	0.0004		< .0001		< .0001		0.0005		< .0001		< .0001		< .0001	

^zExact colony counts were made when possible and severity was estimated using the conversion factor of 30 colonies/leaf = 1%.

^ySweet Reba, Honey Bear, Autumn Delight, and Royal Ace PM are solid green PMRR cultivars; Table Star and Tay Belle PM are green PMR cultivars; and Sugar Dumpling and Celebration are striped acorn-type cultivars.

^xNumbers in each column with a letter in common are not significantly different according to Fisher's Protected LSD (*P* = 0.05).