

Powdery mildew resistant pumpkin cultivar evaluation, 2008.

There are many pumpkin cultivars now commercially available that are advertised as having resistance to powdery mildew. Previous experiments have demonstrated that the level of resistance among these cultivars can be highly variable. In this study, seven Halloween-type pumpkin cultivars with resistance from one parent (PMR), including two cultivars with a putative new resistance gene from Hollar Seeds, and six cultivars with resistance genes from both parents (PMRR) were evaluated for their ability to resist powdery mildew relative to two standard pumpkin cultivars without known genes for resistance, Gold Speck and Sorcerer. A 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 7 May. Seeds were sown on 28 May in the greenhouse. Seedlings were transplanted into black plastic mulch on 10 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 rototilling 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 24 Jun and with Asana XL (9.6 oz/A) applied to foliage on 13 Jun, 30 Jul, and 14 Aug. No fungicides were applied specifically for 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 four plants spaced 36 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. Pumpkin fruit were harvested and weighed on 24 Sep. Unmarketable fruit were counted. Average monthly high and low temperatures (°F) were 80/63 in Jun, 84/67 in Jul, 79/63 in Aug, 75/61 in Sep, and 63/47 in Oct. Rainfall (in.) was 3.88, 3.67, 3.76, 8.34, and 3.18 for these months, respectively.

Symptoms of powdery mildew were first seen on 16 Jul at a very low level in plots of susceptible cultivars. Plants did not grow well apparently as a result of inadequate water and fertilizer due to problems with the drip irrigation system. Cultivars with PMRR did not perform consistently better than those with PMR. Degree of disease suppression with resistant pumpkins was not as high as with resistant melon cultivars in 2008 (PDMR 3:V117), which also was the case in previous experiments. Suppression, calculated as the percentage amount a resistant cultivar's powdery mildew severity rating was below the rating for Sorcerer, numerically ranged from 2-49% on upper leaf surfaces and 10-57% on lower surfaces based on the 26 Aug assessment values and 3-69% and 27-74%, respectively, based on AUDPC values. Some cultivars did not provide effective suppression of powdery mildew. Based on all assessment values of powdery mildew severity on upper leaf surfaces, neither Midas Touch nor Gargoyle were providing suppression; for at least two values there also was no detectable suppression with Magic Lantern, Superior, Magic Wand, and the 3 experimental cultivars. However, all resistant cultivars were suppressing powdery mildew on lower leaf surfaces based on AUDPC values. This is an important finding because powdery mildew is much easier to control on upper leaf surfaces with both conventional and organic fungicides. Midas Touch exhibited the least resistance (27% suppression on lower leaf surfaces). Gold Speck, a mini-fruited cultivar with no known genes for resistance, was substantially less severely affected by powdery mildew than Sorcerer (61% and 65% suppression on upper and lower leaf surfaces, respectively). Powdery mildew was never significantly less severe on Gold Dust, a similar cultivar with PMR (69% and 74% suppression). This confirms previous observations that mini-fruited cultivars are naturally less susceptible to powdery mildew. Wee-B-Little, another mini-fruited cultivar without resistance, performed well in previous evaluations. Camaro, a cultivar that reportedly has a new gene for resistance, did not differ significantly from Gold Dust. An experimental with this gene, HSR 4710, did not perform as well, providing no suppression of powdery mildew on upper leaf surfaces while Camaro provided 44% suppression. Degree of suppression on lower surfaces was 53% and 65%, respectively. There were significant differences among cultivars in percentage of fruit with good handles and weight of fruit, but not percentage of fruit that were rotting.

Cultivar (resistance) ^y	Powdery mildew severity (%) ^z						Good handles (%) ^x	Marketable fruit lb/fruit				
	Upper leaf surface		Lower leaf surface		1-Oct	lb/fruit						
	26-Aug	AUDPC	26-Aug	AUDPC								
Gold Dust (PMR)	40.8	e ^w	179.7	f	37.1	g	205.7	f	98.8	f	0.5	g
Camaro (PMR)	52.8	de	321.8	def	46.6	fg	278.1	ef	67.6	de	13.0	a
Gladiator (PMRR)	53.1	de	327.2	def	54.7	cdefg	301.8	def	26.4	abc	7.0	ef
Warlock (PMRR)	62.8	abcd	353.2	de	54.0	defg	324.0	def	42.4	bc	9.1	cde
Treasure (PMR)	61.9	abcd	340.7	de	63.1	abcdefg	393.4	bcdef	100.0	f	1.5	g
OS 8615 (PMRR)	66.8	abcd	423.1	bcd	51.0	efg	348.4	def	79.4	ef	7.1	def
HSR 4710 (PMR)	71.0	abc	458.9	abcd	57.5	bcdefg	376.8	cdef	23.8	ab	11.7	ab

OS 6866 (PMRR)	74.9	abc	433.3	bcd	77.8	ab	419.4	bcde	26.1	abc	5.7	f
Magic Wand (PMRR)	66.7	abcd	410.4	cd	63.9	abcdef	443.3	bcde	44.6	bcd	9.7	bcd
Gargoyle (PMRR)	69.0	abcd	493.1	abc	53.1	defg	484.3	bcd	97.9	f	2.9	g
Superior (PMRR)	60.8	cd	440.5	abcd	73.3	abcde	550.3	bc	46.1	bcd	11.4	abc
Magic Lantern (PMR)	72.9	abc	445.7	abcd	75.6	abcd	551.8	bc	16.5	a	7.5	def
Midas Touch (PMR)	78.9	ab	555.2	ab	77.4	abc	581.2	b	48.4	cd	11.4	abc
Gold Speck (PMS)	39.4	e	222.8	ef	56.1	bcdefg	279.9	ef	98.7	f	0.4	g
Sorcerer (PMS)	80.4	a	574.5	a	86.5	a	796.4	a	10.0	a	6.8	ef
<i>P</i> -value		0.0004		<.0001		0.010		<.0001		<.0001		<.0001

^zExact colony counts were made when possible and severity was estimated using the conversion factor of 30 colonies/leaf = 1%. Data were transformed from percentages by a square root transformation when needed to obtain normality of variance before analysis of variance was performed. The table has de-transformed means.

^yCultivars listed based on the sum of AUDPC values for both leaf surfaces. PMR = resistance from one parent, PMRR = resistance genes from both parents, and PMS = susceptible to powdery mildew.

^xHandles were considered good if they were solid and not rotting, whether green or brown.

^wMeans followed by the same letter are not statistically different from each other (Fisher's Protected LSD, $P=0.05$).