

Powdery Mildew Resistant Zucchini Squash Cultivar Evaluation, New York 2007

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Powdery mildew is an annual production problem for growers of cucurbit crops throughout the United States, reducing yield potential and fruit quality when not controlled. Effective control with fungicides alone has been challenged by development of fungicide resistance to key chemistries. Recently a variety of zucchini cultivars have become available that are advertised with resistance to this disease. The objective of this study was to evaluate six green zucchini cultivars, three experimental lines, two grey zucchini cultivars (Amatista and Topazio), and one golden yellow cultivar (Sebring Premium) with resistance by comparing them to a susceptible cultivar that is an industry standard (Zucchini Elite). Romulus PM is open-pollinated. Many cultivars evaluated also have resistance to virus. For Judgement III and Justice III this resistance is genetically engineered.

Materials and Methods

A field experiment was conducted at the Long Island Horticultural Research and Extension Center in Riverhead on Haven loam soil. Seeds were sown on June 8 in the greenhouse. Seedlings were transplanted into black plastic mulch on June 18. Fertilizer (N-P-K 10-10-10) at 400 lbs./A was broadcast and incorporated on May 16. Additional fertilizer (N-P-K 46-0-0) at 30 lbs./A was injected through the drip irrigation system on July 9 and 30. Water was provided as needed through drip irrigation lines placed beneath the mulch.

During the season, weeds were controlled with Strategy (2 pts./A) applied on June 1 between the rows of black plastic mulch, hand weeding, and mowing. Cucumber beetles were managed with Admire 2F applied after transplanting as a soil drench around transplants (0.02 ml/plant) on June 21, and with Asana XL 9.6 oz./A applied to foliage on July 16. No fungicides were applied specifically for powdery mildew. The following fungicides were applied preventively for downy mildew (*Pseudoperonospora cubensis*) and Phytophthora blight (*Phytophthora capsici*): Forum 4.16SC (6 oz./A) on July 16, Ranman 400 SC (2.75 fl. oz./A) on August 12, Acrobat 50 WP (6.4 oz./A) on August 19, and Previcur Flex 6F (1.2 pts./A) on August 29. Neither disease developed before the end of this experiment.

Plots were two adjacent rows each with six plants spaced 24 inches apart. Rows were spaced 68 inches apart. One yellow squash plant of a susceptible cultivar (Multipik) 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 surfaces of 15 old and mid-aged leaves were assessed for powdery mildew on July 26, 14 days after fruit were harvested for the first time. Ten old, 10 mid-aged, and 10 young leaves were examined on August 9 in each plot. Leaves were categorized based on leaf physiological appearance and position in the canopy. Powdery mildew colonies (spots) were

counted; severity was assessed 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%. Average severity for the entire canopy was calculated from the individual leaf assessments. Powdery mildew control was calculated for upper and lower leaf surfaces relative to Zucchini Elite using severity values for August 9. A square root transformation was used when needed prior to analysis to achieve homogeneity of variance.

Zucchini fruit were harvested and weighed a total of eight times: July 12, 17, 20, 24, 27, and 31, and August 3 and 7. Fruit were separated into marketable and unmarketable grades based on length, then weighed. There were no unmarketable fruit with blemishes due to disease or insect feeding. Fruit characteristics were evaluated and overall appearance was rated on a scale of 1 to 9; 1 = poor, 5 = marginal, 7 = acceptable, and 9 = good.

Results and Discussion

Only Romulus PM and Amatista exhibited control of powdery mildew on upper and lower leaf surfaces relative to Zucchini Elite based on severity on August 9. The table contains the six standard green zucchini squash cultivars listed in order based on severity on lower leaf surfaces on August 9, followed by the three experimental lines, the golden yellow cultivar (Sebring Premium), the two grey zucchinis, then the standard cultivar included for comparison. Results were substantially different in 2006 when a similar experiment was conducted with most of these cultivars. Severity on lower leaf surfaces on August 9, 2006 was 0% to 5% for the resistant cultivars and 23% for Zucchini Elite. Other powdery mildew resistant squash types and pumpkins evaluated in additional experiments at LIHREC in 2007 also exhibited reduced suppression. The pathogen may have evolved to overcome the main resistant gene in these cultivars. Romulus PM was less severely affected by powdery mildew than the other cultivars likely because it is homozygous resistant and has at least one modifier gene.

HMX 7729 produced the greatest number of marketable fruit, but did not differ significantly in yielding ability from Justice III and RSQ6006. Romulus PM had the lowest yield, as in 2006. This was partly due to delayed fruit production: this is the only cultivar with no fruit at the first and second harvest dates. Sebring Premium also had low yield initially.

All cultivars produced fruit with acceptable characteristics, which were rated at least 7 out of 9, except for Romulus PM.

Envy

Wide, dark green fruit that curve slightly toward the stem end. Glossy appearance. Bulbous blossom end, light green stem, and some ridges near the stem end. Overall appearance 8.5.

HMX 7729

Fruit of this variety were green with many small, light green flecks. The stem was small and a light green color. Fruit was medium in length and width. Bulbous blossom end that tapered slightly toward the stem end. 8.4 overall appearance rating.

Judgement III

Green fruit had many large, light green flecks and slight ridges. Stem was medium in size, and green speckled in color. Semi-gloss appearance. Bulbous blossom end that tapers to a slightly bulbous stem end. Overall appearance rated 8.1.

Justice III

Semi-glossy, green fruit with white flecking. Fruit were long and slender with some ridging. Light green stem and a slightly bulbous stem and blossom end. Appearance was rated 8.

Payroll

Fruit were grass green with many small white flecks and had a semi-gloss appearance. The fruit curved slightly and had some ridges. Green stem. Slightly bulbous blossom end that constricts at the neck and continues into a slightly bulbous stem end. Overall appearance rated 8.4.

Romulus PM

This variety produced glossy, dark green fruit with a few small light green flecks. Fruit was much shorter and wider than the other varieties evaluated and had pronounced ridges. Many were lumpy in appearance. The stem was small and light green. Rated 6.4 in overall appearance.

RSQ6004

Dark green fruit had more of a matte appearance. Tiny, light green flecks. Light green stem. Fruit tended to be long and wide and were mostly uniform from end to end. Nice shape and size. Overall appearance rated 8.1.

RSQ6006

Long and slender fruit were dark green with a matte finish. Tiny, light green flecking throughout and a light green stem. Bulbous blossom end that slightly tapers to the stem end. Rated 8.3 in overall appearance.

Wildcat

Dark green, glossy fruit with a few small light green flecks. Light green speckled stem, slight ridging, and a slightly bulbous blossom end. Fruit were long and slender. Rated 8.5 in overall appearance.

Sebring Premium

Golden yellow fruit with a green and yellow stem. Semi-glossy appearance with ridges on the fruit. Very uniform width the length of the fruit. Rated 7.8 in overall appearance.

Amatista

Yields of this variety were low. Fruit was short and wide with a semi-gloss appearance. Green skin that appeared almost white due to numerous white flecks. Bulbous blossom end that tapers to the stem end. A useful variety for specialty markets. Rated 7 in overall appearance.

Topazio

Very small fruit was light green with numerous white specks that gave the fruit an almost whitish/gray color. Yields were also very low in this variety in comparison to the other varieties

evaluated. Fruit were short and wide with a very bulbous blossom end tapering towards the stem end. Slight ridging. Rated 7 in overall appearance.

Zucchini Elite

Semi-glossy green fruit with many, small light flecks giving the fruit a much lighter appearance. Light green stem and a slightly bulbous blossom end. Ridging near the stem end. Rated 7.6 in overall appearance.

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Table 1. Control of powdery mildew and yield for zucchini cultivars compared on Long Island, New York, 2007. The first nine entries are conventional, green fruit type cultivars with resistance to powdery mildew listed in order of disease control. Next is a golden yellow cultivar, then two grey zucchini cultivars, and lastly the susceptible cultivar included for comparison.

Zucchini Cultivar	Seed Source	Powdery Mildew Control (%)				Marketable Fruit (July 12-Aug. 7)				
		Upper Leaf Surface		Lower Leaf Surface		Number/Plant	Weight (lbs.) /Plant	Fruit Weight (lbs.)		
		July 26	Aug. 9	July 26	Aug. 9					
Romulus PM	TR	99.9 d ^z	91.4 c	99.1 d	98.8 e	1.44 f	1.14 d	0.83 a		
Payroll	SY	83.8 bcd	32.5 ab	77.2 bcd	57.6 cd	3.85 bc	2.27 bc	0.56 ef		
Wildcat	SW	94.0 cd	17.1 ab	89.6 cd	32.2 abcd	3.73 bc	2.19 bc	0.60 cde		
Justice III	SI	99.0 d	13.7 ab	85.3 cd	48.3 bcd	4.00 ab	2.18 bc	0.54 f		
Judgement III	SI	0 a	13.5 ab	23.0 ab	25.9 abcd	3.25 cde	1.88 c	0.58 def		
Envy	SY	72.6 abcd	0 a	61.5 abc	0 a	3.88 bc	2.39 ab	0.61 cde		
HMX 7729	HM	86.0 bcd	8.9 ab	64.1 abc	9.3 abc	4.56 a	2.74 a	0.60 cde		
RSQ6004	SY	41.6 abcd	15.8 ab	81.0 bcd	31.7 abcd	3.46 bcd	2.27 bc	0.66 bc		
RSQ6006	SY	80.6 bcd	2.1 a	81.4 bcd	3.9 ab	4.04 ab	2.54 ab	0.63 cd		
Sebring Premium	SW	0 ab	1.3 a	70.7 abcd	16.0 abc	3.85 bc	2.74 a	0.71 b		
Amatista	SY	95.7 cd	41.6 b	88.3 cd	63.1 d	2.77 e	0.61 e	0.25 g		
Topazio	SY	84.9 bcd	11.5 ab	89.6 cd	14.9 abc	2.94 de	0.69 e	0.26 g		
Zucchini Elite	HM	0 abc	0 a	0 a	0 ab	3.65 bc	2.34 ab	0.66 bc		
<i>P</i> -value		0.068	0.0001	0.0417	0.005	< .0001	< .0001	< .0001		

^zNumbers in each column followed by the same letter are not significantly different from each other according to Fisher's protected LSD ($P=0.05$).