

Powdery Mildew Resistant Zucchini Squash Cultivar Evaluation, New York 2006

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Powdery mildew is an annual production problem for growers of cucurbit crops throughout the US 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. In pumpkin, it has been demonstrated that among resistant cultivars there is a wide range of actual disease suppression. The objective of this study was to evaluate eight green zucchini cultivars, 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. One cultivar (Lynx) is not marketed as having resistance but performed well when evaluated in a previous experiment in terms of both disease severity and yield, producing fruit with very good horticultural characteristics. Most 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. All squash seed was planted on 7 Jun in the greenhouse and were transplanted into black plastic mulch on 19 Jun. During the season weeds were controlled with one application of Select 2EC 8 fl oz on 31 Jul, hand weeding, and mowing between the rows of black plastic mulch. Water was provided as needed through drip irrigation lines placed beneath the mulch. No fungicides were applied specifically for powdery mildew; however, copper fungicides applied for control of bacterial leaf spot (*Xanthomonas campestris* p.v. *cucurbitae*) would have also provided some suppression of powdery mildew on upper leaf surfaces. Champ (2 lb/A) was applied on 29 Jul; Cuprofix Disperss (2.5 lb/A) was applied on 12 Jul, and 5, 13, and 23 Aug; and Kocide 2000 (1.5 lb/A) was applied on 31 Aug. The following fungicides were applied preventively for downy mildew (*Pseudoperonospora cubensis*) and Phytophthora blight (*Phytophthora capsici*): Acrobat 50 WP (6.4 oz/A) on 12 Jul, Previcur Flex 66F (1.2 pt/A) on 29 Jul, Ranman (2.75 fl oz/A) on 23 Aug, and Tanos (8 oz/A) on 31 Aug. Neither disease developed before the end of this experiment.

Plots were one 14-ft row each with a plant spacing of 24-in. One yellow squash plant of a susceptible cultivar (Multipik) was planted between each plot. A randomized complete block design with four replications was used.

Upper and lower surfaces of leaves were assessed for powdery mildew beginning on 26 Jul, one day before fruit were harvested for the second time. Ten old leaves and 10 mid-aged leaves were selected on 26 Jul and on 9 Aug in each plot based on leaf appearance and position in the canopy. On 15 Aug 10 mid-aged leaves were assessed. 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. These canopy severity values were used to calculate area under disease progress (AUDPC) to obtain a measure of severity over the entire assessment period. Powdery mildew control was calculated for upper and lower leaf surfaces using AUDPC values relative to the average AUDPC value for Zucchini Elite. A square root transformation was used when needed prior to analysis to achieve homogeneity of variance.

Squash fruit were harvested and weighed a total of eight times on 24 and 27 Jul; and on 4, 7, 11, 14, 18, and 24 Aug. Fruit were separated into marketable and unmarketable grades based on length and blemishes from disease (bacterial leaf spot) and insect feeding. Weight and length of marketable fruit were measured. 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:

All cultivars tested that are marketed with claims for resistance to powdery mildew exhibited at least 72% control on lower leaf surfaces, where symptoms were most severe, relative to Zucchini Elite based on AUDPC values. Lynx did not exhibit resistance in this study as it had in a previous experiment conducted upstate NY. On upper leaf surfaces control over the entire assessment period was at least 47% for most cultivars. AUDPC values for Felix and Topazio were not significantly different from Zucchini Elite.

On 26 Jul, the first assessment date, powdery mildew severity averaged 6% on lower leaf surfaces and 2% on upper surfaces for Zucchini Elite, 9% and 3% for Lynx and 0-2% and 0-1% for the resistant cultivars. On 9 Aug, severities were 23% on lower surfaces and 4% on upper surfaces for Zucchini Elite, 31% and 7% for Lynx, and 0-5% and 0-3% for the resistant cultivars. And on 15 Aug, severities were 33% and 6% for Zucchini Elite, 36% and 3% for Lynx, and 2-12% and 1-4% for the resistant cultivars. Substantially lower severities on upper than lower leaf surfaces may be due to control provided by the three applications of copper fungicides for bacterial leaf spot (this data not shown in table).

Sebring Premium produced the greatest number and weight of marketable fruit. Total number of fruit produced was also high for the two grey zucchinis. Romulus PM had the lowest yield. Fruit production was affected by poor weed control; therefore, yield data in table 1 should not be considered an indication of yielding ability but rather should be considered relative yield values.

Overall fruit appearance was rated highest for Justice III, Payroll, and Felix which all scored 8 on a 1 to 9 scale. The three lowest ratings were 6 for Zucchini Elite, 4 for Lynx, and 2 for Romulus PM. Justice III produced dark green, glossy fruit with small green flecks. These cylindrical fruit were long with a slightly bulbous base. Payroll produced green semi-glossy fruit with small, light green flecks. Fruit were long and slender with slight ridging and were very uniform from top to base. Felix produced shiny, dark green fruit with small flecking. Fruit were long, uniform and had a bulbous end. Fruit of Zucchini Elite were dark green with small white flecks and a semi-gloss appearance. Fruit were long with ridges and a bulbous base. Many fruit were misshapen. Lynx produced dark green fruit with light green flecking. Fruit were slender but with a very bulbous base and tended to be misshapen and irregular. Romulus PM produced short, glossy, green fruit with small flecks. Most fruit were misshapen or irregular.

Fruit of the other cultivars were rated 7 for overall appearance. Sebring Premium produced golden yellow fruit with a dark green stem and blossom end. Envy fruit were dark green, uniform in color and had a glossy appearance. Fruit were long with a bulbous base. Judgement III fruit were dark green with small flecks. Fruit were long and slender with a slightly bulbous blossom end and slight ridging near the stem end. Wild Cat produced green, semi-glossy fruit with small flecks. Fruit were cylindrical with a bulbous base. Amatista and Topazio were both grey type zucchinis. They produced light green fruit with extensive, large white flecks. Fruit tended to be short, have a short neck and a very bulbous blossom end.

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Table 1. Yield and control of powdery mildew for zucchini cultivars compared on Long Island, NY, 2006. The first eight 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 Squash Cultivar	Seed Source	Marketable Fruit				Total No. Fruit/Plant	Powdery Mildew Control (%)	
		Number/Plant	Weight/Plant (lb)	Fruit Weight (lb)	Fruit Length (in)		Upper Leaf Surface	Lower Leaf Surface
Judgement III	SI	2.2 abc ^z	1.2 bc	0.56 bcd	7.9 a	2.9 ab	93 ab	98 a
Romulus PM (SQ 807)	TR	0.8 d	0.7 d	0.79 a	7.5 ab	0.9 d	97 a	99 a
Wildcat	SW	2.4 abc	1.3 b	0.53 bcd	7.2 ab	2.8 ab	88 abc	92 ab
Justice III	SI	2.1 bc	1.2 bc	0.55 bcd	7.5 ab	2.3 bc	76 abc	91 ab
Envy	SY	1.6 c	0.9 bcd	0.54 bcd	7.0 b	1.7 c	64 bcd	90 ab
Payroll	SY	2.6 ab	1.1 bc	0.46 cd	7.3 ab	2.8 ab	62 bcd	85 ab
Felix (HMX 1712)	HM	2.3 abc	1.2 bc	0.51 bcd	7.2 ab	2.7 ab	47 cde	84 ab
Lynx	SW	2.1 bc	0.9 cd	0.41 d	6.9 b	2.6 ab	0 e	0 d
Sebring Premium	SW	3.1 a	2.0 a	0.62 abc	7.6 ab	3.2 a	80 abc	92 ab
Amatista	SY	2.0 bc ^z	0.9 bcd	0.42 d	5.3 c	3.0 ab	85 abc	88 ab
Topazio	SY	2.5 ab	1.0 bcd	0.42 d	5.3 c	3.3 a	49 cde	72 b
Zucchini Elite	HM	2.2 abc	1.0 bcd	0.66 ab	7.0 b	2.7 ab	0 de	0 c
<i>P-value</i>		0.0003	0.0006	0.0085	0.0001	0.0001	0.0022	0.0001

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