

Powdery mildew resistant yellow summer squash cultivar evaluation, 2011.

The goals of this experiment, which is part of a multi-year cultivar evaluation project, were 1) to continue to monitor adaptation in the pathogen that has been reducing the effectiveness of powdery mildew resistance, 2) to determine whether cultivars with homozygous resistance (two copies of the major powdery mildew resistance gene; PMRR) are better protected against powdery mildew than cultivars with heterozygous resistance (PMR), 3) to investigate the contribution of resistance to an integrated management program, and 4) to evaluate yield. Two experiments were conducted in adjacent fields at the Long Island Horticultural Research and Extension Center in Riverhead on Haven loam soil. Controlled release fertilizer (N-P-K, 19-10-9) at 525 lb/A (100 lb/A of nitrogen) was broadcast and incorporated on 31 May. Beds were formed with drip tape and covered with black plastic mulch on 1 Jun. Seeds were sown on 31 May in the greenhouse. A waterwheel transplanter was used to make planting holes in the beds and apply starter fertilizer plus insecticide on 16 Jun. Seedlings were transplanted by hand on 21 Jun. During the season, water was provided as needed via drip irrigation lines. Weeds were managed by mowing and hand weeding. Cucumber beetles were managed with Admire Pro (7.5 – 10 fl oz/treated A) applied with the transplanter on 16 Jun and Asana XL (9.6 fl oz/A) applied to foliage on 2 Jul. Two field experiments were conducted in separate treatment areas, one receiving a standard commercial powdery mildew fungicide program, and one that did not. The following products were applied to manage cucurbit powdery mildew: Quintec (6 fl oz/A) on 28 Jul, 18 Aug and 3 Sep; Procure 50WS (8 oz/A) on 20 Jul and 26 Aug; Pristine (18.5 oz/A) on 4 Aug; and Actinovate (8 oz/A) on 4 Aug. The following fungicides were applied preventively for downy mildew (*Pseudoperonospora cubensis*) and Phytophthora blight (*Phytophthora capsici*): ProPhyt (4 pt/A) on 6 Aug; Ranman 400 SC (2.75 fl oz/A) on 18 Aug and 2 Sep; and Curzate (3.2 oz/A) on 26 Aug. All fungicide applications were made with a tractor-sprayer equipped with D4 nozzles at 17-in spacing that delivered and 60 gpa operated at 250-275 psi. Plots were four adjacent rows each with three plants spaced 24 in. apart. Rows were spaced 68 in. apart. One plant of Spineless Beauty, a powdery mildew-susceptible zucchini squash 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 14, 21 and 26 Jul, and on 3, 10 and 17 Aug. Powdery mildew colonies 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% severity. Average severity for the entire canopy was calculated from the individual leaf assessments. Area under disease progress curve (AUDPC) was calculated based on the six weekly disease severity ratings. Squash fruit were harvested and counted on 26 Jul, 2 Aug, and 9 Aug. Average monthly high and low temperatures (°F) were 79/61 in Jun, 87/68 in Jul, and 82/66 in Aug. Rainfall (inches) was 6.1, 2.35, and 10.61 for these months, respectively. There was a hurricane (28 Aug) and several atypical intensive rain events during the 2011 growing season on Long Island.

Symptoms of powdery mildew were observed at a low level on 14 Jul: only 1 of the 120 older leaves examined (0.8%) had symptoms. Disease developed quickly. Symptoms were found on Jul 21 in all except two treated plots of the resistant cultivar Sunray. The proportion of older leaves examined that day and found to have symptoms was 42% and 52% in the non-treated and fungicide-treated experiments, respectively. Incidence at that time was unusually high for the region. It was 19% on 27 Jul 2010 in a similar experiment with these same cultivars. Powdery mildew incidence therefore was substantially above the action threshold of 2% on 20 Jul when the powdery mildew fungicide program was started for assessing integrated management. Both resistant cultivars were equally effective for suppressing powdery mildew. There were no significant differences in powdery mildew severity between Cheetah and Sunray when evaluated as the sole management practice or as a component of an integrated management program. Therefore these experiments did not demonstrate a benefit of homozygous resistance over heterozygous resistance. Suppression of powdery mildew with genetic resistance was most evident on the lower leaf surface. This is valuable information considering the pathogen develops best on this part of the leaf and controlling it here with fungicides necessitates using targeted fungicides prone to resistance development in the pathogen because targeted fungicides are able to move to the lower surface after being deposited on the upper surface. Based on AUDPC values, resistant cultivars provided 51-58% and 79-81% control on upper and lower leaf surfaces, respectively, as the sole management practice and increased control on lower leaf surfaces by 75-84% when treated with targeted fungicides compared to the similarly treated Gentry; however, fungicides provided limited control of powdery mildew on lower leaf surfaces. No significant differences in yield were detected amongst the cultivars (data not shown). All cultivars had marketable fruit on the first harvest date.

Fungicide treatment Cultivar (resistance) ^y	Powdery mildew severity (%) ^z					
	Upper leaf surface			Lower leaf surface		
	Aug 10	Aug 17	AUDPC	Aug 10 ^x	Aug 17	AUDPC
Non-fungicide treated						
Sunray (PMRR).....	2.1 b	25.6	200.9 b	3.6 b	23.4 ab	109.7 b
Cheetah (PMR).....	4.3 ab	17.8	169.7 b	7.1 b	13.3 b	120.1 b
Gentry (S).....	11.1 a	32.9	406.2 a	29.3 a	40.3 a	568.6 a
<i>P-value</i> (treatment)	0.0377	0.1436	0.0199	0.0001	0.1010	<0.0001
Fungicide treated						
Sunray (PMRR).....	0.0	2.1	70.5	2.2 b	4.0 b	107.2 b
Cheetah (PMR).....	0.0	3.2	88.3	0.5 b	15.5 b	161.1 b
Gentry (S).....	0.1	4.7	113.1	19.0 a	37.8 a	654.8 a
<i>P-value</i> (treatment)	0.4219	0.4973	0.1227	0.0016	0.0020	< 0.0001

^z Exact colony counts were made when possible and severity was estimated using the conversion factor of 30 colonies/leaf = 1% severity. Area Under Disease Progress Curve (AUDPC) was calculated from 14 Jul through 17 Aug.

^y PMRR = homozygous resistance; PMR = heterozygous resistance.

^x Numbers for each fungicide treatment in each column with a letter in common are not significantly different from each other (Tukey's HSD, *P*=0.05).