PUMPKIN (*Cucurbita pepo* 'Wizard')
Powdery mildew; *Sphaerotheca fuliginea*

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EVALUATION OF FUNGICIDE PROGRAMS INITIATED AFTER DISEASE DETECTION FOR MANAGING POWDERY MILDEW OF PUMPKIN, 1995: A field experiment was conducted at the Long Island Horticultural Research Laboratory in Riverhead, NY, on Plymouth loamy sand and Haven loam soil. Fertilizer (1000 lb/A of 10-10-10) was broadcast on 30 May and incorporated on 1 Jun. Pumpkin seed were planted on 22 Jun at 24-in. within row plant spacing and 68-in. between row spacing. Plots were thinned by hand to obtain 64 plants in four 35-ft rows. Plants were sidedressed with ammonium nitrate at a rate of 30 lb N/A on 2 Aug. Weeds were controlled by applying Curbit EC (1 qt /treated A) in a 12-in. band over the row on 26 Jun, mechanically cultivating and hand-weeding. Cucumber beetles and aphids were managed by applying the following insecticides: Lannate LV (3 pt/A) on 28 Jul, Metasystox R (1 qt/A) on 12 Jul, and Asana (9.6 oz/A) on 21 Jul. Phytophthora fruit and crown rot occurred to a limited extent in part of this field in 1994; therefore, the following management practices were implemented: Ridomil 2E (2 qt/A) was broadcast over the entire field on 1 Jun then incorporated and soil drainage was improved by subsoiling between rows on 21 Jul and rototilling driveways. Average monthly high and low temperatures (F) were 80/57 in Jun, 86/65 in Jul, 86/62 in Aug, and 76/56 in Sep. Rainfall (in.) was 2.52, 1.52, 0.7, and 4.43 for these months, respectively. The field was irrigated (approx. 1.0 in.) 10 times on 26-27 Jun; 5-7, 15+18, and 24-25 Jul; 3-4, 10-12, 17-19, 24 Aug; and 1-2 and 9+12 Sep (several days were required to move pipe across the field). All fungicide programs evaluated were started after detecting powdery mildew, which was shown previously to be as effective as using a preventive schedule (F&N Tests 47:124). All fungicide programs consisted of a broad-spectrum contact fungicide (chlorothalonil, formulated as Bravo Ultrex or formulated with triadimefon as Reach) plus one or two narrow-spectrum systemic fungicides (propiconazole, formulated as Tilt, and/or CGA219417; benomyl, formulated as Benlate, and/or triadimefon, formulated as Reach). For the full-season programs, the systemic fungicide was applied 3 times on a 14-day schedule and the contact fungicide was applied 6 times on a 7-day schedule. Several reduced-sprays programs were included for comparison with the full-season programs. Treatments were applied on 6 dates (31 Jul; 8, 15, 22, 29 Aug; and 7 Sep) with a tractor-mounted boom sprayer equipped with no. 3 hollow cone nozzles that delivered 40 gal/A at 68 psi. A randomized complete block design with 4 replications was used. Upper and lower (under) leaf surfaces in each plot were examined weekly for powdery mildew beginning on 27 Jul. Initially, only older leaves were examined in each plot. Young and mid-aged leaves were also examined beginning on 24 Aug. A total of 15 or 20 leaves were examined in each plot. Powdery mildew colonies were counted; severity was assessed when colonies could not be counted accurately because they had coalesced and/or were too numerous. Average severity for the entire canopy was calculated from the individual leaf assessments. Sensitivities to benomyl and to triadimefon, active ingredients in Benlate and Reach, respectively, were determined using fungicide-treated cotyledon disks for isolates collected on 1 Aug, 18 Aug, and 2 Sep from non-fungicide-treated plots, plots treated once with Reach, plots treated thrice with Reach, and plots treated once with Reach and Benlate. Fruit were harvested on 29 Sep from three treatments: control, Reach 3X + Bravo 3X, and Tilt + CGA219417 + Bravo.

Powdery mildew was observed on the lower surface of 20% of the older leaves examined on 27 Jul. Few of these leaves had symptoms on the upper surface. Powdery mildew was more severe than in 1994 based on a comparison of disease severity on nontreated plants (F&N Tests 50:146-147). Fungicide programs with Reach controlled powdery mildew on upper leaf surfaces but not on lower leaf surfaces most likely because of resistance to triadimefon. Bravo was shown previously to be ineffective on lower leaf surfaces (F&N Tests 47:124). The proportion of isolates resistant to triadimefon (50 ppm) was 70% before treatment. The first application of Reach made on 31 Jul, 4 days after powdery mildew was detected in each plot, did not affect disease development based on severity on lower leaf surfaces on 9 Aug. In contrast, the first Reach application was effective in 1994 when 39% of the isolates were resistant before treatment. Additional applications of Reach did not contribute to control since there were no significant differences among fungicide programs with 1, 2, or 3 applications of Reach + Bravo on other treatment dates for a total of 6 fungicide applications. The 14-day fungicide program with 2 applications of Reach + 1 application of Bravo was not as effective for controlling powdery mildew on upper leaf surfaces as the 7-day fungicide program with 2 applications of Reach + 4 applications of Bravo. The application of Benlate on 15 Aug was effective since severity on lower leaf surfaces on 24 Aug was significantly less compared with most other programs that also included Reach + Bravo. Severity on lower leaf surfaces was not significantly different among these treatments on 16 Aug. Benlate's effectiveness is not surprising considering that none of the isolates collected before fungicide treatment were resistant to Benlate. Only one Benlate-resistant isolate was detected among the 13 isolates collected on 2 Sep from Benlate-treated plots. Tilt + CGA219417 + Bravo was more effective for controlling powdery mildew on lower leaf surfaces than the fungicide programs with Reach + Bravo. It was as effective as the program with Reach + Benlate + Bravo. Tilt was more effective when applied at 4 oz/A in 1994. This is more likely due to high disease pressure and using too little Tilt in 1995 than due to fungicide resistance. In another experiment, Nova did not perform as well as expected although isolates tested at the end of the experiment were as sensitive to this fungicide as isolates tested in previous experiments (F&N Tests 49:142) when both Nova and Tilt were very effective. Isolates of *S. fuliginea* were shown previously to exhibit correlated sensitivity to these DMI fungicides. A higher rate and/or shorter spray interval should be tested in the future. Fungicide treatment significantly affected fruit quality but not yield. Only 56% of the fruit from control plots had firm handles (stems) that were not rotting, whereas there were good handles on 82% and 90% of the fruit from Reach 3X + Bravo 3X and Tilt + CGA219417 + Bravo plots, respectively. Several plants throughout the experimental area died during Jul because of bacterial wilt (approx. 1-3 per plot). This variety may be more susceptible to this disease than other pumpkin varieties since experiments with other varieties and other cucurbits were not affected. Similar results occurred in 1994.

(continued)

Treatment and rate/A (application time [2])	Powdery mildew severity (% leaf coverage)					
	upper leaf surface [1]			lower leaf surface [1]		
	24 Aug	31 Aug	AUDPC	24 Aug	31 Aug	AUDPC
Control (No Fungicide)	56.7 a [3]	82 a	790 a	55 a	85 a	762 a
Reach F 4.25 pt (1,3,5) + Bravo Ultrex 1.8 lb (2,4,6)	2.5 c	4 c	43 d	41 abc	77 ab	612 abc
Reach F 4.25 pt (1,3) + Bravo Ultrex 1.8 lb (2,4,5,6)	2.3 c	3 c	33 d	47 ab	63 bc	609 abc
Reach F 4.25 pt (1) + Bravo Ultrex 1.8 lb (2-6)	9.3 bc	7 bc	121 bcd	50 ab	76 ab	681 ab
Reach F 4.25 pt (1,3) + Bravo Ultrex 1.8 lb (5)	20.8 b	19 b	251 b	48 ab	78 ab	663 ab
Reach F 4.25 pt (1,3) + Bravo Ultrex 1.8 lb (2,4)	4.7 bc	10 bc	92 cd	45 ab	81 ab	655 ab
Reach F 4.25 pt (1) + Benlate 50WP 8 oz (3) + Bravo Ultrex 1.8 lb (2-6)	17.4 bc	9 bc	191 bc	26 cd	69 abc	464 cde
Tilt 45WP 2 oz (1,3,5) + Bravo Ultrex 1.8 lb (1-6)	2.8 c	5 c	41 d	23 cd	67 abc	426 de
CGA219417 75WP 5.3 oz (1,3,5) + Bravo 1.8 lb (1-6)	6.8 bc	16 bc	115 bcd	33 bcd	78 ab	558 bcd
Tilt 45WP 2 oz (1,3,5) + CGA219417 75WP 5.3 oz (1,3,5) + Bravo Ultrex 1.8 lb (1-6)	2.9 c	3 c	40 d	23 d	51 c	367 e
P-value	.0001	.0001	.0001	.0231	.0330	.0025

[1] Exact colony counts were made when possible and severity was estimated using the conversion factor of 30 colonies/leaf = 1%. A transformation was not needed to stabilize variance.
[2] Application times were: 1=31 Jul, 2=8 Aug, 3=15 Aug, 4=22 Aug, 5=29 Aug, and 6=7 Sep.
[3] Numbers in a column with a letter in common are not significantly different according to Fisher's Protected LSD (P=0.05).