

EVALUATION OF FUNGICIDE PROGRAMS FOR MANAGING POWDERY MILDEW OF PUMPKIN, 1999: A field experiment was conducted at the Long Island Horticultural Research and Extension Center in Riverhead, NY, on Haven loam soil. Fertilizer (1000 lb/A of 10-10-10) was broadcast and incorporated on 27 May. Pumpkin seed were planted on 17 Jun at 24-in. within-row plant spacing and 68-in. between-row spacing. Weeds were controlled by applying Curbit EC (4 pt/treated A) + Command 4EC (1 pt/treated A) in a 10-inch band over the planted rows on 17 Jun; these were incorporated by irrigating. Mechanical cultivation and hand weeding were also done. To manage *Phytophthora* fruit and crown rot, Ridomil Gold EC (1 pt/A) was broadcast over the entire field then incorporated on 27 May; it was re-applied as a foliar spray on 18 Aug and 1 Sep. Plots were thinned to about 28 plants in three 27-ft rows. There was 10 ft between plots. Cucumber beetles were managed by applying Sevin XLR (1 qt/A) on 3, 11, and 25 Jul. Average monthly high and low temperatures (F) were 83/62 in Jun, 89/69 in Jul, 83/66 in Aug, and 77/61 in Sep. Rainfall (in.) was 0.8, 3.67, 8.18, and 5.31 for these months, respectively. The field was irrigated (approx. 1.0 in.) 5 times on 25-28 Jun, 4-7 Jul, 17-19 Jul, 29-30 Jul, and 5-6 Aug. Plants were sidedressed with ammonium nitrate at a rate of 30 lb N/A on 11 Aug. An IPM schedule was used for all treatments. It was initiated on 4 Aug after detecting powdery mildew in 50 of 72 plots at a threshold of one leaf with symptoms of 50 old leaves examined, which was shown previously to be as effective as using a preventive schedule (Plant Dis. 80:910-916). Fungicides were applied with a tractor-mounted boom sprayer equipped with D3-45 hollow cone nozzles spaced 11 in. apart that delivered 100 gpa at 200 psi. A randomized complete block design with four replications was used. Upper and lower (under) surfaces of 10-50 leaves in each plot were examined weekly for powdery mildew beginning on 3 Aug. Initially, 50 older leaves were examined in each plot. Young and mid-aged leaves were also examined beginning on 23 Aug. 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. Defoliation was assessed on 14 Sep. Sensitivity to DMI fungicides of the powdery mildew population in some plots was assessed using a leaf disk bioassay (Plant Dis. 80:633-639) conducted in the laboratory with individual isolates collected from the field on 7 Oct. Fruit quality was evaluated in terms of handle (peduncle) condition on 23 Sep. Only fruit in replication 1 were examined because *Phytophthora* fruit and crown rot occurred in some plots in the other replications. Regression was used to examine the relationship between proportion of fruit with good solid handles on 23 Sep and defoliation on 14 Sep.

All treatments provided some control of powdery mildew on upper leaf surfaces. The DMI (demethylation inhibiting) fungicides Nova and Procure applied alone were among the most effective treatments for controlling mildew on both leaf surfaces. Nova at 10 oz/A was significantly better than Nova at 2.5oz/A based on AUDPC values. Good control was also achieved with Nova plus Bravo or sulfur (Microthiol Special) applied in alternation with a strobilurin fungicide (Quadris or Flint). Flint applied in alternation with Actigard was also effective. All of these treatments were significantly more effective than sulfur, the three coppers tested (Kocide 2000, GX-569, and GX-270) and BAS 114 (Milsana bioprotectant) based on AUDPC for upper and lower leaf surfaces, with one exception. There were no significant differences among the copper and BAS 114 treatments. The copper and BAS 114 treatments did not control mildew effectively on lower leaf surfaces. Microthiol Special was more effective when tested in 1998 (F & N Tests 54:230-231). The proportion of the powdery mildew population able to tolerate Nova at 20 ppm a.i. was 27% for nontreated, 33% for Nova applied at 2.5 oz/A, 56% for Quadris applied in alternation with Nova + Bravo, 75% for Procure applied at 6 oz/A, and 75% for Nova applied at 10 oz/A. Increasing the rate of DMI fungicides appears to increase selection for insensitive strains. None of the isolates tested were able to tolerate Nova at 80 ppm a.i. Generally treatments with AUDPC values of less than 80 and 225 for upper and lower leaf surfaces, respectively, had significantly less defoliation on 14 Sep than the nontreated control and at least 75% of fruit had solid handles on 23 Sep. Treatments with  $\leq 50\%$  defoliation on 14 Sep had  $>78\%$  fruit with solid handles on 23 Sep. There was a linear relationship between these variables when defoliation was  $\geq 50\%$  ( $\%Solid = 145.6 - 1.125(\%defoliation)$ ;  $R^2 = 80.7\%$ ).

Treatment and rate/A (application time) <sup>2</sup>	Powdery mildew severity (% leaf coverage)						Defolia- tion (%)	Fruit handle condition (% solid)
	upper leaf surface <sup>1</sup>			lower leaf surface <sup>1</sup>				
	23 Aug	7 Sep	AUDPC	23 Aug	7 Sep	AUDPC		
	23 Aug	7 Sep	AUDPC	23 Aug	7 Sep	AUDPC	14 Sep	23 Sep
Nontreated Control .....	27.5 a	40.3 a	665.5 a	30.5 a	80.6 a	986 a	83 a	38
Nova 40W 10 oz (1-6) .....	0.0 g	0.0 f	0.3 d	0.0 d	6.1 e	23 f	26 f	100
Nova 40W 2.5 oz (1-6).....	1.4 d-g	4.7 de	75.1 c	2.6 cd	26.4 c-e	223 de	33 d-f	79
Procure 50W 6 oz (1-6).....	0.9 fg	0.0 f	2.6 d	1.2 d	12.1 de	86 ef	55 b-e	78
Procure 50W 4 oz (1-6).....	0.5 d-f	0.6 ef	20.3 cd	2.4 cd	6.6 e	87 ef	58 a-d	100
Bravo Ultrex 1.8 lb (1,3,5) + Nova 40W 2.5 oz (1,3,5), Quadris F 11 fl oz (2), 15.4 oz (4,6) <sup>4</sup> .....	0.0 g	0.0 f	0.4 d	0.4 d	25.1 c-e	156 de	30 ef	97
Bravo Ultrex 1.8 lb (1,3,5) + Nova 40W 2.5 oz (1,3,5), Flint WG50 2 oz (2,4,6).....	0.4 fg	0.2 ef	11.2 d	1.2 d	41.7 b-d	337 cd	34 d-f	93
Bravo Ultrex 1.8 lb (1,3,5) + Nova 40W 2.5 oz (1,3,5), Flint WG50 1.5 oz (2,4,6).....	0.0 g	0.1 f	1.1 d	0.6 d	25.5 c-e	175 de	20 f	100
Microthiol Special 80DF 2.4 lb (1,3,5) + Nova 40W 2.5 oz (1,3,5), Flint WG50 1.5 oz (2,4,6).....	0.1 fg	0.3 ef	4.0 d	0.6 d	12.4 de	99 ef	22 f	88
Flint WG50 1.5 oz (1,3,5), Actigard 0.5 oz (2,4,6).....	0.1 fg	1.2 ef	10.2 d	1.1 d	31.1 c-e	207 de	42 c-f	91
Microthiol Special 80DF 4 lb (1-6).....	3.0 c-f	19.1 bc	208.4 b	10.9 bc	72.5 a	681 ab	53 b-e	60
Kocide 2000 24 oz (1-6).....	6.5 b-d	22.2 a-c	237.4 b	26.3 ab	61.5 ab	727 ab	58 a-d	68
GX-569 28.8 oz (1-6).....	8.1 bc	14.0 cd	208.1 b	17.8 ab	71.6 ab	754 ab	65 a-c	53
GX-569 21.6 oz (1-6).....	6.2 b-e	20.3 bc	246.5 b	9.3 bc	81.5 a	764 ab	78 ab	51
GX-569 14.4 oz (1-6) .....	12.8 b	10.3 cd	319.2 b	14.9 ab	52.8 a-c	582 bc	77 ab	59
GX-270 21.6 oz (1-6) .....	13.7 b	23.0 a-c	346.9 b	22.7 ab	63.9 ab	737 ab	75 ab	78
BAS 114 UBF 1% (1-6).....	8.3 bc	35.4 ab	368.6 b	17.4 ab	76.4 a	778 ab	58 a-d	57
BAS 114 UBF 0.5% (1-6).....	9.6 bc	32.2 ab	369.3 b	15.7 ab	73.0 a	734 ab	67 a-c	70
P-value	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	

<sup>1</sup> Exact colony counts were made when possible and severity was estimated using the conversion factor of 30 colonies/leaf = 1%.

<sup>2</sup> Rate of formulated product/A. Application times were: 1=4 Aug, 2=10 Aug, 3=17 Aug, 4=24 Aug, 5=30 Aug, and 6=14 Sep.

<sup>3</sup> Numbers in a column with a letter in common are not significantly different according to Fisher's Protected LSD ( $P = 0.05$ ).

<sup>4</sup> Applied with NuFilm P (6 oz/A).