PUMPKIN (*Cucurbita pepo* 'Appalachian')
Powdery mildew; *Podosphaera xanthii* (formerly named *Sphaerotheca fuliginea*)

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Evaluation of fungicide programs for managing powdery mildew of pumpkin, 2001.

The primary objective of this study was to evaluate protectant fungicides for their suitability as replacements for chlorothalonil. A field experiment was conducted at the Long Island Horticultural Research and Extension Center in Riverhead, NY, on Haven loam soil. Fertilizer (666 lb/A of 15-15-15) was broadcast and incorporated on 8 Jun. Pumpkin seed were planted on 25 Jun at approximately 24-in. plant spacing within rows and 68-in. row spacing. The herbicides Curbit EC (2 pt/treated A) and Command 4EC (1.3 pt/treated A) plus the insecticide Admire 2F (16 fl. oz./ treated A) for cucumber beetles were applied in a 10-inch band over the planted rows on 25 Jun; these were incorporated by irrigating. Mechanical cultivation and hand weeding were also done. Asana XL (9.6 oz/A) was applied on 14 Jul for additional control of cucumber beetles. To manage Phytophthora fruit and crown rot (*Phytophthora capsici*), Ridomil Gold EC (1 pt/A) was broadcast over the entire field then incorporated on 8 Jun**,** Acrobat 50WP (6.4 oz/A) was applied on 24 Jul, 15 Aug, 31 Aug, and 7 Sep, and Aliette 80WG (4 lb/A) was applied on 8 and 31 Aug. Additionally, soil drainage was improved by subsoiling on 25 Jul between rows before vines grew over. Plots were thinned to about 18 plants in three 15-ft rows. There was 10 ft between plots. Average monthly high and low temperatures (F) were 80/63 in Jun, 80/63 in Jul, 84/68 in Aug, 75/59 in Sep, and 66/50 in Oct. Rainfall (in.) was 6.08, 3.43, 4.86, 2.98 and 1.97 for these months, respectively. The field was irrigated (approx. 1.0 in.) on 20 Jul, 2 and 10 Aug, and 4 and 11 Sep when soil was dry due to inadequate rainfall. Two Milsana treatments were started about 3 weeks after planting on 16 Jul. Nutrol and PrudentPlus treatments were started on 31 Jul about 1 week before disease onset was expected. All other treatments were initiated on 15 Aug after the IPM threshold of one leaf with symptoms of 50 old leaves examined was reached in all plots. This threshold 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 88 gpa at 200 psi. A randomized complete block design with four replications was used. Upper and lower (under) surfaces of 5 to 50 leaves in each plot were examined weekly for powdery mildew beginning on 2 Aug. Initially, 50 older leaves were examined in each plot. The examined leaves were selected from the oldest third of the foliage based on leaf appearance and position in the canopy. As disease progressed, the number of leaves examined was adjusted based on the incidence of affected leaves in a plot. Beginning on 16 Aug, mid-aged leaves were also examined. Young leaves were examined beginning on 7 Sep. 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 6, 10, 22, and 27 Sep. Fruit quality was evaluated in terms of handle (peduncle) condition on 28 Sep, 5 Oct, and 12 Oct. Weight was estimated from width x length per fruit using a linear regression equation derived using 30 representative fruit of this cultivar. Fruit width and length were measured on 9 and 16 Oct for eight treatments (Microthiol Disperss, JMS Stylet-oil, Kocide, Bravo, Nutrol, PrudentPlus, Quadris alt. Bravo+Nova, and nontreated).

Symptoms were found on only 2 of 2000 leaves examined on 2 Aug. The IPM threshold had been reached in all plots on 14 Aug. Powdery mildew became severe as usual at this location. All treatments provided some control of powdery mildew based on AUDPC for upper leaf surfaces. Microthiol Disperss, JMS Stylet-oil, and Bravo were the most effective protectant fungicides. Bravo was more effective than the others based on AUDPC for powdery mildew on upper leaf surfaces; Microthiol Disperss and JMS Stylet-oil were more effective than Bravo on lower leaf surfaces based on AUDPC. Fruit were largest for Microthiol Disperss among the eight treatments examined. With this sulfur product, average weight of mature fruit and quantity of fruit weighing at least 15 lb was significantly greater than with Nutrol, PrudentPlus, and JMS Stylet-oil. Microthiol Disperss was the least expensive fungicide treatment tested. Serenade was the least effective protectant fungicide. Powdery mildew severity of Serenade-treated leaves was significantly lower than nontreated only for AUDPC for upper leaf surfaces. This was the only treatment that did not have less defoliation than nontreated on 6 Sep. More treatments were not significantly different from nontreated on subsequent assessment dates (data not shown). There was no benefit to initiating Milsana applications before disease detection. The preventive program had four more applications than the IPM program. The 1% rate was more effective than the 0.5% rate based on AUDPC values for upper leaf surfaces. There were no significant differences between the two potassium bicarbonate products, Armicarb and Kaligreen. Superior control of powdery mildew on lower leaf surfaces was achieved with the seven treatments that included systemic fungicides. These treatments also had the least defoliation, but not significantly less than the best protectant fungicides. The UK formulation of Cabrio was used until supplies were exhausted, then the 02 F formulation, which is reportedly less effective, was used beginning with the 16 oz/A rate on 30 Aug. This could account for superior performance obtained with the 12 oz/A rate based on AUDPC for upper leaf surfaces. Pumpkins treated with Microthiol Disperss or the grower standard program of Quadris alt. Bravo+Nova had the most fruit with good solid handles, an important measure of quality. These treatments were significantly better than the other protectant fungicides.

Treatment and rate/A (application time)[b]	Powdery mildew severity (% leaf coverage)[a]						Defolia-tion (%)	% Solid handles
	Upper leaf surface			Lower leaf surface				
	27 Aug	17 Sep	AUDPC	27 Aug	17 Sep	AUDPC	6 Sep	12 Oct
Nontreated …….….	12.9 a [c]	27.4 a	884 a	16.7 a	78 a	1415 a	21.3 a	52 f
Serenade AS 6 lb (5-9) ……..…..….	9.4 ab	13.1 a-d	563 b	14.2 ab	68 ab	1301 a-c	20.0 ab	60 d-f
Kaligreen 82SP 4 lb (5-9) ……..……	4.5 b-d	17.4 ab	335 c	11.9 a-c	77 a	1347 ab	13.8 cd	56 f
Armicarb 100 85SP 4 lb (5-9) …….....	2.4 d-f	9.7 a-f	332 c	6.7 c-e	70 ab	1194 b-d	10.0 cd	65 b-f
Nutrol 20 lb [d] (3-9) …….….	6.0 b-d	11.0 a-e	286 cd	16.5 a	76 a	1111 d	15.5 bc	66 b-f
Prudent Plus 1.4 qt (3-9) …….....	7.9 a-c	10.7 a-e	532 b	12.8 ab	62 a-d	1181 b-d	10.3 cd	61 d-f
Milsana (KHHCN 01-01) ……..…….. 0.5% Preventive (1-9)	4.4 cd	11.0 a-e	518 b	10.4 a-d	62 a-d	1215 b-d	12.5 cd	57 ef
Milsana 1% Preventive (1-9) …….	3.2 de	11.2 a-e	362 c	10.4 a-d	79 a	1259 a-d	12.5 cd	63 c-f
Milsana 1% IPM (5-9) ……	3.5 d	14.1 a-c	359 c	10.4 a-d	77 a	1267 a-d	11.3 cd	63 c-f
Kocide 2000 53.8DF 2 lb (5-9) …….	0.7 fg	12.2 a-e	141 ef	10.3 a-d	59 a-e	1153 cd	0.9 f	64 c-f
JMS Stylet-oil 1.5% (5-9) ……..	0.7 e-g	4.4 b-f	64 gh	3.6 e-g	61 a-e	638 f	8.8 de	63 c-f
Microthiol Disperss 80W 4 lb (5-9) ……	0.8 e-g	2.1 d-f	64 gh	5.6 d-f	69 ab	663 f	4.1 ef	87 a
Bravo Ultrex 82.5WG 2.7 lb (5-9) …….....	0.5 fg	1.0 f	20 i	8.8 b-d	66 a-c	895 e	4.1 ef	58 d-f
Nova 40WP 5 oz + Dithane DF …..…… Rainshield NT 3 lb (5-9)	0.2 g	3.2 c-f	28 hi	1.0 gh	36 de	333 gh	1.8 f	76 a-e
Milsana 1% alt Quadris [d] + Nova (5-9) …	0.2 g	5.0 b-f	51 g-i	2.2 f-h	33 e	332 gh	1.8 f	69 a-f
Bravo alt Quadris [d] + Nova (5-9) ……...	0.3 g	1.8 ef	23 hi	0.9 gh	38 c-e	327 h	1.6 f	83 ab
Quadris [d] alt Nova + Milsana (5-9) …..….	0.3 g	3.9 b-f	172 e	1.8 gh	44 b-e	511 fg	1.6 f	80 a-c
Quadris [d] alt Nova + Bravo (5-9) ……...	0.0 g	3.9 c-f	47 g-i	1.0 gh	42 b-e	400 gh	0.8 f	87 a
Cabrio 20EG 12 oz (5-9) ……..……..	0.2 g	4.5 b-f	88 fg	0.8 h	46 b-e	390 gh	1.0 f	76 a-e
Cabrio 20EG 16 oz (5-9) ……..……..	0.3 g	15.1 a-c	187 de	0.7 h	52 a-e	411 gh	1.9 f	65 b-f
P-value	0.0001	0.0242	0.0001	0.0001	0.0073	0.0001	0.0001	0.0034

[a] Exact colony counts were made when possible and severity was estimated using the conversion factor of 30 colonies/leaf = 1%. A square root transformation was used when needed to stabilize variance. The table contains de -transformed values.

[b] Rate of formulated product/A. The same rate was used for all treatments with each fungicide. Rate is spe cified in the first treatment with each fungicide. Application times were: 1=16 Jul, 2=25 Jul, 3=31 Jul, 4=7 Aug, 5=15 Aug, 6=22 Aug, 7=30 Aug, 8=6 Sep, and 9=13 Sep.

[c] Numbers in a column with a letter in common are not significantly different according to Fisher's Protected LSD ($P = 0.05$).

[d] Applied with NuFilm P (6 oz/A).