

EVALUATION OF FUNGICIDE PROGRAMS FOR MANAGING POWDERY MILDEW OF PUMPKIN, 2000: 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 30 May. Pumpkin seed were planted on 21 Jun at approximately 24-in. within-row plant spacing and 68-in. between-row spacing. Weeds were controlled by applying Curbit EC (1 pt/treated A) + Command 4EC (4 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. Additionally, soil drainage was improved by subsoiling on 19 Jul between rows before vines grew over. Plots were thinned to about 15 plants in three 15-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 81/61 in Jun, 81/64 in Jul, 81/65 in Aug, 76/59 in Sep, and 66/48 in Oct. Rainfall (in.) was 4.24, 4.7, 2.42, 3.92 and 0.46 for these months, respectively. One Milsana treatment was started about 1 month after planting on 22 Jul. This treatment was to receive at least 1 more application of Milsana before other treatments were started; this was not possible because of frequent rains 26 Jul through 4 Aug. All other treatments were initiated on 4 Aug after the IPM threshold of one leaf with symptoms of 50 old leaves examined was reached in all but 1 plot. 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 100 gpa at 200 psi. A randomized complete block design with four replications was used. Upper and lower (under) surfaces of 5-50 leaves in each plot were examined weekly for powdery mildew beginning on 25 Jul. Initially, 50 older leaves were examined in each plot. 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. Fungicide sensitivity was determined using a leaf disk bioassay (Plant Dis. 80:633-639) for isolates collected before and after treatment. Three isolates collected on 4 Aug were tested at 0, 0.2, 2, 20, and 80 ppm myclobutanil (Nova a.i.). Thirty isolates collected on 18 Sep from plots treated with BAS 500 alternated with Nova + Bravo were tested at 0, 0.2, 2, 20, and 40 ppm a.i. BAS 500 and 0 to 20 ppm myclobutanil. Defoliation was assessed on 8, 18, and 28 Sep; and 4 Oct. Fruit quality was evaluated in terms of handle (peduncle) condition on 4, 12, and 18 Oct. Weight was estimated from width X length using a linear regression equation derived using 30 representative fruit from the experiment. Fruit width and length were measured on 13 Oct.

All treatments provided some control of powdery mildew on both leaf surfaces. Powdery mildew became severe as usual at this location. Symptoms were found on 9 of 3600 leaves examined on 25 Jul, 3 days after the early Milsana treatment. This early application of Milsana did not improve control with this product. Armicarb, Milsana, and Bravo were less effective for controlling powdery mildew on lower leaf surfaces than treatments that included systemic or translaminar fungicides (Nova, Procure, BAS 500, Quadris, and Flint). These differences were evident beginning on 16 Aug. On upper leaf surfaces, Bravo was as effective as some treatments that included systemic fungicides, it was more effective than Armicarb starting on 31 Aug, and it was more effective than Milsana at the last assessment on 18 Sep. When tank mixed with the DMI fungicide Nova and applied in alternation with the strobilurin (QoI) fungicide Quadris, the Bravo alternatives (Armicarb, Milsana, Nutrol, Kocide, and Microthiol Sulfur) were as effective as Bravo. However, Bravo is expected to be more valuable for managing resistance to DMIs and QoIs because it is more effective than the Bravo alternatives. The role of these fungicides with low risk of developing resistance is to reduce the overall size of the pathogen populations and thus the size of the selectable population. Bravo has not been compared directly to Nutrol, Kocide, or Sulfur on pumpkin at this location; however, percent control with Bravo has been higher. Nova + Bravo was more effective than Procure + Bravo for controlling powdery mildew on lower leaf surfaces. Control was not improved by adding Actigard to an alternation program of Flint and Bravo. A12325, a pre-pack mix of Flint + Actigard, was more effective than a tank-mix of these products based on powdery mildew severity on lower leaf surfaces on 31 Aug; however, these treatments were not significantly different based on assessments made on 7 and 18 Sep or AUDPC values. The strobilurins Quadris and BAS 500 were equally effective when used in alternation with Nova + Bravo. These were among the best fungicide programs evaluated. As a consequence of differences in powdery mildew control, treatments without a systemic fungicide had more defoliation beginning on 18 Sep and fewer fruit with good solid handles beginning on 12 Oct than all treatments with a systemic fungicide. All isolates collected before treatment tolerated 20 ppm myclobutanil. After treatment with BAS 500 alternated with Nova + Bravo, the highest fungicide concentrations tolerated were 20 ppm myclobutanil, tolerated by 47% of the isolates, and 2 ppm BAS 500 a.i., tolerated by 83% of the isolates. Yield was highest for treatments with good control of powdery mildew. Weight of mature fruit was 170 to 225 lb/plot for nontreated, Armicarb, Bravo, and Milsana treatments and 323 lb/plot for Quadris alternated with Nova + Bravo. Phytotoxicity was not observed with any treatments. Command injury occurred in several plots but did not appear to affect treatment comparisons.

Treatment and rate/A (application time) ²	Powdery mildew severity (% leaf coverage)						Defolia- tion (%)	Fruit handle condition (% solid)
	upper leaf surface ¹			lower leaf surface ¹				
	31 Aug	18 Sep	AUDPC	31 Aug	18 Sep	AUDPC		
Nontreated Control	8.07 a ³	37.3 a	699.3 a	21.92 a	84.0 a	1204 a	80 a	46 f
Bravo Ultrex 2.7 lb (2-7)	0.18 cd	1.1 c	21.5 de	14.40 b	76.3 ab	1034 ab	54 b	52 ef
Nova 40W 5 oz + Bravo (2-7)	0.00 d	0.1 cd	0.8 fg	0.07 ag	3.4 def	28 fg	16 d	94 a
Procure 50W 6 oz + Bravo (2-7).....	0.11 cd	0.7 cd	7.6 efg	3.07 de	22.6 c	298 c	33 c	90 abc
BAS 500 20WG 1 lb (2,4,6), Nova + Bravo (3,5,7)	0.00 d	0.0 d	0.6 fg	0.05 fg	0.9 ef	10 g	16 d	92 a
Quadris F 15.4 oz (2,4,6) ⁴ , Nova + Bravo (3,5,7)	0.01 d	0.0 d	0.2 g	0.16 fg	2.0 ef	19 fg	20 cd	95 a
Flint 50WG 1.5 oz (2,4,6), Bravo (3,5,7)	0.05 cd	0.9 cd	7.9 efg	2.71 de	23.9 c	246 c	24 cd	94 a
Flint + Actigard 50WG 0.5 oz (2,4,6), Bravo (3,5,7)	0.18 cd	0.3 cd	5.7 efg	4.03 d	32.6 c	284 c	33 c	78 bc
A12325 50WG 2 oz (2,4,6), Bravo (3,5,7)	0.00 d	0.4 cd	2.1 fg	0.92 ef	32.4 c	233 cd	31 cd	75 cd
Milsana (KHHUBF-99-001) 1% (1-7).....	0.63 c	20.5 ab	143.1 c	9.06 bc	72.9 ab	944 ab	65 ab	63 de
Milsana 1% (2-7)	0.70 bc	9.7 b	118.6 c	8.71 c	77.8 ab	894 a	68 ab	59 ef
Quadris (2,6) ⁴ , Nova (4), Bravo (7), Milsana (3,5).....	0.18 cd	0.8 cd	14.4 def	1.81 de	24.8 c	281 c	30 cd	90 ab
Quadris (2,6) ⁴ , Nova (4), Bravo (3,5,7).....	0.00 d	0.2 cd	4.9 efg	1.62 de	27.4 c	233 e	25 cd	88 abc
Quadris (2,6) ⁴ , Nova (4), Bravo (7).....	0.57 c	1.1 c	39.8 d	1.55 de	26.9 c	231 cd	23 cd	90 abc
Armcarb 100 4 lb (2-7)	2.07 b	42.4 a	535.0 b	11.33 bc	61.1 b	927 b	60 b	52 ef
Quadris (2,4,6) ⁴ , Nova + Armcarb (3,5,7)	0.00 d	0.5 cd	5.0 efg	0.00 g	0.7 f	6 g	20 cd	95 a
Quadris (2,4,6) ⁴ , Nova + Nutrol 20 lb (3,5,7) ⁴	0.12 cd	0.5 cd	13.1 def	1.55 de	4.5 de	127 de	26 cd	92 ab
Quadris (2,4,6) ⁴ , Nova (3,5,7), Armcarb (3), Microthiol Sulfur 80DF 4 lb (5), Kocide 2000 1.5 lb (7)	0.00 d	0.5 cd	3.5 efg	0.10 fg	9.1 d	62 ef	18 cd	86 abc
P-value	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001

¹ Colonies were counted when possible; 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.

² Rate of formulated product/A. The same rate was used for all treatments with each fungicide. Rate is specified in the first treatment with each fungicide. Application times were: 1=22 Jul, 2=4 Aug, 3=10 Aug, 4=17 Aug, 5=25 Aug, 6=1 Sep, and 7=9 Sep.

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

⁴ Applied with NuFilm P (6 oz/A).