SQUASH (*Cucurbita moschata* 'Waltham')
Powdery mildew; *Podosphaera xanthii*
Downy mildew; *Pseudoperonospora cubensis*

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Evaluation of fungicides for the management of powdery and downy mildews of winter squash, 2006.

The objective of this study was to evaluate two fungicides, Forum 480 SC and Procure 480 SC, used alone and combined, and compared with a fungicide program consisting of several products combined for the control of powdery mildew and downy mildew in butternut squash. Forum 480 SC is a fungicide registered for downy mildew and Phytophthora blight on cucurbits and Procure 480 SC is labeled for powdery mildew only. This study was done to investigate any synergistic effects of these chemicals on control of either powdery or downy mildew. A field experiment was conducted at the Long Island Horticultural Research and Extension Center on Haven loam soil. The field was tilled on 1 May and fertilizer (N-P-K 10-10-10) at 400 lb/A was broadcast and incorporated on 24 May. Three rows of black plastic mulch spaced 30 in. apart were laid on 30 May. 'Waltham' was direct seeded by hand (2 seeds/hole) into black plastic mulch on 13 Jun. During the season weeds were controlled with one application of Select 2 EC (8 fl oz/A) on 31 Jul, hand weeding, mowing, and roto-tilling between the rows of black plastic mulch. The insecticide Asana XL EC (9.6 fl oz/A) was applied to control cucumber beetles on 30 Jul and 5 Aug. Water was provided as needed through drip irrigation lines placed beneath the mulch. Additional fertilizer (N-P-K 34-0-0) at 29.4 lb/A was injected through the drip irrigation system on 12 Jul, 28 Jul, 10 Aug, and 17 Aug. Cuprofix Disperss (2.5 lb/A), was applied on 12 Jul for control of bacterial leaf spot (caused by *Xanthomonas campestris* p.v. *cucurbitae*), which was sufficiently in advance of powdery mildew onset that it would not have provided any suppression of powdery mildew. Plots were three 12-ft rows spaced 68-in. apart. Each row consisted of 3 plants, each spaced 24 in. apart; 10 ft was left unplanted between plots. A randomized complete block design with four replications was used. Average monthly high and low temperatures (^{o}F) were 77/62 in Jun, 84/69 in Jul, 82/67 in Aug, 73/58 in Sep, and 64/48 in Oct. Rainfall (in.) was 5.83, 3.79, 5.48, 3.66, and 5.53 for these months, respectively. All treatments were started on 24 Jul and reapplied weekly on 1, 8, 15, 23, 30 Aug, 5, and 18 Sep with a tractor-mounted boom sprayer equipped with D5-25 hollow cone nozzles spaced 17 in. apart that delivered 85 gal/A at 100 psi. Upper and lower surfaces were examined weekly for powdery mildew beginning on 9 Aug when fruit were starting to enlarge. Initially, 10 old and 10 mid-aged leaves were examined for powdery mildew severity based on leaf physiological appearance and position in the canopy. Young leaves were also examined for powdery mildew beginning on 13 Sep. Powdery mildew colonies (spots) were counted; severity was assessed by visual estimation of percent leaf area affected 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. A square root transformation was used when needed prior to analysis to achieve homogeneity of variance. Downy mildew was evaluated in the same manner on mid-aged leaves on 18 and 27 Sep.

Powdery mildew was first observed on 21 Jul at an extremely low level and treatments were started on 25 Jul. Downy mildew was not observed until 15 Sep. Procure applied alone provided good suppression of powdery mildew on both leaf surfaces as expected from results of previous experiments at this facility, but in sharp contrast with results obtained in a nearby fungicide efficacy experiment conducted with pumpkin in 2006. Similar results occurred with these crop species in GA (see reports in this volume by D. Langston). As expected, Procure did not suppress downy mildew. Forum applied alone provided good control of downy mildew and limited suppression of powdery mildew on upper leaf surfaces only. Severity was usually numerically lower for the tank mixture of Procure and Forum than for the best single product for each disease, but was never statistically different; thus there was no indication of a synergistic effect with these fungicides for either disease. The fungicide program provided good control of both diseases that was not significantly different from the Procure/Forum combination treatment. No phytotoxicity was observed.

	Powdery mildew severity (%)[z]						Downy mildew severity (%)[z]		
	Upper leaf surface			Lower leaf surface			Lower leaf surface		
Treatment and rate/A	17-Aug	13-Sep	AUDPC	17-Aug	13-Sep	AUDPC	18-Sep	27-Sep	AUDPC
Fungicide program[y] …….....	1.4 b[x]	1.9 c	25 c	3.3 b	22.3 b	313 b	0.1 b	1.3b	6 b
Procure 480 SC 6 fl oz + Forum 480 SC 6.4 fl oz + Silwet 2 oz ……..	0.2 b	0.1 c	7 c	11.4 b	3.3 c	407 b	0.0 b	3.2b	14 b
Procure 480 SC 6 fl oz + Silwet 2 fl oz ……...	2.0 b	1.9 c	83 c	11.4 b	7.9 c	407 b	6.8 a	17.0a	94 a
Forum 480 SC 6.4 fl oz ……	4.3 ab	32.0 b	540 b	30.3 a	52.1 a	1230 a	0.1 b	3.6b	15 b
Nontreated (control) ……	9.6 a	47.3 a	893 a	31.2 a	52.3 a	1217 a	1.7 b	13.4a	65 a
P-value	0.0195	0.0001	0.0001	0.0001	0.0001	0.0001	0.0037	0.0035	0.0010

[z] Exact colony counts were made when possible and severity was estimated using the conversion factor of 30 colonies/leaf = 1%. Powdery mildew severity data is for old and mid-aged leaves on 17 Aug and on mid-aged and young leaves on 13 Sep. Downy mildew severity data is for mid-aged leaves only on both 18 and 27 Sep.

[y] The fungicide program consisted of Microthiol Disperss 80W (4 lb/A) + Quintec 2.08 SC (4 fl oz/A) followed by 4 applications of Microthiol Disperss 80W (4 lb/A) + Gavel 75 DF (2 lb/A) + Dithane DF (1.22 lb/A) with alternating sprays of Nova (5 oz/A) and Quintec 2.08 SC (4 fl oz/A) followed by 1 application of Microthiol Disperss 80W (4 lb/A) + Nova (5 oz/A) + Gavel 75 DF (2 lb/A) + Dithane DF (1.22 lb/A) + Curzate 60 DF (3.2 oz/A) followed by two applications of Microthol Disperss 80W (4 lb/A) alone.

[x] Means followed by the same letter are not statistically different from each other (Fisher's Protected LSD, P=0.05).