PUMPKIN (*Cucurbita pepo* 'Half Pint')
    Phytophthora blight; *Phytophthora capsici*

M. T. McGrath and Z. F. Sexton
Plant Pathology & Plant-Microbe Biology Section
SIPS, Cornell University, LIHREC
3059 Sound Avenue, Riverhead, NY 11901

Efficacy of biopesticides for managing Phytophthora blight in cucurbits, 2018.

An experiment with field-grown pumpkins was conducted at the Long Island Horticultural Research and Extension Center (LIHREC) in Riverhead, NY, in a field with Haven loam soil. The objective was to evaluate an organic program with a combination of biopesticide products plus an organic copper and a program with biopesticides applied to soil early in crop development followed by conventional fungicides applied to foliage for control of Phytophthora blight in pumpkins. All products tested are labeled for this disease in the United States. Biopesticides were selected to have a full range of available active ingredients. All biopesticides included in this experiment are approved for organic production (OMRI-listed). The field was chosen because it has a history of Phytophthora blight. The field was plowed on 28 Jun. Controlled-release fertilizer (N-P-K, 15-5-15) was applied on 29 Jun at 675 lb/A (101 lb/A N). Pumpkins were sown with a vacuum seeder at approximately 24-in plant spacing on 3 Jul. Strategy 3 pt/A, Sandea 0.5 oz/A and Roundup PowerMax 22 oz/A were applied prior to seedling emergence for weed control on 7 Jul using a tractor mounted sprayer. During the season, weeds were controlled by cultivating and hand weeding as needed. Moisture was provided as needed all season using overhead irrigation. Plots were three 12-ft rows spaced 68 in. apart. The 20-ft area between plots was also planted to pumpkin. A randomized complete block design with six replications was used. Four applications of biopesticides were made to soil with two pre-emergence and two while plants were small (at least three expanded true leaves at last application). Foliar applications for Phytophthora blight were made four times on a 7-day preventive schedule beginning on 31 Jul. All eight applications were made using a tractor-mounted boom sprayer equipped with twinjet (TJ60-11004VS) nozzles spaced 17 in. apart that delivered 72 gal/A at 50 psi and 2.3 mph. Plots were evaluated for symptoms of Phytophthora blight on 3, 16, 23, and 28 Aug. At each assessment all plants within plots were inspected for wilting symptoms due to Phytophthora blight. Wilted plants and those dead due to Phytophthora blight were recorded as a percentage of total plants. Area Under Disease Progress Curve (AUDPC) values were calculated from 19 Oct through 8 Nov using the formula: $\sum n_{i=1}[(R_{i+1} + R_i)/2] [t_{i+1} - t_i]$, where R = disease incidence at the ith observation, t_i = time (days) since the previous rating at the ith observation, and n = total number of observations. Data was analyzed with one-way ANOVA and Tukey's HSD to separate means using JMP statistical software. Average monthly high and low temperatures (ºF) were 85/70 in Jul and 84/72 in Aug. Rainfall (in.) was 3.76 and 6.04 for those months, respectively.

Rain on 22 Jul (1.34 in.) and 26 Jul (1.22 in.) likely created favorable conditions for disease onset. Symptoms were first observed on 3 Aug. All but one affected plant was in a strip running north to south that included half of the plots in replications 1, 2, and 3. Replications were arranged in an east to west orientation based on past occurrence of Phytophthora blight in this field reflecting tendency for the south end to be wetter than the north. Replications 4, 5, and 6 were stacked and separated from replications 1, 2, and 3 by a driveway. No significant differences were detected among treatments in percent affected plants. At all ratings the conventional treatment that started with soil-directed biopesticide applications had numerically fewest affected plants while at the last two ratings the organic treatment had numerically the most. At the last rating the percentage of dead plants was significantly lower for the conventional treatment with biopesticides than the organic treatment. Early onset of disease in replications 1, 2, and 3 did not impact results based on re-analysis of data from replications 4, 5, 6, plus the four treatment plots that were adjacent in the half of replications 2 and 3 without symptoms on 3 Aug (data not shown). Conditions in 2018 were more favorable than usual at LIHREC based on incidence of Phytophthora blight in other cucurbit experiments treated with conventional fungicides to manage this disease.

Treatment and rate/A (application dates) [z]	Application target	Plants wilted or dead due to crown rot (%) [y,x]				Dead plants 28 Aug (%) [y,x]
		16 Aug	23 Aug	28 Aug	AUDPC	
Untreated control	--	8.9	49.3	75.5	662	48.1 ab
Bio-Tam 4 lbs + Taegro 4 oz (1,3)	soil					
Stargus 4 qt (2,4)	soil					
Stargus 4 qt (6,8)	plant					
Actinovate AG 12 oz (5,7)	plant					
Cueva 2 qt (5,7)	plant	8.1	53.0	85.8	695	58.2 a
K-Phite 1 qt (5-8)	plant					
Revus 8 fl oz (5,7)	plant					
Presidio 4 fl oz (6,8)	plant	10.3	31.2	58.0	467	21.6 ab
Bio-Tam 4 lbs + Taegro 4 oz (1,3)	soil					
Stargus 4 qt (2,4)	soil					
Revus 8 fl oz (5,7)	plant					
K-Phite 1 qt (5-8)	plant					
Presidio 4 fl oz (6,8)	plant	3.1	15.7	51.8	272	9.4 b
P-value (treatment)		0.8978	0.1228	0.1391	0.4043	0.0393

[z] Rate of formulated product/A. Soil-directed application dates were 1=4 Jul, 2=11 Jul, 3=19 Jul, and 4=24 Jul. Foliar application dates were 5=31 Jul, 6=7 Aug, 7=15 Aug, and 8=21 Aug.

[y] Values in each column with a letter in common or with no letter are not significantly different from each other (Tukey's HSD, *P*=0.05).

[x] Values were square root transformed before analysis because raw data were not distributed normally. Table contains back-transformed values.