

EVALUATION OF CONTROL OF POWDERY MILDEW ON PUMPKIN WITH FUNGICIDES - HANCOCK, 2000: Seeds of pumpkin cultivar Connecticut Field were sown in the greenhouse May 15. The seedlings were transplanted by hand to a field at the Hancock Agricultural Research Station, in central Wisconsin on June 6 to establish a trial to evaluate fungicide efficacy for powdery mildew control. Each treatment plot consisted of a single row containing five plants, spaced three feet apart in the row. Adjacent rows were planted 12 feet apart with alleys 10 feet wide between ends of adjacent plots. Where it was necessary for spray equipment to drive between rows to make fungicide applications, the rows were 18 feet apart. The trial was designed as a randomized complete block with four replications. Soil type was a Plainfield sand with pH 6.3. Fertilizer applications consisted of 6-24-24, 100 lb/A, broadcast preplant June 5 and two additional applications of N during the growing season (150 lb/A), June 23 and July 6. Fungicide treatments began at flowering and were applied with a plot sprayer with a tractor-mounted boom pressurized with an air compressor. Treatments were applied beginning July 18, according to treatment protocol, at a rate equivalent to 35 gal water/A at 40 psi, using Tee Jet D3-23 nozzles (15 nozzles at 8-inch spacing). Plots were naturally inoculated with spores of the powdery mildew fungus. Powdery mildew colonies were first observed on pumpkin foliage on August 7 and mildew severity was rated on a Horsfall-Barratt scale of 0 (no infection) to 11 (all foliage and stems dead). Ratings were converted to percentages. On Aug 7, 14, 22 and 28, and Sep 8 and 15, eight older leaves, eight middle-aged leaves and eight new leaves were rated in each plot. In addition, whole plot assessment (also using the Horsfall-Barratt scale) was done for five 1-meter square areas in each plot on Aug 28, and Sep 8 and 15. All pumpkins were harvested and weighed individually on October 2. Pumpkins were classed at harvest as marketable (solid, predominantly orange), green (more than 50% green) or soft and rotting. Rainfall measured during the growing season (inches) was June (6.93); July (2.3); Aug (4.55) and Sep (3.51). An additional 9.1 inches of water was applied as overhead sprinkler irrigation in 19 applications (June 5 - Aug 31).

Weather conditions during August were ideal for powdery mildew development. Periodic rainfall, cool nights and warm days contributed to extensive disease development, especially in the untreated control plots where over 50% of the older leaves exhibited symptoms by August 22 and over 70% of all untreated leaves were diseased by Sep 8. Disease progressed fastest on the older leaves and slowest on the younger leaves. All treatments provided some level of disease control. Alternating treatments with Procure and Flint at two-week spray intervals for a total of four sprays provided the best season-long control. Rate differences of Procure in these alternating treatments did not affect disease control. Procure, applied alone four times, did not control powdery mildew as well as the alternating treatments of Procure and Flint. Control observed with four treatments of Procure alone was similar to control achieved with seven sprays of BAS 500. Control was somewhat poorer in plots treated with Benlate (four sprays at 2 week intervals), seven sprays of Topsin M + Penncozeb and Topsin M alternated with Penncozeb (seven sprays). Total yield in all fungicide treated plots was significantly better than yield in untreated control plots. The average weight of each pumpkin was unaffected by chemical treatment, but the number of pumpkins per plot was affected by treatment. The number and percentage of green fruit were highest in plots treated with Procure alternated with Flint. Plots treated with these products in an alternating program were still green and lush at the time of harvest on October 2. These field data suggest that it may be possible to extend the interval between sprays of Procure and Flint to three weeks instead of the two weeks used in this trial. Use of the new reduced risk fungicides in a season-long program greatly reduces the total amount of fungicide active ingredients when compared with standard programs using Topsin and Penncozeb

Table 1. Summary of treatments applied.

No.	Treatment, Rate/Acre Formulated Product (and active ingredient in []) and Application Dates	Total a.i./Trt (lb)
1	Unsprayed Control	0
2	Benlate 50 WP, 0.25 lb [0.125 lb] Appl: 7/18, 8/1, 8/15, 8/29	0.5
3	BAS 500 02 F 20 WG, 1.0 lb [0.2 lb] Appl: 7/18, 7/25, 8/1, 8/8, 8/15, 8/23, 8/29	1.4
4	Procure, 0.38 lb [0.19 lb] + Bond (0.125 %) Appl: 7/18, 8/1, 8/15, 8/29	0.8
5	Procure, 0.38 lb [0.19 lb] + Bond (0.125 %) Appl: 7/18, 8/15 Flint 50 WG, 0.094 lb [0.047 lb] + Nufilm (0.125 %) Appl: 8/1, 8/29	0.5
6	Procure, 0.26 lb [0.13 lb] + Bond (0.125 %) Appl: 7/18, 8/15 Flint 50 WG, 0.094 lb [0.047 lb] + Nufilm (0.125 %) Appl: 8/1, 8/29	0.4
7	Topsin M 70WP, 0.5 lb [0.35 lb] +Penncozeb 75DF, 2.0 lb [1.5 lb] Appl: 7/18, 7/25, 8/1, 8/8, 8/15, 8/23, 8/29	13.0
8	Topsin M 70 WP, 0.5 lb [0.35 lb] Appl: 7/18, 8/1, 8/15, 8/29 Penncozeb 75DF, 2.0 lb [1.5 lb] Appl: 7/25, 8/8, 8/23	5.9

Table 2. Effect of treatment on severity of powdery mildew (percent foliage infection on individual young, middle-aged and older leaves and whole plot rating)

Treatment No.	Percent Foliage Infection (individual leaf rating) ¹																		Percent foliage infection (whole plot rating) ²		
	8/7			8/14			8/22			8/28			9/8			9/15			8/28	9/8	9/15
	Older	Middle	Young	Older	Middle	Young	Older	Middle	Young	Older	Middle	Young	Older	Middle	Young	Older	Middle	Young			
1	0.4	2.3	0.0	19.8	5.6	1.0	54.3	26.4	1.4	79.6	57.4	5.7	98.0	79.3	2.9	97.8	77.3	3.5	38.0	70.7	86.8
2	2.4	0.0	0.0	1.0	1.5	0.0	21.7	10.9	1.2	36.1	9.1	1.0	79.0	49.0	1.5	94.9	73.6	1.5	12.5	28.7	62.2
3	0.1	0.1	0.0	0.3	0.0	0.0	0.9	0.1	0.0	15.3	7.2	1.0	34.5	13.9	1.2	82.5	40.5	3.3	8.4	18.0	32.7
4	0.1	0.1	0.0	0.8	0.0	0.0	1.8	0.4	0.3	15.1	5.9	1.0	29.5	8.2	0.0	71.3	29.9	1.0	9.7	20.3	39.5
5	0.1	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.0	6.1	2.3	0.1	15.5	5.1	0.3	30.6	6.6	1.0	4.4	8.7	16.8
6	0.0	0.0	0.0	0.0	0.0	0.1	1.0	0.0	0.0	5.3	1.2	0.4	10.7	3.1	0.5	23.7	7.0	0.3	3.5	7.5	12.7
7	0.1	0.0	0.0	0.1	0.0	0.0	7.2	0.6	0.0	25.1	6.1	1.3	76.5	36.7	5.4	97.2	70.1	8.7	7.8	40.0	69.1
8	0.1	0.0	0.0	1.5	0.2	0.1	7.8	6.6	0.5	49.9	22.8	2.9	68.5	18.9	0.6	94.6	34.0	1.0	15.0	35.9	51.1
Pr>F ³	0.54	0.16	---	0.12	0.02	0.25	< 0.01	< 0.01	0.02	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	0.17	< 0.01	< 0.01	0.36	< 0.01	< 0.01	< 0.01
LSD	NS	NS	---	NS	3.2	NS	13.3	6.6	1.0	16.4	14.9	2.4	26.7	19.3	NS	19.0	33.3	NS	8.7	17.6	21.7

1 Severity was rated on a Horsfall-Barratt scale of 0 (no infection) to 11 (all foliage and stems dead). Ratings were converted to percentages. On each rating date, eight older leaves, eight middle aged leaves and eight young leaves were rated in each plot.

2 On each rating date, five approximately 1 m² areas per plot were observed. Severity was rated on a Horsfall-Barratt scale of 0 (no infection) to 11 (all foliage and stems dead). Ratings were converted to percentages.

3 Analysis of variance was performed on data, and Fisher's protected least significant difference (LSD) was calculated. NS = not significant at $P = 0.05$.

Table 3. Effect of treatment on pumpkin yield.

Treatment number	Total Yield			Avg. weight per pumpkin (lb)		Mean no. of pumpkins per plot	Pumpkin quality at harvest					
	Weight (ton/A)		% Marketable (weight)	All harvested	Marketable ¹		Marketable		Green ²		Soft, rotting	
	Total	Marketable ¹					Mean no./ plot	%	Mean no./ plot	%	Mean no./ plot	%
1	14.5	13.3	91.7	16.5	17.9	9.8	8.0	83.7	1.3	12.7	0.5	3.6
2	22.0	16.6	77.0	18.9	22.2	12.0	7.8	66.1	2.8	22.1	1.5	11.8
3	23.9	17.6	73.9	19.5	21.3	13.0	8.8	66.2	3.5	28.8	0.8	5.0
4	20.4	15.1	74.3	16.3	17.1	13.0	9.3	70.9	3.0	23.4	0.8	5.7
5	23.5	14.7	63.6	16.5	20.3	15.0	7.5	52.0	4.8	32.0	2.8	16.0
6	23.3	15.2	65.2	17.9	20.2	13.8	8.3	59.2	4.3	30.8	1.3	10.0
7	20.1	17.0	85.8	16.0	17.2	13.0	10.5	80.8	1.5	11.2	1.0	8.0
8	20.6	17.2	84.0	18.8	19.1	11.8	9.8	82.7	2.0	17.3	0.0	0.0
Pr > F ³	0.03	0.36	0.04	0.64	0.34	0.38	0.57	0.01	0.01	0.06	0.47	0.39
LSD ³	5.2	NS	17.7	NS	NS	NS	NS	18.4	2.0	15.4*	NS	NS

1 Marketable yield excludes green and soft-rotted pumpkins

2 More than 50% green at time of harvest

3 Analysis of variance was performed on data, and Fisher's protected least significant difference (LSD) was calculated. NS = not significant at $P = 0.10$. * indicates differences between pairs of treatments were significant at $P = 0.10$ (but not at $P = 0.05$).