

Evaluation of fungicide programs for control of downy mildew of cucumber, 2018.

This trial was established at the Michigan State University Plant Pathology Farm in Lansing, MI, in a field of Capac loam soil previously planted to soybean. Roundup PowerMax 1 qt/A was applied for weed control prior to planting. Soil was prepared by plowing and discing, forming raised beds, and covering them with black plastic. Drip tape was established for irrigating the plot. Cucumber 'Vlaspik' seeds were planted on 20 Jul into the raised beds. Treatment rows were spaced 5.5 ft apart and plants were spaced 12 in. within the row. Treatments were arranged in a completely randomized block design with four replicates. Each treatment replicate consisted of a single-row 20-ft plot with a 3-ft buffer between treatments within the row. The trial was fertilized throughout the growing season with weekly applications of 20-20-20 via drip tape at 2.5 lb/A. One application of Admire Pro 8 fl oz/A was applied via drip irrigation 4 weeks after planting for insect control. The plots were hand weeded. Foliar spray treatments were applied on 10, 16, 23 and 30 Aug and 7, 14, and 21 Sep using a CO₂ backpack sprayer and a broadcast boom equipped with three XR8003 flat-fan nozzles spaced 18 in. apart, calibrated at 50 psi and delivering 50 gal/A. Foliar infection was evaluated using a 0 to 100% scale on 29 Aug; 6 and 16 Sep. Marketable fruit were harvested from the entire 20-ft plot on 12, 17, 21 and 26 Sep and weighed. Data were analyzed using an analysis of variance (ANOVA), with means separation performed using Fisher's protected least significant difference (LSD).

Downy mildew was first reported in Ingham County on 15 Aug in cucumber research plots on the Michigan State University Plant Pathology Farm. Foliar disease of the control plants increased significantly over the 18 days spanning from the first to last assessment. On the first rating, all treatments except Timorex ACT SC reduced foliar blight compared to the control. Approximately one week later (6 Sep), all treatment programs containing Ranman SC, Zing! SC, or Orondis Opti SC had significantly less foliar blight than the control. At the final rating these same treatments, with the exception of the programs containing Zing! SC or Stargus SC, were significantly better than the control; the Ranman SC + Silwet L-77 SL treatment limited foliar blight more than any other treatment program. According to the area under disease progress curve (AUDPC) data, all treatment programs limited disease compared to the control with the exception of AVIV SC, Timorex ACT SC, Double Nickel LC, Serenade ASO SC, Stargus SC 3 qt + Bravo WeatherStik SC, and the multi-fungicide program including Stargus SC, Zampro, and Ranman (each tankmixed with Bravo WeatherStik SC). The AUDPC data indicated that the Ranman SC + Silwet L-77 SL treatment provided the best control over the course of the season. Treatments resulting in yields significantly greater than the control included the treatment program with Zing! SC, Ranman SC, Orondis Opti SC, and the program of Stargus SC 3 qt + Bravo WeatherStik SC. The following treatments were among the highest yielding: Ranman SC + Silwet L-77 SL; Zampro SC + Bravo WeatherStik SC alternated with Ranman SC + Bravo WeatherStik SC, Ranman SC alternated with Echo 720 SC alternated with Zampro SC. Growers are advised to use fungicides representing multiple modes of action in a downy mildew program. This study indicates that Ranman SC remains an effective product for Michigan cucumber growers to limit downy mildew and can be used in conjunction with other effective downy mildew fungicides identified in this study.

Treatment ^z and rate/A, application schedule, applied at 7-day intervals	Foliar disease symptoms (%) ^y				Total yield (lb)
	8/29	9/6	9/16	AUDPC ^x	
Untreated control	13.0 a ^w	23.8 a	78.8 ab	1282.8 a	13.3 fg
AVIV SC 28 fl oz, apps A-G	4.5 b	25.0 a	80.0 a	1261.3 a	12.4 fg
Timorex ACT SC 18 fl oz, apps A-G	10.8 a	21.3 ab	68.8 ab	1153.5 ab	11.0 g
Double Nickel LC 24 fl oz, apps A-G	4.0 b	23.8 a	76.3 ab	1216.8 ab	10.2 g
Serenade ASO SC 3 qt, apps A-G	4.5 b	23.8 a	73.8 ab	1173.0 ab	15.3 e-g
Zing! SC 36 fl oz, apps A,C,E,G -alt- Echo 720 SC 2 pt, apps B,D,F	0.3 b	14.3 c	61.3 bc	892.5 cd	27.5 de
Ranman SC 2.75 fl oz, apps A,D,G -alt- Echo 720 SC 2 pt, apps B,E -alt- Zampro SC 14 fl oz, apps C,F	1.3 b	2.5 d	40.0 d	568.1 e	52.9 a
Orondis Opti SC 2.5 pt, apps A,D,G -alt- Echo 720 SC 2 pt, apps B,D,F	0.8 b	11.8 c	50.0 cd	743.8 de	33.4 cd
Elumin SC 8 fl oz, apps A,D,G -alt- Ranman SC 2.75 fl oz, apps B,E -alt- Zampro SC 14 fl oz, apps C,F	0.5 b	2.5 d	47.5 cd	608.9 e	35.8 b-d
Zampro SC 14 fl oz + Bravo WS SC 1.5 pt, apps A,C,E,G -alt- Ranman SC 2.75 fl oz + Bravo WS SC 1.5 pt, apps B,D,F	0.5 b	3.5 d	40.0 d	542.8 e	43.5 a-c
Stargus SC 3 qt + Bravo WS SC 1.5 pt, apps A-G	2.5 b	21.3 ab	76.3 ab	1129.8 ab	27.2 de
Stargus SC 4 qt + Bravo WS SC 1.5 pt + NuFilm P SL 0.25% v/v, apps A-G	1.5 b	20.0 ab	65.0 a-c	1005.3 bc	24.6 d-f
Stargus SC 4 qt + Bravo WS SC 1.5 pt + NuFilm P SL 0.25% v/v, apps A,D,G -alt- Zampro SC 14 fl oz + Bravo WS SC 1.5 pt, apps B,E -alt- Ranman SC 2.75 fl oz + Bravo WS SC 1.5 pt, apps C,F	0.3 b	16.8 bc	76.3 ab	1082.9 a-c	29.9 d
Ranman SC 2.75 fl oz + Silwet L-77 SL 2 fl oz, apps A-G	0.0 b	1.0 d	21.3 e	272.4 f	48.3 ab

^z-alt- = alternate. apps = applications. Bravo WS = Bravo WeatherStik.

^yBased on a visual estimation of the percentage of foliage diseased.

^xArea under the disease progress curve.

^wColumn means with a letter in common are not significantly different (LSD t Test; $P=0.05$).