

Evaluation of biological and conventional products to control downy mildew on pickling cucumbers, 2022.

The trial was established at the Michigan State University Plant Pathology Farm in Lansing, MI, in a field of Capac loam soil previously planted to cucumber. The field was plowed on 20 May and disced on 1 Jun. Preplant fertilizer (220 lb/A urea and 180 lb/A of potash) was applied and incorporated on 1 Jun. On 9 Jul, raised beds were formed in the field with black plastic mulch 8 ft apart with drip tape for irrigation and in-season fertilization. Biweekly mechanical cultivation and hand weeding were used for weed control. Planting occurred on 26 Jul from seed. The cultivar used for this experiment was ‘Vlaspik’. The treatments were arranged in a randomized complete block design with four replications. Each replicate was 20 ft with a 5-ft buffer between each plot in a row. Each week during the growing season the trial was fertilized with urea ammonium nitrate (28% N) liquid fertilizer at 1 gal/A through the drip tape. Quadris F (15.5 fl oz/A) and Torino SC (3.4 fl oz/A) were sprayed on 26 Aug to control the incidence of *Alternaria* spp. and powdery mildew; Admire Pro (10.5 fl oz/A) was applied through the drip lines on 10 Aug for insect control. Four weekly spray treatments were applied on 10, 16, 23, and 30 Aug using a CO₂ backpack sprayer and a broadcast boom equipped with three XR8003 flat-fan nozzles spaced 18 in. apart, calibrated at 35 psi, and delivering 50 gal/A. Foliage was evaluated for infection on 18, 24, and 29 Aug, and 5 Sep and the area under the disease progress curve (AUCPC) was calculated at the end of the season. Data were analyzed with SAS statistical software, version 9.4, using the PROC GLIMMIX procedure for a one-way ANOVA, with mean separation performed using Fisher’s least significant difference test (LSD; $P=0.05$).

Disease in the untreated control progressed from 31.3% on 18 Aug to 56.3% on 29 Aug. On 5 Sep, foliar infection was determined to be 32.5% as a result of new foliage development. On 5 Sep, all treatments had less foliar infection and lower AUDPC values compared to the untreated control. The industry standard (RenaZ [same active ingredient as Ranman] + Bravo WeatherStik alternated with Orondis Opti alternated with Zampro + Bravo WeatherStik) had the lowest disease severity (2.0%) and AUDPC value, which were significantly less than all other treatments. The treatment program that included Howler had less foliar infection and a reduced AUDPC value compared to the treatment program that included Theia. The treatment program that included Esendo WP was similar to the programs with either Howler WP or Theia WP according to the AUDPC data; the foliar infection on 5 Sep was reduced in the treatment program containing Esendo compared to the program with Theia WP.

Treatment ^z and rate/A, application schedule, applied at 7-day intervals	Foliar infection (%) ^y				AUDPC ^x
	18 Aug	24 Aug	29 Aug	5 Sep	
Untreated control	31.3 a ^w	33.8 a	56.3 a	32.5 a	730.6 a
RenaZ SC 2.75 fl oz + BWS 32 fl oz, AD -alt- Orondis Opti SC 40 fl oz, B -alt- Zampro SC 14 fl oz + BWS 32 fl oz, C	5.5 b	3.0 b	1.0 d	2.0 d	46.0 d
Howler WP 5 lb + Dyne-Amic 0.375% V/V, A -alt- Ranman SC 2.75 fl oz, B -alt- Zampro SC 14 fl oz, C -alt- Orondis Opti SC 40 fl oz, D	12.8 b	15.3 ab	25.0 c	20.0 c	342.1 c
Esendo WP 2.8 lb + Dyne-Amic 0.375% V/V, A -alt- Ranman SC 2.75 fl oz, B -alt- Zampro SC 14 fl oz, C -alt- Orondis Opti 40 fl oz, D	25.0 a	28.8 a	36.3 b	18.8 c	516.3 bc
Theia WP 3lb + Dyne-Amic 0.375% V/V, A -alt- Ranman SC 2.75 fl oz, B -alt- Zampro SC 14 fl oz, C -alt- Orondis Opti 40 fl oz, D	23.8 a	31.3 a	37.5 b	25.0 b	555.6 b
<i>P</i> -value	0.001	0.0006	<0.0001	<0.0001	<0.0001

^z-alt- = alternate. BWS = Bravo WeatherStik.

^yBased on visual estimation of foliage diseased.

^xAUDPC = Area under the disease process curve.

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