

Vegetable Disease Management Research Reports 2005

Tomato, Pepper, Potato, Cucumber, Squash, Radish, Mustard Greens, Turnip Greens, and Lettuce

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TOMATO (*Lycopersicon esculentum* 'Peto 696')
 Bacterial spot; *Xanthomonas campestris* pv. *vesicatoria*
 Anthracnose; *Colletotrichum coccodes*
 Bacterial canker; *Clavibacter michiganensis* pv. *michiganensis*

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Evaluation of fungicides and bactericides for the control of foliar and fruit diseases of processing tomatoes, 2005.

The experiment was conducted at the Ohio Agricultural Research and Development Center's North Central Research Station in Fremont, OH on Hoytville silty clay loam. Potassium (240 lb/A K₂O), phosphorous (104 lb/A P₂O₅) and nitrogen (20 lb/A urea) were incorporated into the test field, which was then chisel plowed on 5 Oct 04. On 7 May an additional 84 lb/A of nitrogen was applied, the field was cultivated and raised beds on 5 ft centers were prepared. 'Peto 696' tomato seeds were hot water-treated and sown on 19 Apr into 288-cell plug trays containing Metromix 360 seedling mix. On 17 May, seedlings were transplanted 1 ft apart into single rows 25 ft long on the beds. Starter fertilizer (N-P-K 10-34-0; 0.7 qt/50 gal water) was applied in the transplant water. Treatments were arranged in a randomized complete block design with four replications. Treatment rows were alternated with untreated guard rows. On 13 Jun the trial was replanted due to Roundup drift damage. Seedlings used for the treatment rows were from the 19 Apr seedling, and those used for the guard rows were the same cultivar from a different trial. The herbicides Dual II Magnum at 1.25 pt/A and Sencor 75 DF at 0.33 lb/A were applied on 16 May for weed control. Sevin XLR at 1 qt/A was applied on 22 Jun and Asana XL at 7 oz/A was applied 6 Jul to control insects. The field was cultivated on 6 Jun and 5 and 6 Jul and hand weeded and hoed on 7 Jun and 6 Jul. Plants were inoculated with approximately 10⁸ CFU/ml *Xanthomonas campestris* pv. *vesicatoria* strain 767 (race T1P8, copper sensitive), during the evening of 7 Jul using a tractor mounted CO₂-pressurized sprayer (55 psi, 39.3 gal/A, 3 mph). Plants were misted with water using an FMC sprayer with a PTO-driven pump (200 psi, 32.6 gal/A) prior to inoculation. Plants were overhead irrigated with 1.25 and 0.25 in. water on 23 Jun and 8 Jul respectively. Treatments were applied using a tractor-mounted CO₂-pressurized sprayer (60 psi, 44.31 gal/A, 3 MPH) on a 7-10 day schedule beginning 28 Jun and ending 2 Sept for a total of 9 applications. Severity of bacterial leaf spot on foliage was evaluated on 25 Jul, 9, 17, and 23 Aug and 19 Sep, and of bacterial canker on 19 Sep using a modified Horsfall-Barratt rating scale. Fruit were machine-harvested from all plants in each plot using a tomato harvester on 7 and 8 Sep and total weight per plot was recorded. Weights for marketable fruit, green fruit, fruit with bacterial disease, anthracnose, blossom end rot or other rots, and fruit damaged by stinkbugs were determined from a sub-sample from each plot, ranging from 15-17 kg. Average maximum temperatures for 13-30 Jun, Jul, Aug and 1-20 Sep were 85.3, 86.2, 84.6, and 80.4 °F; average minimum temperatures were 57.1, 59.9, 57.0, 51.7 °F; and rainfall was 0.52, 6.72, 4.15, and 1.39 in., respectively. Data were analyzed by ANOVA using SAS statistical software. Means were separated using Fisher's protected least significant difference test.

Bacterial spot pressure was high, and bacterial canker appeared naturally in the plots in mid-late August. None of the treatments provided high levels of control of bacterial spot under these conditions. There were no differences between treated plots or the untreated control in the AUDPC, although Tanos 50DF (8 oz) + Manzate 75DF (2 lb) + Kocide 2000 DF (2 lb) alt. Manzate 75DF (2 lb) + Kocide 2000 DF (2 lb), Tanos 50DF (8 oz) + Manzate 75DF (2 lb) + DPX-GFJ52 WG (1 lb) alt. Manzate 75DF (2 lb) + DPX-GFJ52 WG (1 lb), DPX-JE874 SE (7.58 fl oz) + Manzate 75DF (2 lb) + Kocide 2000 DF (2 lb) alt. Manzate 75DF (2 lb) + Kocide 2000 DF (2 lb), and Manzate 75DF (2 lb) + Kocide 2000 DF (2 lb) could be separated from the control based on foliar bacterial spot symptoms at the 19 Sep rating. None of the treatments were more effective in bacterial spot control than Manzate + Kocide alone. None of the treatments affected bacterial spot incidence on fruit. All of the treatments except Serenade Max + Kocide 2000 DF significantly reduced bacterial canker severity compared to the untreated control. The incidence of anthracnose on fruit was significantly lower than the control for plants treated with DPX-JE874 SE (7.58 fl oz) or DPX-JE874 SC (3.2 fl oz) + Manzate 75DF (2 lb) + Kocide 2000 DF (2 lb) alt. Manzate 75DF (2 lb) + Kocide 2000 DF (2 lb), and Tanos 50DF (8 oz) + Manzate 75DF (2 lb) + DPX-GFJ52 WG (1 lb) alt. Manzate 75DF (2 lb) + DPX-GFJ52 WG (1 lb). There were no significant differences in marketable yield from plots treated with any of the product combinations or not treated.

Treatment and rate/A (application time ^z)	Foliar bacterial spot ^y		Bacterial spot (% fruit affected)	Foliar bacterial canker (19 Sep)	Total marketable yield (ton/A)
	% disease (19 Sep)	AUDPC ^x			
DPX-JE874 EC 19 fl oz + Manzate 75DF 2 lb + Kocide 2000 DF 2 lb (1,3,5,7,9) <i>alt.</i> Manzate 75DF 2 lb + Kocide 2000 DF 2 lb (2,4,6,8,10).....	89.9 abc ^w	1766.3 a	18.5 ab	9.6 bc	13.5 a
DPX-JE874 SC 3.2 fl oz + Manzate 75DF 2 lb + Kocide 2000 DF 2 lb (1,3,5,7,9) <i>alt.</i> Manzate 75DF 2 lb + Kocide 2000 DF 2 lb (2,4,6,8,10).....	84.1 a-d	1769.3 a	12.6 abc	7.3 c	17.6 a
DPX-JE874 SE 7.58 fl oz + Manzate 75DF 2 lb + Kocide 2000 DF 2 lb (1,3,5,7,9) <i>alt.</i> Manzate 75DF 2 lb + Kocide 2000 DF 2 lb (2,4,6,8,10).....	80.5 bcd	1827.1 a	11.1 bc	9.6 bc	18.4 a
Manzate 75DF 2 lb + Kocide 2000 DF 2 lb (1-10).....	80.5 bcd	1646.3 a	14.3 abc	7.3 c	16.2 a
Serenade MAX 1 lb + Kocide 2000 DF 1 lb + Biotune 0.2% V/V (1-10)..	94.1 a	2238.1 a	8.4 c	14.3 ab	16.9 a
Tanos 50DF 8 oz + Manzate 75DF 2 lb + DPX- GFJ52 WG 1 lb (1,3,5,7,9) <i>alt.</i> Manzate 75DF 2 lb + DPX-GFJ52 WG 1 lb (2,4,6,8,10).....	76.9 cd	1437.6 a	19.9 a	9.5 bc	15.8 a
Tanos 50DF 8 oz + Manzate 75DF 2 lb + Kocide 2000 DF 2 lb (1,3,5,7,9) <i>alt.</i> Manzate 75DF 2 lb + Kocide 2000 DF 2 lb (2,4,6,8,10).....	72.3 d	1620.1 a	11.9 abc	2.8 d	19.5 a
Tanos 50DF 8 oz + Manzate 75DF 2 lb + Kocide 2000 DF 2 lb (1,3,5,7,9) <i>alt.</i> Manzate 75DF 2 lb + Kocide 2000 DF 1 lb (2,4,6,8,10).....	91.1 ab	1828.4 a	18.6 ab	6.1 cd	16.6 a
Untreated Control.....	96.0 a	2187.5 a	12.8 abc	19.0 a	13.2 a
<i>P</i> value	0.0157	0.2991	0.0963	0.0001	0.2385

^zApplication times were: 1= 28 Jun-5 Jul; 2= 6-12 Jul; 3= 13-19 Jul; 4= 20-27 Jul; 5= 28 Jul-2 Aug; 6= 3-9 Aug; 7= 10-16 Aug; 8= 17-23 Aug; 9= 24 Aug-1 Sep; 10= 2-8 Sep.

^yDisease rating and area under the disease progress curve (AUDPC) based on the midpoint values of a modified Horsfall-Barratt rating scale where 1=0%, 2= 1-3%, 3= 4-6%, 4=7-12%, 5= 13-25%, 6=26-50%, 7=51-75%, 8= 76-87%, 9=88-94%, 10= 95-97%, 11=98-99% and 12= 100% bacterial leaf spot.

^xCalculated according to the formula: $\sum [(x_i + x_{i-1})/2](t_i - t_{i-1})$ where x_i is the rating at each evaluation time and $(t_i - t_{i-1})$ is the time between evaluations.

^wValues are the means of four replicate plots; treatments followed by the same letter within a column are not significantly different at $P \leq 0.1$.

TOMATO (*Lycopersicon esculentum* 'Peto 696')
 Early blight; *Alternaria solani*
 Anthracnose; *Colletotrichum coccodes*
 Bacterial speck; *Pseudomonas syringae* pv. *tomato*

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Evaluation of fungicides for the control of foliar and fruit diseases of processing tomatoes, 2005.

The experiment was conducted at the Ohio Agricultural Research and Development Center North Central Experiment Station in Fremont, OH on Hoytville silty clay loam. Potassium (240 lb/A K₂O), phosphorous (104 lb/A P₂O₅) and nitrogen (20 lb/A urea) were incorporated into the test field, which was chisel plowed on 5 Oct 04. On 7 May an additional 84 lb/A nitrogen was applied, the field was cultivated, and raised beds on 5 ft centers were prepared. 'Peto 696' tomato seeds were hot water-treated and sown on 19 Apr into 288-cell plug trays containing Metromix 360 seedling mix. On 18 May, seedlings were transplanted 1 ft apart into single rows 25 ft long on the beds. The starter fertilizer (N-P-K 10-34-0; 0.7 qt/50 gal water) was applied in the transplant water. Treatments were arranged in a randomized complete block design with four replications. Treatment rows were alternated with untreated border rows. Dual II Magnum was applied at 1.25 pt/A on 16 May and Sencor 75 DF was applied at 0.33 lb/A on 16 May and 20 Jun. for weed control. Asana XL (7 oz/A) was applied 6 Jul to control insects. Plants were overhead irrigated with 1.25 in. water on 24 Jun. The field was cultivated on 6 and 13 Jun and hand weeded and hoed on 7 Jun and 7 Jul. Treatments were applied using a tractor-mounted CO₂-pressurized sprayer (60 psi, 44.31 gal/A, 3 MPH) on a 7-10 day schedule beginning 30 Jun and ending 30 Aug for a total of nine applications. Severity of early blight was evaluated on 25 Jul and 9, 17, and 23 Aug using a modified Horsfall-Barratt rating scale. Fruit were harvested from all plants in each plot on 7 and 8 Sep and weights were recorded. Weights for marketable fruit, green fruit, and fruit with anthracnose, bacterial disease, blossom end rot and other rots were determined from a 14-24 kg sub-sample from each plot. Average maximum temperatures for 18-31 May, Jun, Jul, Aug, and 1-7 Sep were 70.8, 85.9, 86.2, 84.6, and 80.3 °F; average minimum temperatures were 43.8, 58.3, 59.9, 57.0, and 48.9 °F; and rainfall was 0.95, 1.71, 6.72, 4.15, and 0.03 in., respectively. Data were analyzed by ANOVA using SAS statistical software. Means were separated using Fisher's protected least significant difference test. Disease severity data for 23 Aug were analyzed using Horsfall-Baratt ratings and converted to midpoints (% disease).

Early blight pressure was moderate. There were no significant differences among treatments and the untreated control in early blight intensity. All treatments significantly reduced anthracnose incidence compared to the untreated control, but there were no differences between treatments. Marketable yields were confounded by a non-uniformly distributed outbreak of buckeye rot (*Phytophthora capsici*) and are not reported.

Treatment and rate/A (application time ^z)	Early blight ^y		% anthracnose
	% disease 23 Aug	AUDPC	
Amistar 80WG 2 oz (1,3,5,7,9)			
<i>alt.</i> Bravo Weather Stik 6 SC 1.7 pt (2,4,6,8).....	13.1 a ^x	163.4 a	5.4 b
Bravo Ultrex 82.5 WG 1.55 lb (1-9).....	26.5 a	265.1 a	7.1 b
IR5885 CTL WP 1.10 lb (1-9).....	41.5 a	244.8 a	11.5 b
IR5885 CTL WP 1.35 lb (1-9).....	35.3 a	203.9 a	8.5 b
IR5885 CTL WP 1.60 lb (1-9).....	46.3 a	317.8 a	10.5 b
Reason SC 5.5 oz + Bond 0.1% v/v (1,3)			
<i>alt.</i> Bravo Weather Stik 6 SC 2.75 pt (2,4-9).....	16.6 a	126.3 a	9.2 b
Reason SC 8.2 oz + Bond 0.1% v/v (1,3)			
<i>alt.</i> Bravo Weather Stik 6 SC 2.75 pt (2,4-9).....	31.3 a	226.7 a	8.0 b
Untreated control.....	43.4 a	342.4 a	22.0 a
<i>P</i> value	0.4476	0.1995	0.0044

^zNumbers in parentheses indicate the applications in sequence of the preceding product. Application timings were: 1= 30 Jun-6 Jul; 2= 7-13 Jul; 3= 14-22 Jul; 4= 23-31 Jul; 5= 1-7 Aug; 6= 8-14 Aug; 7= 15-22 Aug; 8= 23-29 Aug; 9= 30 Aug-6 Sep.

^yDisease rating and area under the disease progress curve (AUDPC) based on the midpoint values of a modified Horsfall-Barratt rating scale where 1=0%, 2= 1-3%, 3= 4-6%, 4=7-12%, 5= 13-25%, 6=26-50%, 7=51-75%, 8= 76-87%, 9=88-94%, 10= 95-97%, 11=98-99% and 12= 100% early blight. AUDPC calculated according to the formula: $\sum[(x_i+x_{i-1})/2](t_i-t_{i-1})$ where x_i is the rating at each evaluation time and (t_i-t_{i-1}) is the time between evaluations.

^xValues are the means of four replicate plots; treatments followed by the same letter within a column are not significantly different at $P \leq 0.05$.

PEPPER (*Capsicum annuum* 'Paladin')
 Bacterial leaf spot; *Xanthomonas campestris* pv. *vesicatoria*
 Anthracnose; *Colletotrichum acutatum*

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Evaluation of products for the control of bacterial leaf spot and anthracnose of bell peppers, 2005.

The experiment was conducted at the Ohio Agricultural Research and Development Center's North Central Experiment Station in Fremont, OH on Hoytville silty clay loam. Potassium (240 lb/A K₂O), phosphorous (104 lb/A P₂O₅) and nitrogen (20 lb/A Urea) were incorporated into the test field, which was chisel plowed on 5 Oct 04. On 7 May an additional 84 lb/A nitrogen was applied, the field was cultivated, and raised beds on 5 ft centers were prepared. 'Paladin' pepper seeds were Clorox-treated and sown on 19 Apr into 200-cell plug trays containing Metromix 360 seedling mix. On 13 Jun, seedlings were transplanted 1 ft apart into single rows 25 ft long on the beds. The starter fertilizer (N-P-K 10-34-0; 0.7 qt/50 gal water) was applied in the transplant water. Treatments were arranged in a randomized complete block design with four replications. Treatment rows were alternated with untreated border rows. The herbicides Dual II Magnum (1 pt/A) and Command ME (1.5 pt/A) were applied on 26 May; Round-Up Ultra (1qt/A) was applied on 7 Jun. Asana XL (7 oz/A) was applied 6 Jul to control insects. The field was cultivated on 5 and 6 Jul and hand weeded and hoed on 6 Jul. Plants were inoculated with approximately 10⁷ CFU/ml *Xanthomonas campestris* pv. *vesicatoria* strain 110C (race T1P8, copper sensitive), in the evening of 7 Jul using a tractor mounted CO₂-pressurized sprayer (55 psi, 39.3 gal/A, 3 mph). Plants were misted with water using an FMC sprayer with a PTO-driven pump (200 psi, 32.6 gal/A) prior to inoculation. Plants were overhead irrigated with 1.25 and 0.25 in. water on 23 Jun and 8 Jul, respectively. Treatments were applied using a tractor-mounted CO₂-pressurized sprayer (60 psi, 44.31 gal/A, 3 MPH) on a 5-7 day schedule beginning 29 Jun and ending 22 Aug for a total of nine applications. Ridomil Gold EC (1pt/A) and Ridomil Gold SL (1 pt/A) treatments were applied as band application on 10 Jun, 14 Jul, and 12 Aug using a CO₂-pressurized backpack sprayer (40 psi, 0.08 mph, 159.6 gal/A). Manex 37F (1.6 qt/A) + Kocide 2000 DF (2 lb/A) were applied as cover sprays to these treatments for a total of nine applications starting 29 Jun and ending 22 Aug. On 10 Jun Ridomil Gold SL (1 pt/A) was applied to all treatments except the untreated control and the Ridomil Gold EC treatments. Severity of bacterial leaf spot on foliage was evaluated on 25 Jul and 9, 17, and 23 Aug using a modified Horsfall-Barratt rating scale. Immature (green) fruit were harvested from the center 10 plants of each treatment row on 23 Aug and numbers and weights of healthy fruit, fruit with bacterial leaf spot, fruit with anthracnose, and other fruit were determined. Average maximum temperatures for 13-30 Jun, Jul, and 1-23 Aug were 85.9, 86.2, and 88.62 °F; average minimum temperatures were 58.3, 59.9, and 59.1°F; and rainfall was 0.52, 6.72 and 0.60 in., respectively. Data were analyzed by ANOVA using SAS statistical software. Means were separated using Fisher's protected least significant difference test. Disease severity data for 23 Aug were analyzed using Horsfall-Baratt ratings and converted to midpoints (% disease).

Bacterial leaf spot pressure was severe, and all treatments significantly reduced disease progress (AUDPC) compared to the untreated control. However, at harvest (23 Aug) foliar disease severity was significantly lower than the control for only four treatments: Tanos 50DF (8 oz) + Manex 37F (1.6 qt) + Kocide 2000 DF (1 lb) alt. Manex 37F (1.6 qt) + Kocide 2000 DF (1 lb), Tanos 50DF (8 oz) + Manex 37F (1.6 qt) + DPX-GFJ52 WG (1 lb) alt. Manex 37F (1.6 qt) + DPX-GFJ52 WG (1 lb), and DPX-JE874 SE (7.58 fl oz) or DPX-JE874 EC (19 fl oz) + Manex 37F (1.6 qt) + Kocide 2000 DF (2 lb) alt. Manex 37F (1.6 qt) + Kocide 2000 DF (2 lb). Bacterial spot on fruit was also lowest for these treatments, although the 8 and 10 oz rates of Tanos combined with Manex 37F (1.6 qt) + Kocide 2000 DF (2 lb) and alternated with Manex 37F (1.6 qt) + Kocide 2000 DF (2 lb), and Manex 37F (1.6 qt/A) + Kocide 2000 DF (2 lb/A) applied alone or as cover sprays to the Ridomil Gold EC treatment also reduced bacterial spot incidence on fruit compared to the control. Anthracnose appeared naturally in the plots, affecting 35% of untreated fruit. All treatments except Tanos (8 oz) + Manex 37F (1.6 qt) + Kocide 2000 DF (2 lb) alt. Manex 37F (1.6 qt) + Kocide 2000 DF (2 lb) significantly reduced anthracnose on pepper fruit compared to the untreated control. Fruit were small (data not shown) and none reached marketable size; application of treatments containing the DPX-JE874 SE and EC formulations resulted in the highest marketable yield.

Treatment rate/A (application time ²)	Foliar bacterial leaf spot		Fruit		Healthy fruit (ton/A)
	% disease 23 Aug ^y	AUDPC ^x	Bacterial leaf spot (%)	Anthrachnose (%)	
DPX-JE874 SC 3.2 fl oz + Manex 37F 1.6 qt + Kocide 2000 DF 2 lb (1,3,5,7,9) <i>alt.</i> Manex 37F 1.6 qt + Kocide 2000 DF 2 lb (2,4,6,8)	83.9 abc ^w	1866.1 b	63.4 ab	14.7 bc	1.1 bcd
DPX-JE874 SE 7.58 fl oz + Manex 37F 1.6 qt + Kocide 2000 DF 2 lb (1,3,5,7,9) <i>alt.</i> Manex 37F 1.6 qt + Kocide 2000 DF 2 lb (2,4,6,8).....	61.4 c	994.1 e	45.8 de	8.2 bc	2.3 ab
DPX-JE874 EC 19 fl oz + Manex 37F 1.6 qt + Kocide 2000 DF 2 lb (1,3,5,7,9) <i>alt.</i> Manex 37F 1.6 qt + Kocide 2000 DF 2 lb (2,4,6,8)	63.8 c	1257.0 de	37.9 e	7.7 bc	3.0 a
Manex 37F 1.6 qt + Kocide 2000 DF 2 lb (1-10).....	88.6 ab	1807.8 bc	65.2 ab	14.9 bc	1.2 bcd
Ridomil Gold EC 1 pt (1,2,3) ^y	83.9 abc	1606.1 bcd	53.0 b-e	15.3 bc	1.7 a-d
Ridomil Gold SL 1 pt (1,2,3) ^y	74.6 abc	1658.8 bcd	62.7 abc	4.6 c	0.8 cd
Tanos 50DF 8 oz + Manex 37F 1.6 qt + Kocide 2000 1 lb (1,3,5,7,9) <i>alt.</i> Manex 37F 1.6 qt + Kocide 2000 DF 1 lb (2,4,6,8)	61.4 c	1202.7 de	46.8 cde	8.4 bc	1.8 a-d
Tanos 50DF 8 oz + Manex 37F 1.6 qt + Kocide 2000 DF 2 lb (1,3,5,7,9) <i>alt.</i> Manex 37F 1.6 qt + Kocide 2000 DF 2 lb (2,4,6,8)	81.5 abc	1736.6 bc	57.9 bdc	21.6 ab	1.8 abc
Tanos 50DF 8 oz + Manex 37F 1.6 qt + DPX-GFJ52 WG 1 lb (1,3,5,7,9) <i>alt.</i> Manex 37F 1.6 qt + DPX-GFJ52 WG 1 lb (2,4,6,8)	68.4 bc	1533.8 bcd	51.7 b-e	16.8 bc	1.5 bcd
Tanos 50DF 10 oz + Manex 37F 1.6 qt + Kocide 2000 DF 2 lb (1,3,5,7,9) <i>alt.</i> Manex 37F 1.6 qt + Kocide 2000 DF 2 lb (2,4,6,8).....	76.9 abc	1351.9 cde	55.4 bcd	12.6 bc	1.1 bcd
Control	90.9 a	2332.6 a	75.8 a	35.3 a	0.4 d
<i>P</i> value	0.0394	0.0002	0.0060	0.0111	0.0917

²Application times were: 1= 29 Jun-5 Jul; 2= 6-10 Jul; 3= 11-17 Jul; 4= 18-24 Jul; 5= 25-31 Jul; 6= 1-7 Aug; 7= 8-14 Aug; 8= 15-21 Aug; 9= 22-28 Aug.

^yDisease rating and area under the disease progress curve (AUDPC) based on the midpoint values of a modified Horsfall-Barratt rating scale where 1=0%, 2= 1-3%, 3= 4-6%, 4=7-12%, 5= 13-25%, 6=26-50%, 7=51-75%, 8= 76-87%, 9=88-94%, 10= 95-97%, 11=98-99% and 12= 100% bacterial leaf spot.

^xCalculated according to the formula: $\sum[(x_i+x_{i-1})/2](t_i-t_{i-1})$ where x_i is the rating at each evaluation time and (t_i-t_{i-1}) is the time between evaluations.

^wValues are the means of four replicate plots; treatments followed by the same letter within a column are not significantly different at $P \leq 0.10$ (*p* values shown).

^yApplied as band application on: 1= 10 Jun; 2= 14 Jul; 3= 12 Aug; Kocide 2000 DF (2 lb/A) and Manex 37F (1.6 qt/A) were applied nine times as cover sprays.

PEPPER (*Capsicum annuum* 'Red Knight')
Phytophthora blight; *Phytophthora capsici*

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Evaluation of fungicides for control of the foliar phase of *Phytophthora* blight of peppers, 2005.

The experiment was conducted at Wiers Farms, Celeryville, OH. Plots were managed for fertility, irrigation and weed control according to standard practices for this farm. The field was disked and beds prepared and covered with black plastic mulch in spring 03. 'Red Knight' pepper seeds were sown on 15 Apr 05 into 128-cell plug trays containing Scott's Metro seedling mix. Transplants were fertilized on 13 and 27 May, and 14 Jun with 100 ppm, 200 ppm, and 250 ppm Peter's 20-20-20, respectively. In May 04 the remaining residue from the 2004 pepper crop was removed. Pepper seedlings were transplanted into existing beds on 16 and 17 Jun. Treatments were arranged in a randomized complete block design with four replications. Each treatment consisted of four rows (one row per bed), 40 ft long, spaced 1 ft apart. The ProPhyt (4 pt/100 gal) treatment was applied 2 days prior to transplanting. Ridomil Gold EC (1pt/A) and Omega 500F (1.5 pt/A) were applied as drench treatments in a 12-in. band at the base of each plant on 17 Jun. Foliar treatments were applied on 5, 12, 19-20, 29 Jul, 8, 16, and 24 Aug, and 2 Sep using a tractor-mounted 3.0 hitch (hydraulic attach) PTO driven sprayer (110 psi, 74.25 gal/A, 1.9 MPH) with the exception of the 20 Jul treatments, which were applied using a tractor mounted 3.0 hitch (hydraulic attach) motor driven sprayer (50 psi, 43.5 gal/A, 3 MPH). Beginning with the third application, the sprayer was fitted with three nozzles with the center nozzle positioned over the center of the row, and two angular drop down, mini side booms connected to the main boom on each side of the plant to insure spray penetration to the lower portion as well as the base of the plants. On 26 Jul and 9 and 26 Aug, the total number of plants and plants with *Phytophthora* blight symptoms were determined. Average maximum temperatures for 16-30 Jun, Jul, Aug, and 1-14 Sep were 85.2, 87.0, 84.7, and 83.3 °F; minimum temperatures were 55.9, 60.6, 57.4, and 53.7 °F; and rainfall was 1.4, 4.3, 2.8, and 0.0 in., respectively.

Phytophthora blight pressure was very high, but the disease was non-uniformly distributed in the test field. There were no significant differences among treatments or between treatments and the untreated control in the proportion of plants diseased or killed by *Phytophthora* blight, or in disease progress. However, treatment with Maestro 80DF resulted in numerically less disease, and Maestro-treated plots were relatively consistent in the proportion of diseased or dead plants regardless of location in the field. No fruit were marketable due to small size and there were no significant differences in yield of healthy fruit between treatments or the untreated control.

Treatment rate/A (application time ²)	% disease (26 Aug)	AUDPC ^y	Healthy yield (ton/A)	Fruit with <i>Phytophthora</i> (ton/A)
Maestro 80DF 6 lb 91 (1-8)	27.8 a ^x	246.6 a	2.08 a	0.31 a
NOA 446510 250 SC 8 fl oz (1-8).....	35.2 a	403.5 a	1.97 a	0.18 a
Omega 500F 1.5 pt (drenched at transplanting), Omega 500F 1 pt (1,3)				
alt. Ranman 400SC 2.75 fl oz + Silwet L-77 2 fl oz (4,6,8).....	47.7 a	487.5 a	1.62 a	0.12 a
ProPhyt 4 pt/100 gal (2-3 day before planting) alt. Forum 4.16 SC 6.2 fl oz + Kocide 2000 DF 1.5 lb (1-8)	82.6 a	954.5 a	0.21 a	0.04 a
Ranman 400SC 2.75 fl oz + Silwet L-77 2 fl oz + Kocide 2000 DF 1.5 lb (1-8)	61.1 a	652.8 a	1.17 a	0.15 a
Reason 500 SC 5.5 fl oz + Previcur Flex 1.2 pt + Kocide 2000 DF 1.5 lb (1-8).....	58.8 a	607.4 a	1.43 a	0.12 a
Ridomil Gold EC 1 pt (drenched at transplanting), Forum 4.16 SC 6.2 fl oz + Kocide 2000 DF 1.5 lb (1-8).....	51.4 a	509.1 a	1.64 a	0.18 a
Tanos 50DF 10 oz + Kocide 2000 2 lb + Manex 37F 1.6 qt (1,3,5,7)				
alt. Forum 6.4 fl oz + Kocide 2000 DF 2 lb + Manex 37F 1.6 qt (2,4,6,8).....	62.7 a	678.9 a	1.20 a	0.14 a
TM-47301 F 3 fl oz (1-8)	73.2 a	810.6 a	1.07 a	0.13 a
V-10161 4 lb ai/gal F 40 g ai (1-8).....	47.4 a	548.3 a	1.63 a	0.18 a
Untreated	82.6 a	862.8 a	0.82 a	0.06 a
<i>P</i> value	0.2411	0.3334	0.7093	0.1640

²Application times were: 1= 5-11 Jul; 2= 12-18 Jul; 3= 19-28 Jul; 4= 29 Jul-7 Aug; 5= 8-15 Aug; 6= 16-23 Aug; 7= 24 Aug-1 Sep; 8= 2-9 Sep

^yCalculated according to the formula: $\sum[(x_i+x_{i-1})/2](t_i-t_{i-1})$ where x_i is the rating at each evaluation time and (t_i-t_{i-1}) is the time between evaluations.

^xValues are the means of four replicate plots; treatments followed by the same letter within a column are not significantly different at $P \leq 0.05$.

Potato (*Solanum tuberosum* 'Snowden')
Early blight; *Alternaria solani*

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Evaluation of fungicides for control of foliar early blight of potatoes, 2005.

The experiment was conducted at the Ohio Agricultural Research and Development Center's Snyder Farm in Wooster, OH on Wooster silt loam. Prior to planting on 9 May, 600 lb/A 19-19-19 (N-P-K) was broadcast, top dressed and incorporated into the test field. Certified machine-cut 'Snowden' seed pieces were planted using a potato planter on 10 May. Admire 2 F (16 oz/A) and an additional 600 lb/A 19-19-19 were applied at planting. Treatments were arranged in randomized complete block design with four replications. Each plot consisted of two rows, 25 ft long, spaced 10 in. apart with 3 ft between rows. Treatment rows were alternated with untreated border rows. The herbicides Dual II Magnum (1 pt/A) and Sencor 75 DF (0.66 lb/A) were applied on 7 Jun. Thiodan EC was applied at 1 qt/A on 21 Jul to control insect pests. The field was cultivated on 14 Jun and 12 Jul and hand weeded and hoed on 11 Jul and 22 and 23 Aug. Treatments were applied using a tractor-mounted CO₂-pressurized sprayer (40 psi, 79.2 gal/A, 3 MPH) on a 7-10 day schedule beginning 27 Jun and ending 5 Sep for a total of nine applications. Severity of early blight was evaluated on 28 Jul, 10, 16, and 23 Aug and 9 Sep using a modified Horsfall-Barratt rating scale. Vines were killed with an application of Gramoxone Max 2 qt/A on 27 Sep. Tubers were mechanically harvested from all plants in each plot on 4 Oct and weights were recorded. Marketable (USA #1) and B-culls were separated by using a potato grader, and culls were separated manually. Weights of marketable USA #1 (>2.25 in. diam), B-culls (<2.25 in.), and culls (misshapen or with green or decayed areas >1.0 in.) were determined from a 50 lb sub-sample from each plot. Average maximum temperatures for 10-31 May, Jun, Jul, Aug, Sep, and 1-4 Oct were 70.5, 84.7, 86.1, 84.1, 79.8, and 83.0 °F; average minimum temperatures were 45.9, 60.5, 63.2, 62.3, 53.4, and 49.6 °F; and rainfall was 2.26, 1.39, 4.03, 4.82, 2.73, and 0.01 in., respectively. Foliar Horsfall-Barratt ratings were converted to midpoints prior to statistical analysis. Data were analyzed by ANOVA using SAS statistical software. Means were separated using Fisher's protected least significant difference test.

Early blight pressure was moderate until late in the season. All treatments except the 1.1 lb/A rate of IR5885 CTL WP resulted in significantly less early blight than in the untreated control. Penncozeb 75DF and the three rates of IR5885 MZ WG were most effective in reducing early blight intensity. There were no significant differences between treatments or between treatments and the untreated control in marketable yield or proportion of US No. 1 potatoes and B-culls.

Treatment and rate/A (application time ^z)	% early ^y blight 23 Aug	AUDPC ^x	Marketable yield (ton/A)	% US No. 1	% B-culls
Bravo Weather Stik 6 SC 0.75 pt (1,3,5,6,7,8,9) <i>alt.</i> Amistar 80WG 2 oz (2,4).....	39.5 bc ^w	804.3 bcd	12.9 a	89.8 a	6.3 a
Bravo Weather Stik 6 SC 0.75 pt (1,3,5,6,7,8,9) <i>alt.</i> Quadris 2.08SC 1.6 pt (2,4).....	34.8 c	907.6 bc	12.6 a	90.8 a	5.9 a
Bravo Weather Stik 6 SC 0.75 pt (1-3) and 1.25 pt (4-9).....	45.8 bc	708.5 bcd	13.1 a	89.8 a	5.8 a
IR5885 CTL WP 1.10 lb (1-9).....	61.4 ab	1083.5 ab	12.8 a	91.6 a	6.3 a
IR5885 CTL WP 1.35 lb (1-9).....	44.3 bc	766.8 bcd	13.7 a	91.3 a	5.4 a
IR5885 CTL WP 1.60 lb (1-9).....	44.3 bc	685.8 bcd	12.7 a	91.5 a	6.2 a
IR5885 MZ WG 2.25 lb (1-9).....	28.5 c	433.3 d	14.2 a	93.3 a	3.9 a
IR5885 MZ WG 2.7 lb (1-9).....	30.0 c	593.6 cd	13.5 a	91.2 a	5.8 a
IR5885 MZ WG WP 1.8 lb (1-9).....	23.8 c	507.7 cd	13.9 a	92.3 a	4.2 a
Penncozeb 75DF 0.8 lb (1-3) and 1.85 lb (4-9).....	28.5 c	566.9 cd	13.4 a	91.2 a	5.3 a
Control.....	82.9 a	1469.9 a	11.5 a	88.7 a	7.6 a
<i>P</i> value	0.0006	0.0025	0.6841	0.6841	0.234

^zNumbers in parentheses indicate the applications in sequence of the preceding product. Application times were: 1= 27 Jun-5 Jul; 2= 6-12 Jul; 3= 13-19 Jul; 4= 20-28 Jul; 5= 29 Jul-7 Aug; 6= 8-16 Aug; 7= 17-24 Aug; 8= 25 Aug-4 Sep; 9= 5-13 Sep.

^yDisease rating and area under the disease progress curve (AUDPC) based on the midpoint values of a modified Horsfall-Barratt rating scale where 1=0%, 2= 1-3%, 3= 4-6%, 4=7-12%, 5= 13-25%, 6=26-50%, 7=51-75%, 8= 76-87%, 9=88-94%, 10= 95-97%, 11=98-99% and 12= 100% bacterial leaf spot.

^xCalculated according to the formula: $\sum [(x_i + x_{i-1})/2](t_i - t_{i-1})$ where x_i is the rating at each evaluation time and $(t_i - t_{i-1})$ is the time between evaluations.

^wValues are the means of four replicate plots; treatments followed by the same letter within a column are not significantly different at $P \leq 0.05$.

Cucumber (*Cucumis sativus*)
Angular leaf spot; *Pseudomonas syringae* pv. *lachrymans*

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Evaluation of resistance of cucumber cultivars to angular leaf spot, 2005.

Twelve cucumber cultivars were evaluated for resistance to angular leaf spot on foliage and fruit in a field trial on Wooster silt loam at the Ohio Agricultural Research and Development Center's Snyder Farm in Wooster, Ohio. Cucumber seeds were Clorox treated and sown on 18 May into 50-cell plug trays containing Fafard seedling mix and maintained in a greenhouse at approximately 80 °F day and 75 °F night. On 7 Jun 400 lb/A N-P-K (19-19-19) was broadcast, top dressed, and incorporated into the test field. The herbicide Command 3 ME (0.5 pt/A) was applied for weed control. On 8 Jun, seedlings were transplanted by hand 1 ft apart into single rows 25 ft long on 5 ft centers. Starter fertilizer (N-P-K 9-45-15; 1.65 lb/55 gal water) was applied in the transplant water. Cultivars were arranged in a randomized complete block design with four replications. Thiodan EC was applied at 1 qt/A on 21 Jul, and Asana XL 0.66 EC was applied at 6 oz/A on 21 and 29 Jul to control insects. The field was hand weeded and hoed on 28 Jul and 1 and 2 Aug. Plants were inoculated with approximately 10⁸ CFU/ml *Pseudomonas syringae* pv. *lachrymans* strain JSF1-04 in the evening of 23 Jun using a CO₂-pressurized backpack sprayer (40 psi, 78.9 gal/A). Plants were overhead irrigated with 1.0, 0.5, 0.5 and 0.5 in. water on 10, 23, and 24 Jun and 2 Aug, respectively. Amistar 80 WG (4.25 oz/A) and Quadris 2.08SC (4 oz/A) were applied on 7 and 30 Jul, respectively, alternated with Bravo Ultrex (1.8 lb/A) applied on 13 and 21 Jul and 9 Aug as cover sprays to all plots. Severity of foliar angular leaf spot was evaluated on 12 and 28 Jul and 16 Aug using a modified Horsfall-Barratt rating scale. Fruits were harvested from plants in the center 15 ft of each row on 12, 19, and 28 Jul and 8 Aug. Weights and numbers of healthy fruits, culls, and fruits with sunscald or angular leaf spot lesions were determined. Numbers of angular leaf spot lesions on fruit were counted separately to estimate disease severity. Fruit incidence data were sqrt transformed prior to analysis; non-transformed means are reported. Data were analyzed by ANOVA using SAS statistical software and means were separated using Fisher's protected least significant difference test. Average maximum temperatures for 8-30 Jun, Jul, and 1-16 Aug were 85.1, 84.7, and 87.0 °F; average minimum temperatures were 61.2, 60.5, and 63.9 °F; and rainfall was 1.21, 1.39, and 1.99 in., respectively.

Angular leaf spot disease pressure was moderate, reaching 50-60% foliar infection in the more susceptible cultivars by the end of the growing season. Disease progress differed significantly among cultivars, with 'Classy', 'Slice More', 'Talladega' and '2409' the least susceptible. 'Intimidator' and 'Speedway' were the most susceptible to foliar infection. Disease incidence on fruit ranged from 0.2-7.5% and severity from 2.80-3.01, but there was no correlation between fruit incidence and severity and foliar disease severity. 'Slice More' had the highest marketable yield, while 'Thunder', 'Sassy' and 'Intimidator' had the lowest. Although 'Speedway' was among the most susceptible to angular leaf spot, it had a relatively high marketable yield and ranked among the highest in percentage marketable fruit. Fruit size varied among cultivars, with 'Speedway' having the largest fruit and 'Sassy' the smallest.

Cultivar	Seed Source	Angular leaf spot ^z			Marketable yield (ton/A)	Marketable (%)	Marketable fruit size (lb/fruit)
		Foliar AUDPC	Fruit incidence (%)	Fruit severity ^x			
Classy.....	Harris Moran Seed Co.	408.4 d ^y	0.2 d	2.96 ab	16.3 bcd	84.3 a	0.80 d
Slice More	Siegers Seed Co.	563.4 cd	1.0 bcd	2.83 de	23.8 a	82.5 a	0.93 abc
Talladega	Seminis Vegetable seeds	571.6 dc	6.7 a	2.86 cde	18.0 bc	77.5 abc	0.89 bc
2409	Seminis Vegetable seeds	600.9 bcd	2.9 a	2.85 cde	19.2 b	80.0 ab	0.93 abc
Thunder.....	Seminis Vegetable seeds	733.7 a-d	7.2 a	2.90 bcd	13.1 d	65.5 d	0.91 abc
Thunderbird...	Seminis Vegetable seeds	799.8 a-d	3.7 ab	2.85 de	17.6 bc	82.2 a	0.93 abc
Stonewall	Harris Moran Seed Co.	902.0 abc	4.7 a	2.88 b-e	14.5 cd	72.4 bcd	0.89 bc
Sassy	Harris Moran Seed Co.	907.0 abc	0.7 cd	3.01 a	13.2 d	78.5 abc	0.78 d
Green Slam....	Siegers Seed Co.	926.9 abc	0.3 cd	2.88 b-e	18.6 b	83.5 a	0.89 bc
Indy	Seminis Vegetable seeds	985.4 ab	4.6 a	2.85 de	17.9 bc	70.0 cd	0.96 ab
Intimidator	Seminis Vegetable seeds	1074.1 a	7.5 a	2.90 abc	13.4 d	71.2 cd	0.85 cd
Speedway.....	Seminis Vegetable seeds	1129.3 a	4.5 a	2.80 e	18.6 b	83.5 a	0.99 a
<i>P</i> value		0.0151	0.0002	0.0012	0.0001	0.0006	0.0007

^zArea Under the Disease Progress Curve (AUDPC) based on the midpoint values of a modified Horsfall-Barratt rating scale where 1=0%, 2= 1-3%, 3= 4-6%, 4=7-12%, 5= 13-25%, 6=26-50%, 7=51-75%, 8= 76-87%, 9=88-94%, 10= 95-97%, 11=98-99% and 12= 100% angular leaf spot. AUDPC calculated according to the formula: $\sum [(x_i + x_{i-1})/2](t_i - t_{i-1})$ where x_i is the rating at each evaluation time and $(t_i - t_{i-1})$ is the time between evaluations.

^yValues are the means of four replicate plots; treatments followed by the same letter within a column are not significantly different at $P \leq 0.05$.

^xAngular leaf spot severity was calculated using the number of cucumbers in each of five categories that were based on the number of lesions (0, 1, 2, 3, or 4)/fruit. Severity = $[\sum(\text{category value} * \text{number of plants in category})]/n$, where n = number of total cucumbers harvested.

SQUASH (*Cucurbita maxima* 'Taybelle')
Powdery mildew; *Sphaerotheca fuliginea*

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Evaluation of fungicides for the control of powdery mildew on winter squash, 2005.

The experiment was conducted at the Ohio Agricultural Research and Development Center's Muck Crops Agricultural Research Station in Celeryville, OH. Fertilizer (17-17-17, 500 lbs/A) was incorporated into the test field on 13 Apr. Plots were disked, leveled and rolled on 14 Jun. 'Taybelle' squash seeds were sown on 27 May into 72-cell plug trays containing Scott's Metro seedling mix. Squash seedlings were transplanted on 14 Jun. Treatments were arranged in a randomized complete block design with four replications. Each row consisted of 15 plants spaced 2 ft apart on 6 ft centers. Treatments were applied using a tractor mounted 3.0 hitch (hydraulic attach) motor driven sprayer (50 psi, 43.5 gal/A, 3 MPH) on a 7-10 day schedule beginning 6 Jul and ending 2 Sep for a total of eight applications. The insecticide Sevin XLR Plus (1 qt/A) was applied on 2 Aug. Plants were overhead irrigated with 1.4 in. and 0.7 in. water on 17 and 20 Jun, respectively. Severity of powdery mildew was evaluated on upper and lower leaves on 9 and 23 Aug and 8 Sep using a modified Horsfall-Barratt rating scale. Fruit were harvested from the entire row of each treatment on 9 Sep and the number and weight of healthy fruit, damaged culls and healthy culls were determined. Average maximum temperatures for 14-30 Jun, Jul, Aug, and 1-9 Sep were 85.7, 87.0, 84.7, and 81.4 °F; minimum temperatures were 56.9, 60.6, 57.4, and 53.0 °F; and rainfall was 1.4, 4.3, 2.8 and 0.0 in., respectively. Data were analyzed by ANOVA using SAS statistical software. Means were separated using Fisher's protected least significant difference test.

Powdery mildew pressure was severe. All treatments except the 3.0 and 6.0 oz/A rates of Rubigan significantly reduced powdery mildew on the upper and lower surfaces of squash leaves compared to the untreated control. The 0.02 and 0.03 lb/A rates of V10118 and the combination of Microthiol Disperss 80 DF + Quintec 2.08SC, Nova 40W, and/or Gavel 75W + Dithane 75W were highly effective in reducing powdery mildew severity, whereas Cabrio alternated with Bravo Weatherstick and Nova were moderately effective. Microthiol Disperss 80 DF was relatively ineffective against powdery mildew when applied alone. There were no statistically significant differences in marketable yield between treatments and the untreated control.

Treatment and rate/A (application time ^z)	% powdery mildew 8 Sep ^y		AUDPC ^y		Marketable yield (ton/A)
	Upper	Lower	Upper	Lower	
Cabrio 14 oz (1,3,5,7)					
alt. Bravo Weather Stik 2.5 pt + Nova 4 oz (2,4,6,8)....	43.4 d ^x	87.1 c	459.6 a	859.6 a	8.5 a
Microthiol Disperss 80 DF 4 lb (1-8).....	80.5 c	95.4 bc	925.2 c	1492.7 cd	7.3 a
Microthiol Disperss 80 DF 4 lb (1-8) + Quintec 2.08SC 4 fl oz (2,4,6), Nova 40W 4 oz (3,5,7), Gavel 75W 2 lb + Dithane 75W 1.225 lb (3-8).....	10.8 e	7.3 e	129.4 f	77.1 ef	6.8 a
Rubigan EC 3.0 oz (1-8).....	96.6 ab	99.3 ab	1984.1 e	1647.4 de	4.8 a
Rubigan EC 6.0 oz (1-8).....	96.6 ab	98.5 ab	1434.4 d	1133.6 abc	6.3 a
Rubigan EC 9.0 oz (1-8).....	90.5 bc	94.8 bc	1181.1 f	1090.2 g	7.8 a
V 10118 0.02 lb ai (1-8).....	13.6 e	38.3 d	165.4 b	498.4 ab	7.0 a
V 10118 0.03 lb ai (1-8).....	9.6 e	19.0 de	148.9 c	277.0 bc	8.7 a
Untreated Control.....	99.3 a	99.6 a	2432.3 ef	1678.3 f	5.0 a
<i>P</i> value	0.0001	0.0001	0.0001	0.0001	0.1401

^zApplication times were: 1= 6-12 Jul; 2= 13-19 Jul; 3= 20-28 Jul; 4= 29 Jul-7 Aug; 5= 8-14 Aug; 6= 15-22 Aug; 7= 23 Aug-1 Sep; 8= 2-9 Sep.

^yDisease rating and area under the disease progress curve (AUDPC) based on the midpoint values of a modified Horsfall-Barratt rating scale where 1=0%, 2= 1-3%, 3= 4-6%, 4=7-12%, 5= 13-25%, 6=26-50%, 7=51-75%, 8= 76-87%, 9=88-94%, 10= 95-97%, 11=98-99% and 12= 100% powdery mildew. AUDPC calculated according to the formula: $\sum[(x_i+x_{i-1})/2](t_i-t_{i-1})$ where x_i is the rating at each evaluation time and (t_i-t_{i-1}) is the time between evaluations.

^xValues are the means of four replicate plots; treatments followed by the same letter within a column are not significantly different at $P \leq 0.05$.

SQUASH (*Cucurbita maxima* 'Taybelle')
 Powdery mildew; *Sphaerotheca fuliginea*
 Bacterial wilt; *Erwinia tracheiphila*
 Phytophthora blight; *Phytophthora capsici*

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Evaluation of biorational products for the control of diseases of organic winter squash, 2005.

The experiment was conducted at the Ohio Agricultural Research and Development Center Badger Farm near Wooster, OH in a transitional organic field on Wooster silt loam soil, pH 6.1. Composted poultry manure (4-0-0, 6.3 T/A, 75% moisture; Daylay Egg Farm Inc., West Mansfield, OH) was incorporated into the test field on 15 Jun. Squash seeds (cv. 'Taybelle') were sown on 23 May into 50-cell plug trays containing organic Plant Pro potting mix (Ohio Earth Food, Inc., Hartville, OH). The field was cultivated, beds prepared, and the irrigation system and black plastic laid on 17 Jun. Black nursery shade cloth was laid between beds for weed control. Squash seedlings were hand-transplanted on 20 Jun. Treatments were arranged in a randomized complete block design with four replications per treatment. Each plot consisted of 15 plants spaced 2 ft apart on 7 ft centers. Treatment rows were alternated with untreated border rows. All rows except the borders and non-protected control were covered with a floating row cover (Johnny's Selected Seed, Winslow, ME) on 20 Jun. Plants under the row covers were damaged by high temperatures and all treatment rows were replanted by direct seeding 'Taybelle' on 28 Jun. Floating row covers were replaced immediately after seeding, then removed on 8 Aug when plants began to bloom. Plants were drip irrigated on 21, 23 and 28 Jun, 2 Jul, and 19 Aug. Diatect V at 3.5-5.0 lb/A was applied to border rows on 28 Jul, and to treatment plots on 9, 16, 23 and 30 Aug using a CO₂ backpack sprayer (143 gal/A, 40 psi, Tee Jet nozzle type), when the average number of cucumber beetles reached 4-5 per plant. Treatments were applied on 11, 18 and 25 Aug and 1 Sep, using a CO₂ backpack sprayer (143 gal/A, 40 psi, Tee Jet nozzle). The surfactant BioLink (1.5 qts/100 gal) was added to Armicarb 100 treatments. Intensity of powdery mildew on the upper and lower leaf surfaces was determined on 13, 20 and 27 Aug, and 4 Sep using a modified Horsfall-Barrat rating scale. Disease ratings were converted to midpoints (% powdery mildew) and the AUDPC was calculated. Incidence of bacterial wilt was determined on 26 Jul and 6, 13 and 20 Aug. Incidence of Phytophthora blight was determined on 20 and 27 Aug, and 4 Sep. Fruits were harvested from the entire row of each plot on 12 Sep and sorted into four categories: healthy, diseased culls, healthy culls and fruit affected by Phytophthora. The number and weight of fruits in each category were determined. Data were analyzed by ANOVA using SAS statistical software. Means were separated using Fisher's protected least significant difference test. Average maximum temperatures for 20-30 Jun, 1-31 Jul and Aug, and 1-12 Sep were 93, 91, 88 and 84 °F; minimum temperatures were 70, 72, 68 and 62 °F; and total rainfall was 1.4, 5.7, 3.8 and 3.3 in., respectively.

Powdery mildew pressure was moderate to high. The control plots covered with floating row covers and sprayed with Diatect V after cover removal (protected) had significantly less powdery mildew than the non-protected controls. All treatments significantly reduced powdery mildew intensity on the upper and lower surfaces of squash leaves compared to the untreated controls. The Serenade Max plus Kocide 2000, sulfur and milk treatments were most effective in reducing powdery mildew intensity. All of the protected plots had significantly fewer wilted plants than the non-protected control. Phytophthora blight occurred naturally and was non-uniformly distributed. There were no significant differences among treatments and the controls in the proportion of plants killed by Phytophthora blight, or in the number of fruit affected by Phytophthora fruit rot (data not shown). There were no differences in marketable yield or percentage of marketable fruit.

Treatment and rate of product	Powdery mildew*			
	% foliar upper	AUDPC	% foliar lower	AUDPC
Armcarb- 100 5.0 lb/A+ Biolink 1.5 qts/100 gal	11.6 f**	192.1 fg	19.7 ef	330.7 de
Armcarb-100 2.5 lb/A + Biolink 1.5 qts/100 gal	14.7 ef	255.9 ef	21.7 de	375.4 de
Whole milk 50%	5.9 g	114.2 gh	18.7 efg	329.0 de
Mineral oil (Stylect-oil) 3.5 qts/100 gals	11.8 ef	224.4 ef	18.6 efg	336.0 de
Neem oil 0.75 %	23.1 d	419.6 d	32.9 c	609.9 c
Serenade Max 1 lb/A + Kocide 2 lb/A	2.9 g	61.3 h	10.3 gh	199.9 ef
Serenade Max 2 lb/A + Kocide 2 lb/A	2.2 g	41.1 h	5.6 h	119.0 f
Soil soup compost tea 33%	31.8 c	619.5 c	31.8 c	627.8 c
Soil soup compost tea 100%	17.0 e	304.5 e	28.8 cd	507.1 cd
Sulfur 16 lb/A	5.0 g	101.1 gh	11.3 fgh	210.0 ef
Untreated control, protected	52.9 b	1008.9 b	45.7 b	861.9 b
Untreated control, non-protected	80.7 a	1705.4 a	77.2 a	1638.9 a
<i>P</i> value	0.0001	0.0001	0.0001	0.0001

*Disease rating based on the midpoint values of Horsfall-Barratt rating scale where 1=0%; 2=1-3%; 3=4-6%; 4=7-12%; 5=13-25%; 6=26-50%; 7=51-75%; 8= 76-87%; 9=88-94%; 10=95-97%; 11=98-99% and 12= 100% powdery mildew coverage of leaves. AUDPC calculated according to the formula: $\sum [(x_i + x_{i-1})/2](t_i - t_{i-1})$ where x_i is the rating at each evaluation and $(t_i - t_{i-1})$ is the time between evaluations.

**Values are the means of four replicate plots; means followed by the same letter within a column are not significantly different at $P \leq 0.05$.

Treatment and rate of product	Bacterial wilt	Phytophthora blight	Marketable yield (ton/A)	% marketable fruit
	% wilted	% dead plants		
Armcarb- 100 5.0 lb/A+ Biolink 1.5 qts/100 gal	0.0 b**	8.3 a	2.0 a	35.7 a
Armcarb-100 2.5 lb/A + Biolink 1.5 qts/100 gal	3.3 b	31.7 a	2.2 a	34.3 a
Whole milk 50%	0.0 b	21.7 a	3.3 a	46.3 a
Mineral oil (Stylect-oil) 3.5 qts/100 gals	1.7 b	28.3 a	2.7 a	42.7 a
Neem oil 0.75 %	0.0 b	10.0 a	3.2 a	40.0 a
Serenade Max 1 lb/A + Kocide 2 lb/A	0.0 b	8.3 a	2.1 a	34.5 a
Serenade Max 2 lb/A + Kocide 2 lb/A	0.0 b	0.0 a	3.7 a	51.3 a
Soil soup compost tea 33%	0.0 b	23.3 a	2.6 a	47.2 a
Soil soup compost tea 100%	0.0 b	28.3 a	2.6 a	40.3 a
Sulfur 16 lb/A	0.0 b	10.0 a	2.9 a	46.8 a
Untreated control, protected	0.0 b	6.7 a	3.0 a	41.4 a
Untreated control, non-protected	13.3 a	15.0 a	4.4 a	48.3 a
<i>P</i> value	0.0029	0.8946	0.6687	0.8010

**Values are the means of four replicate plots; means followed by the same letter within a column are not significantly different at $P \leq 0.05$.

RADISH (*Raphanus sativus* 'Cabernet')
Rhizoctonia root and hypocotyl rot; *Rhizoctonia solani*

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Evaluation of biopesticides and fungicides for the management of clubroot and Rhizoctonia root and hypocotyl rot of radish, 2005.

The experiment was conducted at Buurma Farms, Celeryville, OH. Fertilizer (N-P-K-S 8.4-0-36-9.6, 250 lb/A) was broadcast and incorporated into the field on 23 Apr. The field was disked, leveled, and raise beds were prepared on 23 May. Radish cv. 'Cabernet' was direct seeded on 1 Jun. The herbicide Dual II Magnum was applied at 1.5 pt/A on 24 May. Treatments were arranged in a randomized complete block design with four replications. Each plot consisted of three, 20 ft rows seeded at a rate of 10 seeds/ft. The field was overhead irrigated with 1.25 in. water on 16 Jun. Muscodor was applied at the rate of 7.4 and 3.5 oz/ft³ soil 7 and 5 days before planting by using a broadcast spreader and a Land Pride RTA 2064 rototiller to incorporate the product to a 4 in. depth in the plots. Irrigation was applied as necessary to maintain moisture in the Muscodor-treated plots prior to planting. Treatments applied as in-furrow and foliar sprays were applied in 24.75 gal water/A at 15 psi by using a Stan-Hay vacuum seeder/sprayer containing three Tee Jet 8002VS nozzles spaced 18 in. apart with a spray band of 7 in. on 1 and 20 Jun, respectively. Radishes were harvested from a 10 ft section of the center row for each treatment on 29 Jun and numbers of marketable radishes, radishes with Rhizoctonia root rot symptoms, radishes with clubroot, healthy culls and damaged culls were recorded. Average maximum temperatures for 24-31 May and 1-29 Jun were 71.9 and 86.5 °F; minimum averages were 45.13 and 58.1 °F and rainfall was 0.33 and 1.52 in., respectively. Data were analyzed by ANOVA using SAS statistical software. Means were separated using Fisher's protected least significant difference test

All treatments resulted in significantly higher total yield than the untreated control, from which no seedlings emerged. Plots treated with the low rate of Muscodor either 5 or 7 days prior to planting had the highest total yield, both significantly higher than the standard treatment (Thiram seed treatment). Ranman 400SC applied in furrow also resulted in higher total yield than the standard treatment. None of the other treatments significantly increased total yield compared to the standard. Marketable yield was generally low due to a high number of off-size culls, but was highest for plots treated with the low rate of Muscodor, the low rate of Serenade ASO, Ranman 400S and the standard Thiram. Rhizoctonia root and hypocotyl rot incidence was highest in plots treated with Muscodor 7 days prior to planting. No treatments resulted in significantly less Rhizoctonia root and hypocotyl rot than the standard Thiram seed treatment.

Treatment, rate and application time	Total yield (no./plot)	Marketable yield (no./plot)	Total healthy (no./plot)	Total culls (no./plot)	% Rhizoctonia
Maxim 0.16 fl oz/100 lb of seed + Amistar 80WG 0.068 fl oz/1000 ft row in-furrow at planting followed by Amistar 80WG 0.068 fl oz/1000 ft row (foliar).....	21.8 de*	2.8 cd**	10.8 d	16.3 fg	1.1 cd
Maxim 4FS 0.16 fl oz/100 lb of seed + Amistar 80WG 0.135 fl oz/1000 ft row in-furrow at planting	20.5 e	3.5 bcd	12.0 cd	16.8 efg	1.8 d
Maxim 4FS 0.16 fl oz/100 lb seed + Amistar 80WG 0.135 fl oz/1000 ft row (foliar)	31.3 cde	1.3 d	22.0 bcd	29.0 a-f	2.8 d
Maxim 4FS seed treatment 0.16 fl oz/100 lb seed	40.0 bcd	4.5 bcd	22.0 bcd	34.0 abc	3.8 d
Moncut 70-DF 0.61 oz /1000 foot row in-furrow at planting	30.3 cde	1.8 cd	13.5 cd	25.8 b-g	9.0 cd
Muscodor 3.5 oz/ft ³ soil 5 days before planting....	58.5 ab	9.5 ab	35.3 ab	41.3 a	12.3 cd
Muscodor 3.5 oz/ft ³ soil 7 days before planting....	72.3 a	15.0 a	37.3 a	37.3 ab	29.5 b
Muscodor 7.4 oz/ft ³ soil 5 days before planting....	27.3 cde	0.8 d	18.0 cd	22.0 c-g	15.5 c
Muscodor 7.4 oz/ft ³ soil 7 days before planting....	39.8 bcd	2.5 cd	12.5 cd	17.3 efg	42.5 a
Ranman 400SC 6 fl oz/A in furrow at planting	41.8 bc	7.8 a-d	19.8 cd	29.8 a-e	11.0 cd
Serenade ASO 0.05% in-furrow at planting.....	32.8 cde	10.5 abc	24.8 abc	21.8 c-g	1.5 d
Serenade ASO 1.0 % in-furrow at planting.....	36.8 cde	3.0 bcd	23.3 bcd	31.8 a-d	4.8 cd
Serenade ASO 2.0 % in-furrow at planting.....	21.5 de	2.0 cd	13.5 cd	18.8 d-g	4.5 d
Thiram 50WP 8 fl oz/100 lb seed	22.0 de	5.0 a-d	12.8 cd	15.5 g	6.0 cd
Untreated control (raw seed)	0.0 f	0.0 e	0.0 e	0.0 h	0.0 e
<i>P</i> value	0.0001	0.0365	0.0034	0.0019	0.0001

*Values are the means of four replicate plots; means followed by the same letter within a column are not significantly different at $P \leq 0.05$.

**Marketable yield data were log transformed prior to analysis; non-transformed means are reported.

RADISH (*Raphanus sativus* 'Cabernet')
 Clubroot; *Plasmodiophora brassicae*
 Rhizoctonia root and hypocotyl rot; *Rhizoctonia solani*

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Evaluation of the biofumigant Muscodor for the management of clubroot and Rhizoctonia root and hypocotyl rot of radish, 2005.

The experiment was conducted at the Ohio Agricultural Research and Development Center Muck Crops Agricultural Research Station in Celeryville, OH. Fertilizer (17-17-17, 500 lb/A) was incorporated into the field on 13 Apr, and the field was disked and leveled on 15 Aug. Beds were prepared on 16 Aug, and radish cv. "Cabernet" was direct seeded on 24 Aug. Treatments were arranged in a randomized complete block design with four replications. Each plot consisted of three, 20 ft rows seeded at a rate of 10 seeds/ft using a Stan-Hay vacuum seeder. The field was overhead irrigated with 0.23, 0.17, 0.23, and 0.47 in. water on 17, 19, and 25 Aug and 9 Sep, respectively. Muscodor was applied at the rates of 7.5 and 3.5 g/l soil 7 and 5 days before planting using a broadcast spreader and a Land Pride RTA 2064 rototiller to incorporate the product 4 in. into plots. The rye seed carrier control was applied 7 days before planting at the rate of 7.5 g/l soil using the same mode of application used for Muscodor. Radishes were harvested from a 10 ft section of the center row of each plot on 19 Sep and numbers of marketable radishes, radishes with Rhizoctonia root and hypocotyl rot symptoms, radishes with clubroot, healthy culls and damaged culls were recorded. Average maximum temperatures for 24-31 Aug and 1-19 Sep were 80.9 and 82.3 °F; minimum averages were 54.4 and 55.7 °F and rainfall was 2.60 and 0.89 in., respectively. Data were analyzed by ANOVA using SAS statistical software. Marketable yield data were sqrt transformed prior to analysis but actual means are reported. Means were separated using Fisher's protected least significant difference test.

Rhizoctonia root and hypocotyl rot pressure was low, while clubroot pressure was very high. There were no significant differences between treatments and the controls in total yield or clubroot incidence or severity. Marketable yield was highest for Thiram-treated seed, but not significantly higher than in the untreated control. Marketable yield was lowest for plots in which the rye seed carrier (Muscodor is formulated on rye seeds) was incorporated alone. None of the treatments reduced Rhizoctonia root and hypocotyl rot compared to the untreated control, although plots treated with the high rate of Muscodor 5 days before planting were significantly more diseased than the untreated control.

Treatment, rate and application time	Marketable yield (no./plot)	Total yield (no./plot)	Rhizoctonia (%)	Clubroot (%)	Clubroot ^z severity
Thiram treated seed	26.0 a	70.5 a	0.4 c	40.1 a	10.8 a
^x Muscodor 3.5g/l soil 7 days before planting.....	18.0 ab	80.5 a ^y	3.3 bc	42.5 a	9.4 a
Untreated control.....	17.3 abc	77.5 a	3.4 bc	57.8 a	15.8 a
^x Rye seed carrier 7.5g/l soil 7 days before planting.....	3.0 d	73.0 a	5.3 abc	74.8 a	21.0 a
^x Muscodor 7.5g/l soil 7 days before planting.....	6.3 bcd	73.3 a	6.7 abc	59.7 a	12.3 a
^w Muscodor 3.5g/l soil 5 days before planting	10.3 bcd	76.8 a	7.0 ab	42.0 a	9.4 a
^w Muscodor 7.5g/l soil 5 days before planting	7.5 cd	67.5 a	10.8 a	37.4 a	10.0 a
<i>P</i> value	0.0127	0.3510	0.0622	0.2842	0.2391

^zClubroot severity calculated using the number of radishes in each of five categories and the midpoint value from the categories: 1 = 0% disease; 2 = 1-25% disease; 3 = 26-50% disease; 4 = 51-75% disease; and 5 = 76-100% disease. Severity = [$\Sigma(\text{category midpoint} \times \text{number of plants in category})$]/n, where n = number of total plants harvested.

^yValues are the means of four replicate plots; means followed by the same letter within a column are not significantly different at $P \leq 0.05$.

^xApplied on 17 Aug

^wApplied on 19 Aug

MUSTARD (*Brassica juncea*)
Clubroot; *Plasmodiophora brassicae*

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Resistance of mustard greens cultivars to clubroot, 2005.

Five mustard cultivars were evaluated for resistance to clubroot in a field trial at the Ohio Agricultural Research and Development Center Muck Crops Agricultural Research Station in Celeryville, OH. Fertilizer (N-P-K 17-17-17, 500 lb/A) was incorporated into the test field on 13 Apr. Mustard seeds were sown on 11 May into 200-cell plug trays containing Metromix 360 seedling mix. Plots were disked and rolled and raised beds were formed on 21 Jun. Seedlings were transplanted on 23 Jun. Cultivars were arranged in a randomized complete block design with four replications. Each plot consisted of three 15-ft rows with 4 in. plant spacing and 18 in. row spacing. Plots were separated by 6 ft. Transplants were overhead irrigated with 0.7 in. water on 24 Jun and 13 Jul. Mustard plants were harvested from a 10 ft section of the center row of each plot on 2 Aug and evaluated for clubroot disease severity and plant vigor. Data for clubroot disease severity were analyzed by ANOVA and data for plant vigor were analyzed using the Kruskal-Wallis test. Means were separated using Fisher's protected least significant difference test. Data were analyzed using SAS statistical software. Average maximum temperatures for 23-30 Jun, 1-31 Jul and 1-2 Aug were 91.1, 87.0 and 87.5 °F; minimum temperatures were 59.5, 60.6 and 54.5 °F; and rainfall was 0.1, 0.1 and 0.0 in., respectively.

Disease pressure was high for clubroot and no significant differences in disease severity were observed among cultivars. 'Savanna' mustard plants were significantly more vigorous than those of the other cultivars evaluated, although they exhibited moderate stunting.

Cultivar	Seed Supplier	Clubroot severity ^z	Plant vigor ^y
Florida Broadleaf	Siegers Seed Co.	85.4 a ^x	5.0 a
Green Wave	Siegers Seed Co.	88.0 a	5.0 a
Savanna	Siegers Seed Co.	80.4 a	3.3 b
Southern Giant Curled	Siegers Seed Co.	86.0 a	5.0 a
Tender Green	Rupp Seed Inc.	85.7 a	4.5 a

^zClubroot severity calculated using the number of plants in each of five categories and the midpoint value from the categories: 1 = 0% disease; 2 = 1-25% disease; 3 = 26-50% disease; 4 = 51-75% disease; and 5 = 76-100% disease. Severity = $[\sum(\text{category midpoint} \times \text{number of plants in category})] / n$, where n = number of total plants harvested.

^yPlant vigor rated according to the following scale; 5=severe stunting, few small sized leaves, chlorosis; 4=stunting, few small-medium sized leaves, chlorosis 3=moderate stunting, medium-large leaves, reduced leaf number, chlorosis; 2=slight stunting, slight reduction in leaf number, mild chlorosis, mainly larger leaves; 1=healthy plant, large leaves, no chlorosis.

^xValues are the means of four replicate plots; means followed by the same letter within a column are not significantly different at $P \leq 0.05$.

MUSTARD (*Brassica juncea* 'Southern Giant Curled')
Clubroot; *Plasmodiophora brassicae*

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Evaluation of fungicides for the management of clubroot in mustard greens, 2005.

The experiment was conducted at the Ohio Agricultural Research and Development Center's Muck Crops Agricultural Research Station in Celeryville, OH. Fertilizer (N-P-K 17-17-17, 500 lb/A) was incorporated into the test field on 13 Apr. 'Southern Giant Curled' mustard seeds were sown on 8 Jun into 200-cell plug trays containing Metromix 360 seedling mix. Plots were disked and rolled and raised beds were formed on 7 Jul. Seedlings were transplanted on 8 Jul. Treatments were arranged in a randomized complete block design with four replications. Each plot consisted of three 15-ft rows with 4 in. plant spacing and 18 in. row spacing. Plots were separated by 6 ft. Transplants were overhead irrigated with 0.7 in. water on 8, 11 and 13 Jul. Treatments were applied as a drench to the base of transplants immediately after planting. A second drench of Endorse 25WP was applied on 22 Jul. Mustard plants were harvested from a 10 ft section of the center row for each treatment on 2 Aug and evaluated for clubroot disease severity and plant vigor. Data for clubroot disease severity were analyzed by ANOVA and means were separated using Fisher's protected least significant difference test. For plant vigor data the Friedman test was used to compare treatments. Data were analyzed using SAS statistical software. Average maximum temperatures for 8-31 Jul and 1-2 Aug were 87.0 and 87.5 °F; minimum temperatures were 60.6 and 54.5 °F; and rainfall was 0.1 and 0.0 in., respectively.

Clubroot disease pressure was high. Both rates of Ranman 400SC significantly decreased clubroot severity compared to all other treatments and the untreated control, but the high rate was significantly more effective than the low rate. Plants treated with either rate of Ranman had significantly better vigor ratings (healthier plants) than those treated with other products or not treated. Compared to the untreated control neither Endorse 25WP nor Calirus 150 decreased clubroot severity nor increased plant vigor.

Treatment	Rate	Clubroot severity ^z	Plant vigor ^y
Calirus 150	1%	87.7 a ^x	4.6 a
Calirus 150	2%	86.8 a	4.6 a
Endorse 25WP (TM-43802)	1.86 lb/A	83.8 a	4.1 a
Ranman 400SC	3.4 fl oz /1000 plants	53.3 b	1.4 b
Ranman 400SC	6.8 fl oz /1000 plants	38.1 c	1.6 b
Control		85.8 a	4.6 a

^zClubroot severity calculated using the number of plants in each of five categories and the midpoint value from the categories: 1 = 0% disease; 2 = 1-25% disease; 3 = 26-50% disease; 4 = 51-75% disease; and 5 = 76-100% disease. Severity = $[\sum(\text{category midpoint} \times \text{number of plants in category})] / n$, where n = number of total plants harvested.

^yPlant vigor rated according to the following scale; 5=severe stunting, few small sized leaves, chlorosis; 4=stunting, few small-medium sized leaves, chlorosis 3=moderate stunting, medium-large leaves, reduced leaf number, chlorosis; 2=slight stunting, slight reduction in leaf number, mild chlorosis, mainly larger leaves; 1=healthy plant, large leaves, no chlorosis.

^xValues are the means of four replicate plots; means followed by the same letter within a column are not significantly different at $P \leq 0.05$.

Turnip (*Brassica rapa* 'Purple Top White Globe')
Downy mildew; *Peronospora parasitica*

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Evaluation of fungicides for the control of downy mildew on turnip greens, 2005.

The experiment was conducted at the Ohio Agricultural Research and Development Center Muck Crops Research Branch Station in Celeryville, OH. Fertilizer (N-P-K 17-17-17, 500 lb/A) was incorporated into the test field on 13 Apr. Plots were disked and rolled, and raised beds were prepared on 10 Aug. Turnip seeds were direct seeded at a rate of 9 seeds/ft on 11 Aug. Treatments were arranged in a randomized complete block design. Plots consisted of three 14 ft rows with 18 in. between rows on 6 ft centers. Dual II Magnum (1.5 pt/A) was applied on 11 Aug for weed control. Sevin XLR Plus 1 qt/A was applied on 7 Sep to control insects. Plants were sprinkle irrigated with 1.05, 0.3, and 0.3 in water on 12, 17 and 19 Aug, respectively. Treatments were applied on 1, 9, 19, and 30 Sep and 11 Oct using a tractor mounted 3.0 hitch (hydraulic attach) motor driven sprayer (50 psi, 43.5 gal/A, 3 MPH). Foliar disease severity was evaluated on 19 Sep and 3 and 13 Oct using a modified Horsfall-Barratt rating scale. Average maximum temperatures for 11–31 Aug, Sep and 1-13 Oct were 82.9, 81.0, and 73.2 F; minimum averages were 56.5, 53.9, and 49.8 °F; and total rainfall was 2.80, 3.34, and 1.09 in., respectively. Data were analyzed by ANOVA using SAS statistical software. For the 13 Oct data, analysis was done using Horsfall-Barratt ratings but average midpoints (% downy mildew) are shown. AUDPC values were calculated and analyzed using midpoint values. Means were separated using Fisher's protected least significant difference test.

Downy mildew pressure was low and no significant differences among treatments and the untreated control were observed.

Treatment rate/A (application time ²)	% downy mildew (13 Oct) ^y	Downy mildew AUDPC ^x
AI3842 3.7 SC 2.5 pt (1,3,5)		
<i>alt.</i> Bravo Weather Stik 6 SC 1.5 pt (2,4).....	12.0 a ^w	222.1 a
AI3842 3.7 SC 2.5 pt (1-5).....	16.6 a	236.6 a
Cabrio EG 16 oz (1,3,5)		
<i>alt.</i> Bravo Weather Stik 6 SC 1.5 pt (2,4).....	14.8 a	186.0 a
GFJ52 WG 0.8 lb		
+ Manex 37F 1.6 qt (1-5).....	21.4 a	228.9 a
Kocide 2000 DF 0.8 lb		
+ Manex 37F 1.6 qt (1-5).....	14.4 a	160.9 a
Kocide 2000 DF 1.5 lb		
+ Manex 37F 1.6 qt (1-5).....	21.4 a	231.1 a
Manex 37F 1.6 qt (1-5).....	14.8 a	171.1 a
Ridomil Gold Bravo 76.5 WP 24 oz (1-5).....	7.3 a	96.8 a
Tanos 50DF 8 oz + Kocide 2000 DF 1.5 lb + Manex 37F 1.6 qt (1,3,5)		
<i>alt.</i> Kocide 2000 DF 1.5 lb + Manex 37F 1.6 qt (2,4).....	10.8 a	164.1 a
Tanos 50DF 8 oz + Manex 37F 1.6 qt (1,3,5)		
<i>alt.</i> + Manex 37F 1.6 qt (2,4).....	7.3 a	106.5 a
Control.....	10.8 a	166.8 a
<i>P</i> value	0.5381	0.7027

²Application times were: 1= 1-8 Sep; 2= 9-18 Sep; 3= 19-29 Sep; 4= 30 Sep-10 Oct; 5= 11-17 Oct.

^yDisease rating and area under the disease progress curve (AUDPC) based on the midpoint values of a modified Horsfall-Barratt rating scale where 1=0%, 2= 1-3%, 3= 4-6%, 4=7-12%, 5= 13-25%, 6=26-50%, 7=51-75%, 8= 76-87%, 9=88-94%, 10= 95-97%, 11=98-99% and 12= 100% downy mildew.

^xCalculated according to the formula: $\sum[(x_i+x_{i-1})/2](t_i-t_{i-1})$ where x_i is the rating at each evaluation time and (t_i-t_{i-1}) is the time between evaluations.

^wValues are the means of four replicate plots; treatments followed by the same letter within a column are not significantly different at $P \leq 0.05$.

Lettuce (*Lactuca sativa* 'Green Towers' romaine)
Sclerotinia drop; *Sclerotinia minor*

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Evaluation of fungicides to control Sclerotinia drop in lettuce, 2005.

The experiment was conducted at K. W. Zellers & Sons Farms, Hartville, OH on Linwood muck soil (pH 5.6, 76% organic matter). Fertilizer (N-P-K 16-8-32, 650 lb/A) was incorporated into the field on 15 Apr. 'Green Towers' romaine lettuce seeds were sown on 20 Feb into 200-cell plug trays containing Fine Premier germination mix. Raised beds were formed and seedlings transplanted on 20 Apr. Treatments were arranged in a randomized complete block design with four replications. Each plot consisted of two raised beds separated by 3 ft. Each bed had two 70 ft rows of lettuce with 10 in. plant spacing and 18 in. row spacing. Plots were separated by 1 ft. Transplants were overhead irrigated with 0.3 in. water on 21 Apr. Transplants were side dressed with 80 lb/A urea on 6 May and the insecticide Mustang (4 oz/A) was applied on 2 Jun. Rovral, Endura alternated with Rovral and the first application of Botran 75W were applied using a tractor mounted CO₂-pressurized sprayer (25 psi, 100 gal/A). Omega, Switch, V-10135 (both rates) and the second application of Botran 75W were applied using a backpack CO₂-pressurized sprayer (40 psi, 30.3 gal/A). All treatments except V-10135 were applied to the entire 70 ft of each row. V-10135 was applied to the center 30 ft of each row. The numbers of healthy plants and plants with drop symptoms from the treated or control areas were evaluated on 13 Jun. Proportional data were arcsin square root transformed prior to analysis by ANOVA using SAS statistical software. Means were separated using Fisher's protected least significant difference test. Non-transformed means are reported. Average maximum temperatures for 1-30 Apr, 1-31 May and 1-30 Jun were 59.0, 70.0 and 78.0 °F; minimum temperatures were 37.0, 48.0 and 57.0 °F; and rainfall was 3.4, 4.0 and 3.6 in., respectively.

Sclerotinia pressure was low to moderate in this trial. Plots treated with Switch 62.5 WG or Endura alternated with Rovral 4F had significantly less Sclerotinia drop than the untreated control. Rovral alone, Botran 75W, Omega 500F and V-10135 were ineffective in reducing Sclerotinia drop incidence.

Treatment and rate/A (application date)	% Sclerotinia drop
Botran 75W 1.3 lb (22 Apr) 4.0 lb (29 Apr)	7.8 ab*
Endura 5.5 oz (22 Apr) 11 oz (13, 21 May) alt. Rovral 4F 1 qt (4 May).....	4.0 bc
Rovral 4F 0.5 qt (22 Apr) 1.0 qt (13,19 May).....	9.3 a
Switch 62.5 WG 5.5 oz (22 Apr) 11 oz (10, 21,31 May)	2.0 c
Omega 500F 1.5 pt (26 Apr)	7.0 ab
V-10135 2.5 lb (22 Apr, 5, 18, 31 May)	11.5 a
V-10135 3.8 lb (22 Apr, 5, 18, 31 May)	9.0 a
Untreated control	11.3 a

*Values are the means of four replicated plots; treatments followed by the same letter are not significantly different at $P=0.019$.

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