

TOMATO (*Lycopersicon esculentum*)
Early blight; *Alternaria solani*
Septoria leaf spot; *Septoria lycopersici*

W. R. Stevenson, R. V. James and R. E. Rand
 Department of Plant Pathology
 University of Wisconsin-Madison
 Madison, WI 53706

Evaluation of fungicides to control foliar diseases on tomato – Hancock, 2001

Seeds of tomato cultivar ‘Jetstar’ were sown in the greenhouse May 15 and seedlings were transplanted June 19 to a field at the Hancock Agricultural Research Station to establish a field trial to evaluate fungicide efficacy for control of tomato leaf blight. A randomized complete block design with four replications was used for the experiment, with each plot consisting of a single row containing five plants spaced 2-feet apart. Treatment rows were spaced 6 feet apart and alleys were placed between plots to allow pesticide application equipment to be driven beside the plants. The soil type was Plainfield loamy sand, pH 6.0. Fertilizer consisted of sidedress applications of 34-0-0, 225 lb/A, on June 27 and July 11. Treflan MTF, 1.0 pt/A, was applied June 13 for weed control. Fungicide treatments were applied with a tractor-mounted boom pressurized with an air compressor. Treatments were applied July 24 and 31, August 7, 14, 21 and 28, according to treatment protocol, at a rate equivalent to 35 gal water/A at 40 psi, using Tee Jet D3-23 nozzles (8 nozzles at 8-inch spacing). Disease severity was rated for each plant August 22 and 31, September 13 and October 1 using the Horsfall-Barratt system. Symptoms observed were primarily those of early blight with some lesions of Septoria leaf spot. Disease ratings were made for combined symptom expression without scoring severity of the two diseases separately. Fruit were picked by hand and counted and weighed on August 28, September 7, September 18 and September 27. On the first three dates, all ripe fruit were picked and sorted into three classes: marketable, split or deformed and rotted. On September 27, the ripe fruit were picked and sorted as on the previous three dates but two additional categories were also harvested: fruit that were not ripe but were more than 50% orange and green fruit that were greater than 2 inches in diameter. Rainfall recorded at Hancock during the growing season (inches) was June (4.1); July (2.73); August (4.57) and September (4.59). An additional 8.0 inches of water was applied as overhead sprinkler irrigation in 16 applications (June 26 – Sep 5).

While disease pressure was light due to hot dry weather during July and early August, there were significant differences in foliar infection on the last rating (October 1). All fungicide programs provided acceptable control of foliar diseases compared with the untreated check on October 1. The proportion of rotted fruit at each of the harvest dates was small in comparison with the proportion of marketable fruit. When compared with the untreated check, none of the fungicide treatments affected total yield, marketable yield, fruit splitting or fruit decay. Over 85% of the fruit in every plot were marketable, regardless of whether or not the plots were treated with fungicide sprays. Including Quadris in a treatment program provided good control with half the total amount of a.i. used in a standard Bravo WS program. The BAS experimental treatments show potential for good control with very low total a.i. of product.

Table 1. Description of foliar fungicide treatments.

Treatment chemicals	Rate/Acre		Schedule summary (Application dates: 1 = 7/24, 2 = 7/31, 3 = 8/7, 4 = 8/14, 5 = 8/21, 6=8/28)	Total active ingredient (ai) used during season (lb/A)
	Formulation	a.i.		
1 Untreated Control				0
2 BAS 500 20% WG	0.75 lb	0.15 lb	14-day interval (Appl 1, 3, 5)	0.45
3 BAS 510 70% WG	0.214 lb	0.15 lb	14-day interval (Appl 1, 3, 5)	0.45
4 Bravo WS	1.5 pt	1.13 lb	Weekly	5.65
5 Quadris 2.08 SC	5.0 fl oz	0.08 lb	Appl 1, 3, 5	2.49
Bravo WS	1.0 pt	0.75 lb	Appl 2, 4, 6	

Table 2. Effect of foliar fungicide treatment on disease development .

Treatment number	Disease Severity (%) ¹				Relative AUDPC ²
	8/22	8/31	9/13	10/1	
1	0.2	2.2	4.3	51.6	0.090
2	0.0	2.5	4.9	25.8	0.054
3	0.4	2.2	3.5	23.0	0.047
4	0.0	2.1	3.5	19.7	0.041
5	0.1	2.6	3.7	23.9	0.049
Pr > F ³	0.3	0.6	0.5	< 0.01	< 0.01
LSD ³	NS	NS	NS	11.8	0.019

- 1 Severity of leaf blight symptoms was rated on a Horsfall-Barratt scale of 0 (no infection) to 11 (all foliage dead). Ratings were converted to percentages.
- 2 Relative area under the disease progress curve. Data for each date were plotted on a graph and the area under the line was calculated for each treatment providing a measure of the relative severity of disease throughout the season. A disease rating of 100% foliage infection for the entire season would produce a value of 1.0. All relative AUDPC values are expressed as the proportion of this value. Either decreased disease severity or later disease development will contribute to lower relative areas under the disease progress curve.
- 3 Analysis of variance was performed on data, and Fisher's protected least significant difference (LSD) was calculated. NS = not significant at $P = 0.10$.

Table 3. Effect of foliar fungicide treatment on yield and quality.

August 28 Harvest

Trt	Total yield ¹		Marketable yield				Split fruit ²		Rotted fruit ³	
	Ton/A	Number of fruit	Ton/A	% of fruit (by weight)	Number of fruit	Avg. fruit wt (lb)	% of fruit (by weight)	Number of fruit	% of fruit (by weight)	Number of fruit
1	0.8	6.3	0.5	68.8	3.5	0.4	31.2	2.8	0.0	0.0
2	0.6	5.8	0.5	80.0	4.5	0.5	14.6	0.5	5.4	0.8
3	0.9	8.3	0.8	92.8	6.5	0.4	7.2	1.8	0.0	0.0
4	1.1	10.3	0.9	83.9	8.8	0.4	2.1	0.3	14.0	1.3
5	0.8	6.8	0.7	80.8	5.8	0.4	19.2	1.0	0.0	0.0
Pr > F ⁴	0.74	0.75	0.44	0.65	0.31	0.81	0.37	0.71	0.56	0.59
LSD ⁴	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS

September 7 Harvest

Trt	Total yield ¹		Marketable yield				Split fruit ²		Rotted fruit ³	
	Ton/A	Number of fruit	Ton/A	% of fruit (by weight)	Number of fruit	Avg. fruit wt (lb)	% of fruit (by weight)	Number of fruit	% of fruit (by weight)	Number of fruit
1	3.4	26.5	3.2	94.4	24.3	0.4	3.2	1.3	2.4	1.0
2	2.6	20.0	2.5	93.4	18.5	0.4	2.3	0.5	4.3	1.0
3	3.1	25.3	2.7	85.7	20.8	0.4	9.5	2.3	4.8	2.3
4	3.3	27.3	3.0	92.5	25.0	0.4	1.1	0.3	6.4	2.0
5	3.7	27.0	3.5	94.4	25.3	0.5	1.7	0.8	3.8	1.0
Pr > F ⁴	0.35	0.29	0.44	0.09	0.29	0.84	0.13	0.16	0.72	0.62
LSD ⁴	NS	NS	NS	7.0*	NS	NS	NS	NS	NS	NS

September 18 Harvest

Trt	Total yield ¹		Marketable yield				Split fruit ²		Rotted fruit ³	
	Ton/A	Number of fruit	Ton/A	% of fruit (by weight)	Number of fruit	Avg. fruit wt (lb)	% of fruit (by weight)	Number of fruit	% of fruit (by weight)	Number of fruit
1	4.4	25.0	3.6	82.1	21.0	0.6	12.2	2.5	5.7	1.5
2	4.3	22.5	3.5	84.2	17.8	0.7	10.7	2.5	5.1	2.3
3	3.7	20.5	2.8	72.0	15.8	0.6	19.3	2.8	8.8	2.0

	4	3.3	19.5	2.5	77.1	15.0	0.6	14.9	3.5	8.1	1.0
	5	4.2	25.8	3.1	73.4	19.0	0.6	19.7	4.8	6.9	2.0
Pr>F ⁴	049	0.66	0.39	0.44	0.62	0.46	0.67	0.60	0.91	0.55	
LSD ⁴	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS

September 27 Harvest

Trt	Total yield ⁵		Marketable yield				"Potentially Marketable"			Split fruit ²		Rotted fruit ³	
	Ton/A	Number of fruit	Ton/A (ripe fruit)	% ripe fruit (by weight)	Number of ripe fruit	Avg. ripe fruit wt (lb)	Number of fruit > 50% orange	Number of fruit green, > 2" diam.	% (wt) of fruit green, > 2" diam.	Number of fruit	% of fruit (by weight)	Number of fruit	% of fruit (by weight)
1	21.6	170.3	4.9	36.5	28.3	0.5	18.8	109.0	54.0	6.3	4.6	8.0	4.8
2	18.7	138.5	4.4	38.3	24.8	0.6	16.5	79.8	46.9	10.3	9.7	7.3	5.1
3	20.9	153.3	6.6	44.9	36.5	0.6	19.0	86.0	45.8	4.3	3.8	7.5	5.5
4	23.1	182.0	5.7	36.4	33.5	0.5	18.8	112.0	51.8	7.5	4.9	10.3	6.9
5	22.6	166.3	6.1	41.9	36.0	0.6	20.0	94.5	45.8	8.5	6.9	7.3	5.3
Pr>F ⁴	0.67	0.26	0.51	0.51	0.41	0.96	0.98	0.12	0.56	0.52	0.15	0.84	0.89
LSD ⁴	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS

Total Season

Trt	Total yield Ton/A	Marketable yield ⁶			Unmarketable yield	
		Number of fruit	% of fruit (by weight)	Avg. fruit wt (lb)	Number of fruit	% of fruit (by weight)
1	30.2	204.8	88.7	0.5	23.3	11.3
2	26.3	161.8	85.2	0.6	25.0	14.8
3	28.6	184.5	88.1	0.5	22.8	11.9
4	30.7	213.0	87.3	0.5	26.0	12.7
5	31.3	200.5	86.6	0.5	25.3	13.4
Pr>F ⁴	0.61	0.38	0.17	0.90	0.38	0.86
LSD ⁴	NS	NS	NS	NS	NS	NS

1 All ripe fruit picked on that date – including marketable, split and rotted.

2 Split or deformed fruit, not rotted

3 Fruit with any disease or rot (may also be split or deformed)

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

5 On the final harvest date, total yield includes all fruit that were ripe, over 50% ripe or green and greater than 2 inches in diameter.

6 All fruit that were ripe, over 50% ripe, or green and greater than 2 inches in diameter are included in the number of marketable fruit and % of fruit by weight. Only ripe fruit and those that were over 50% ripe (those that had reached mature size) were included in the calculation of the average fruit weight.

