

TOMATO (*Solanum lycopersicum* 'Jasper')
Septoria leaf spot; *Septoria lycopersici*
Powdery mildew; *Oidium lycopersicum*
Late blight; *Phytophthora infestans*

M. T. McGrath and K. A. LaMarsh
Dept of Plant Pathology & Plant-Microbe Biology
Cornell University, LIHREC
3059 Sound Avenue, Riverhead, NY 11901

Evaluation of biopesticides for managing foliar diseases in organically-produced tomato, 2013.

The experiment was conducted at the Long Island Horticultural Research and Extension Center (LIHREC) in Riverhead, NY, in a field with Haven loam soil that has been dedicated to research on evaluating fungicides on organically-produced crops. Organic fertilizer at 105 lb/A N was spread over rows to be planted, then incorporated. Three products were used each at 700 lb/A: Pro-Grow 5-3-4, Cheep Cheep 4-3-3, and 6-0-6 Cottonseed blend. Next, drip tape was laid as the rows were being covered with black plastic mulch. A living mulch was established between strips of plastic mulch by broadcasting Dutch white clover and annual ryegrass seed with a hand-operated spreader, then lightly raking to incorporate. The living mulch plus weeds that grew were mowed routinely. Some weeds were removed by hand. Tomato variety 'Jasper' was selected for this study because it has resistance to late blight and has demonstrated susceptibility to Septoria leaf spot, the primary disease of interest in this experiment. Seeds were sown on 17 May in the greenhouse. Seedlings were transplanted on 21 Jun by hand into holes opened in the plastic mulch by a waterwheel transplanter that also placed in the holes a starter fertilizer, Neptune's Harvest Benefits of Fish (2-4-1 N-P-K). Plants were staked and trellised following standard procedure for fresh-market tomato production. Thrips and tomato fruit worms were managed by applying Entrust (8 fl oz/A) on 16 and 23 Jul. Plots consisted of 10 plants in a single row with 24-in. plant spacing and 68-in. row spacing. There was 5-ft spacing between plots in a row. A completely randomized block design with four replications was used. Plots for each of the four replications were in two adjacent rows. There was a spreader row planted between replications 1 and 2 also between replications 3 and 4. Foliar treatment applications were made using a CO₂-pressurized backpack sprayer with a boom that has a single twin-jet nozzle (TJ60-11003) delivering 50 gal/A at 54 psi. Each side of the planted row was treated with the boom held sideways to obtain thorough coverage of foliage mimicking a drop nozzle on a tractor sprayer. A preventive 7-day application schedule was used. Applications were made on 16, 20, and 27 Aug and on 6, 13, 17, and 24 Sep. Leaves were examined routinely for disease symptoms. All diseases that occurred started from naturally-occurring inoculum. Leaves with Septoria leaf spot collected from an organic farm were put in the canopy of each plot on 28 Aug to increase the amount of inoculum. Disease severity was assessed by counting number of leaves with symptoms when incidence was low. When symptoms were more common, estimations were made of the percentage of leaves in each plot with symptoms (incidence) and the severity of symptoms on these affected leaves. Canopy severity was calculated with these values. Defoliation was assessed as percent of leaves that had died. Average monthly high and low temperatures (°F) were 78/61 in Jun, 86/71 in Jul, 80/64 in Aug, 74/57 in Sep, and 67/51 in Oct. Rainfall (inches) was 9.92, 3.07, 2.43, 2.62, and 0.19 for these months, respectively.

During the 2013 growing season, as rainfall decreased, conditions became progressively less favorable for development of foliar diseases. Symptoms were first observed of Septoria leaf spot on 7 Aug, of late blight on 28 Aug, and of powdery mildew on 3 Sep. No significant differences were detected among treatments in amount of leaves affected by Septoria leaf spot. The biopesticide treatment with the lowest values on the first three assessments was Optiva alternated with Cueva. No significant differences were detected among treatments in amount of leaves affected by powdery mildew. Three biopesticide treatments had low values on the first three assessments: Double Nickle + Cueva, Regalia + Cueva, and Actinovate + Badge X. Late blight was also assessed to determine if control achieved with the resistant variety was improved by any of the treatments. Few symptoms were found, in contrast with a near-by variety evaluation, and there were no significant differences among treatments.

Treatment and rate/A (application dates) ^y	Canopy severity (%) ^z					
	Septoria leaf spot		Late blight		Powdery mildew	
	9 Oct	AUDPC ^x	9 Oct	AUDPC ^x	9 Oct	AUDPC ^x
Nontreated	5.6	309.8	0.0	9.0	5.1	127.1
Optiva 24 oz (1-7).....	4.6	211.7	0.0	1.5	6.8	108.2
Soil Serenade drench; Optiva 24 oz (1-7)	5.8	187.0	0.0	1.3	7.1	85.1
Optiva 24 oz (1,3,5,7); Cueva 2 qt (2,4,6).....	1.2	158.8	0.0	0.5	8.3	78.8
Double Nickle 1qt + Cueva 2 qt (1-7).....	0.3	155.6	1.5	0.3	0.3	57.4
MilStop 2.5 lbs (1-7) + Optiva 24 oz (1,3,5,7).....	6.8	135.7	0.0	0.2	1.7	56.3
Regalia 1 qt + Cueva 2 qt (1-7).....	6.8	115.0	0.1	0.1	6.6	34.5
Regalia 2 qt (1,3,5,7); Cueva 2 qt (2,4,6).....	4.5	112.9	0.0	0.1	0.7	33.1
Actinovate AG ^w 6 oz (1-7).....	18.6	105.6	0.5	0.1	3.4	17.4
Actinovate AG ^w 6 oz (1-7) + Badge X2 2 qt (2,4,6).....	3.1	99.5	0.0	0.0	1.8	16.4
BWN127N 2% v/v (1-7).....	0.8	98.0	0.3	0.0	1.9	13.5
BWN130N 1.5% v/v (1-7).....	4.4	81.5	0.1	0.0	5.9	10.6
BWN127N 2% v/v + BWN130N 1.5% v/v (1-7).....	0.1	81.0	0.0	0.0	9.0	10.2
Cueva 2 qt (1-7) (<i>Organic Standard</i>).....	1.7	40.0	0.1	0.0	2.9	8.1
Bravo Ultrex 1.3–1.8 ^v (1-7) (<i>Conventional Standard</i>)	2.4	26.0	0.0	0.0	0.1	1.4
<i>P-value (treatment)</i>	<i>0.6076</i>	<i>0.2448</i>	<i>0.4523</i>	<i>0.2448</i>	<i>0.4115</i>	<i>0.0681</i>

^z Numbers in each column with a letter in common are not significantly different from each other (Tukey's HSD, P=0.05).

^y Rate of formulated product/A. Soil drench treatment was done on 20 and 26 Jun. Foliar application dates were 1=16 Aug, 2=20 Aug, 3=27 Aug, 4=6 Sep, 5=13 Sep, 6=17 Sep, and 7=24 Sep.

^x AUDPC values were square root transformed before analysis.

^w Actinovate was applied with Nu-Film P.

^v Rate increased over time.