

Evaluation of biopesticides and an organic copper for managing bacterial speck in tomato, 2022.

An experiment was conducted at the Long Island Horticultural Research and Extension Center (LIHREC) in Riverhead, NY, in a field with Haven loam soil. The objective was to evaluate organic fungicides and programs for controlling bacterial speck on tomato. Treatments consisting of an organic (OMRI-listed) copper fungicide (Cueva) and a program with conventional fungicides (Actigard, copper, and mancozeb) were included as grower standards for comparison. Controlled-release fertilizer (N-P-K, 19-10-9) at 525 lb/A (101 lb/A N) was applied with a 2-row fertilizer spreader over rows that subsequently were covered with black plastic mulch while drip tape was laid on 25 May. Weeds were managed between the mulched beds by applying a tank mix of Devrinol DF 4 lb/A and Metribuzin 1.33 lb/A with a shielded sprayer on 27 May, then covering the soil with landscape cloth and hand weeding. Seeds were sown on 18 Apr in the greenhouse. A waterwheel transplanter was used to make planting holes in the beds and apply starter fertilizer (9-18-9). All plants were placed outdoors to harden for a few days and then transplanted by hand into the holes in the beds on 26 May. Plots were single rows with 6 plants at 24-in spacing. Treatments were arranged in a randomized block design with four replications, two in each row. There was a 4-foot non-planted space between plots in a row and 23 feet between the two rows. Space between rows was large because there was intended to be an inoculated spreader row in the center of the experiment to serve as a source of inoculum and to have adequate space for making applications. An isolate of *Pseudomonas syringae* pv. *tomato* from a Long Island farm was used to inoculate seedlings for the spreader row and likely unintentionally spread to the experimental plants before planting. Plants were staked and trellised using a modified Florida weave as is standard practice in the region for fresh-market tomatoes. The treatments were applied 16 times on a 7-day schedule beginning on 7 Jun using a CO₂-pressurized backpack sprayer with a boom that has a single twin-jet nozzle (TJ60-11003VS), calibrated to deliver 45.8 gal/A when operated at 55 psi and 2.35 mph. Each side of the planted row was treated with the boom held sideways to obtain thorough coverage of foliage and to mimic the coverage obtained with a drop nozzle on a tractor sprayer. Application 7 was done only two days after the sixth due to concern that wind during the sixth might have affected spray deposition and forecast rain would provide favorable conditions for pathogen spread and infection. Applications 13 and 15 had to be delayed one day due to heavy rains the day before the scheduled date. Bacterial speck was assessed from 16 Jun through 16 Sep, usually 4 days after a treatment application. Disease incidence (percent of leaflets with symptoms) and severity (percent tissue affected) on symptomatic leaflets were rated for each side of each plot, and then averaged. AUDPC was calculated from 24 Jun through 16 Sep. Observations of fruit symptoms and visible spray residue on fruit in each plot were recorded on 5, 10, 19, and 31 Aug and 14 Sep. To promote bacterial speck development, all plots were sprayed with water using overhead sprinklers attached to a tractor sprayer on 7, 8 and 12 Sep. Average monthly high and low temperatures (°F) were 79.0 and 60.2 in Jun, 85.3 and 68.9 in Jul, 85.4 and 68.7 in Aug, and 76.3 and 60.3 in Sep. Rainfall of at least 0.01 in. occurred on 11 days in Jun (3.6 in.), 4 days in Jul (4.1 in.), 7 days in Aug (2.0 in.), and 3 days over the first two weeks in Sep (4.3 in.).

Symptoms of bacterial speck were first seen in some plots on 14 Jun while the second application was being made. This was before the inoculated spreader row was scheduled to be planted. Some level of symptoms was seen in all plots examined on 16 Jun (replications 3 and 4) and on 24 Jun (all plots). The experiment plants likely became infected as a result of pathogen spread from the inoculated seedlings while all the plants were in the greenhouse although the two groups of plants were separated by 38 feet. The first two applications were intended to be preventive. Symptoms were common during Jun when frequent rain and moderate temperatures provided favorable conditions for speck development. Fewest symptoms were seen in plots receiving the conventional standard fungicide program, but differences usually were not significant. Incidence and severity declined substantially during hot, dry summer months (data not shown), then increased during Sep. Only the conventional program was effective (significantly less disease than untreated control) and only based on incidence on 26 Aug and AUDPC values for incidence. Symptoms of bacterial speck on fruit were seen least commonly in plots receiving the conventional program and most commonly in untreated plots and plots treated with Cueva or LifeGard alt. Cueva (not quantified). Least visible spray residue on fruit was seen in plots treated with LifeGard alt. Cueva and most residue was seen in the conventional program plots (not quantified). No phytotoxicity was observed. Photographs are posted at <https://blogs.cornell.edu/livegpath/research/foiar-diseases-of-tomato/evaluation-of-organic-biopesticides-for-tomato-bacterial-speck-2022/>.

Treatment and rate (application dates) ^y	Bacterial speck incidence (%) ^z					Bacterial speck severity (%) ^z				
	30 Jun	8 Jul	26 Aug	16 Sep	AUDPC	30 Jun	8 Jul	26 Aug	16 Sep	AUDPC
Untreated control	18.9 ab	6.8 ab	3.7 ab	42.3	732 a	3.3	1.4 ab	1.0 ab	13.2	220
Serifel 10 oz (1-16) ^w	8.4 ab	5.1 ab	1.0 bc	26.9	443 ab	1.7	1.3 ab	0.7 ab	8.0	150
Timorex ACT 20 fl oz (1-12)	17.7 ab	8.8 ab	1.2 abc	28.7	559 ab	4.1	2.1 a	0.8 ab	8.2	165
LifeGard 4.5 oz/100 gal (1, 3, 5, 7, 9);										
Cueva 64 fl oz (2, 4, 6, 8, 10-16)	16.2 ab	10.2 a	3.8 a	29.1	592 ab	4.0	2.1 a	1.3 a	8.8	176
Cueva 64 fl oz (1-16)	21.0 a	9.5 ab	1.6 abc	27.0	594 ab	4.3	2.0 a	0.8 ab	8.5	174
Actigard 0.33 oz (1), 0.5 oz (3), 0.75 oz (5, 7);										
Badge X2 1.8 lb + Manzate Pro- Stick 3 lb (2, 4, 6, 8-16)	2.5 b	3.1 b	0.7 c	18.5	244 b	0.9	0.8 b	0.5 b	5.2	93
<i>P-value (treatment)</i>	0.0195	0.0274	0.0053	0.1982	0.0689	0.0369	0.0093	0.0315	0.356	0.1396

^z Numbers in each column with a letter in common or no letters are not significantly different from each other (Tukey's HSD, $P=0.05$). For the 30 Jun severity data, all treatments were assigned an 'a' mean separation letter although the P -value was less than 0.05.

^y Rate of formulated product/A unless otherwise noted. Application dates were 1=7 Jun, 2=14 Jun, 3=21 Jun, 4=28 Jun, 5=5 Jul, 6=12 Jul, 7=14 Jul, 8=19 Jul, 9=25 Jul, 10=1 Aug, 11=8 Aug, 12=15 Aug, 13=24 Aug, 14=29 Aug, 15=7 Sep, and 16=12 Sep.

^x Values were square root transformed before analysis because raw data were not distributed normally. Table contains de-transformed values.

^w Treatment applied with the nonionic surfactant Dyne-Amic at 0.38% v/v.