

TOMATO (*Solanum lycopersicum* 'Better Boy,'
'Mountain Merit,' 'Damsel,' Mr. Stripey')
Late Blight; *Phytophthora infestans*
Early Blight; *Alternaria solani*
Bacterial spot; *Xanthomonas* spp.

D.E. Perla and M.K. Hausbeck
Michigan State University
Department of Plant, Soil and Microbial Sciences
East Lansing, MI 48824

Evaluation of cultivars and organic fungicides for management of late blight, bacterial spot, and early blight on tomato, 2018.

This trial was established at the Michigan State University Plant Pathology Farm in Lansing, MI, in a field of Capac loam soil previously planted to cucumbers. Roundup PowerMax 1 qt/A was applied for weed control prior to planting. The soil was prepared by plowing and discing, forming raised beds, and covering them with black plastic. Drip tape was established for irrigating the plot; a mist irrigation system was used to increase humid conditions within the plot. Tomato seeds were planted in nursery trays in a greenhouse on 18 May. Five days after germination, plants were sprayed with a growth regulator Sumagic 5 ppm. Four weeks after germination, tomato plants were moved outdoors and allowed to acclimatize for one week. Plants were transplanted into the raised beds on 25 Jun. Treatments were arranged in a split-plot within a completely randomized block design, where the plot corresponded to fungicide treatments, and the subplot corresponded to four tomato cultivars. Rows were 20 ft long, spaced 5.5 ft apart with plants spaced 18 in. apart within a row. The trial was fertilized throughout the growing season with weekly applications of 20-20-20 via drip tape at 3 lb/A. One application of Warrior 2 with Zeon Technology 2.8 ml/3 gal was applied at 50 psi for tomato hornworm control on 24 Aug. Plots were hand-weeded as needed. The trial was inoculated with 1×10^4 zoospores/ml suspension of *Phytophthora infestans* isolate US-23 on 15, 28 Aug, and 6 Sep using a manual backpack sprayer equipped with a hollow cone nozzle, calibrated to spray 15 ml of inoculum per plant. Foliar spray treatments were applied on 18, 17, 24 and 31 Aug; and 7, 14 and 22 Sep using a CO₂ backpack sprayer and a broadcast boom equipped with four XR8003 flat-fan nozzles spaced 18.5 in. apart and calibrated at 50 psi delivering 50 gal/A. Plants were visually assessed for bacterial leaf spot, early blight, and late blight using a 0 to 100% scale where 0=no disease and 100=complete defoliation due to disease. Data were analyzed using an analysis of variance (ANOVA), with means separation performed using Fisher's protected least significant difference (LSD) using statistical software SAS v9.4.

During Aug, the maximum/minimum temperatures were 86°/50°F (69.8°F average). In Sep, the maximum/minimum temperatures were 98.6°/35.6°F (64.4°F average). Early blight and bacterial spot symptoms were observed across the plot. Late blight disease developed on 'Better Boy' tomatoes except for those treated with Kocide 3000 O. Bacterial spot was significantly limited on 'Mr. Stripey' and 'Mountain Merit' tomatoes treated with Kocide 3000 O compared to many of the other tomato cultivar/treatment combinations, but were similar to Kocide-treated 'Damsel' and 'Better Boy' plants. 'Better Boy' and 'Damsel' tomatoes treated with Zonix Biofungicide or EF400 or untreated were often significantly more diseased by the bacterial spot pathogen than the other cultivar/treatment combinations. Early blight symptoms were significantly limited on Kocide-treated 'Mr. Stripey,' 'Mountain Merit' and 'Better Boy' tomatoes compared to all other cultivar/treatment combinations with the exception of Kocide 3000 O-treated 'Damsel' and EF400-treated 'Mr. Stripey' tomatoes. In our study, cultivar had an important impact on late blight as 'Better Boy' tomato appeared to be more susceptible than the other cultivars, and applications of Zonix Biofungicide or EF400 did not appear to be helpful. In contrast, Kocide 3000 O limited late blight in 'Better Boy' tomato and significantly reduced bacterial spot and early blight compared to most of the other cultivar/treatments. Thus, in organic tomato production, cultivar selection and use of Kocide 3000 O could offer meaningful disease management strategies.

Treatments (rate/A unless otherwise indicated)	Cultivar	Foliar blight (%) [*]		
		Bacterial spot	Early blight	Late blight
Untreated	Better Boy	51.3 cd ^{**}	38.0 e	43.0 c
Untreated	Damsel	65.0 de	38.0 e	3.0 a
Untreated	Mountain Merit	41.3 bc	35.0 de	0.0 a
Untreated	Mr. Stripey	38.8 a-c	28.0 b-d	0.0 a
Kocide 3000 O DF 1.75 lb	Better Boy	26.3 ab	18.0 a	0.0 a
Kocide 3000 O DF 1.75 lb	Damsel	26.3 ab	20.0 ab	0.0 a
Kocide 3000 O DF 1.75 lb	Mountain Merit	23.8 a	18.0 a	0.0 a
Kocide 3000 O DF 1.75 lb	Mr. Stripey	23.8 a	18.0 a	0.0 a
EF400 96 fl oz/100 gal	Better Boy	58.8 de	33.0 c-e	30.0 b
EF400 96 fl oz/100 gal	Damsel	50.0 cd	28.0 b-d	0.0 a
EF400 96 fl oz/100 gal	Mountain Merit	38.8 a-c	33.0 c-e	0.0 a
EF400 96 fl oz/100 gal	Mr. Stripey	40.0 a-c	25.0 a-c	0.0 a
Zonix Biofungicide 500 ppm	Better Boy	60.0 de	38.0 e	38.0 c
Zonix Biofungicide 500 ppm	Damsel	67.5 e	30.0 c-e	0.0 a
Zonix Biofungicide 500 ppm	Mountain Merit	38.8 a-c	33.0 c-e	0.0 a
Zonix Biofungicide 500 ppm	Mr. Stripey	41.3 bc	28.0 b-d	0.0 a

^{*}Disease based on a visual estimation of percentage of foliage infected.

^{**}Column means with a letter in common are not significantly different (LSD t-Test; $P=0.05$).