MAPPING YOUR ROUTE TO THE FUTURE

Great Lakes Fruit, Vegetable & Farm Market EXPO
DeVos Place Convention Center
Grand Rapids, MI
December 7-9, 2004

Tomato

Tuesday morning 9:00 am

Where: Grand Gallery Room E-F (lower level)

Recertification credits: 1 (Private, 1B)

CCA Credits: SW(1) IPM(1)

Moderator: Ron Goldy, SWMREC MSU Extension

9:00 a.m.	Strategies to Control Bacterial Diseases and Late Blight • Mary Hausbeck, Plant Pathology Dept., MSU
9:30 a.m.	Weed Management in Tomato (tentative title) • David W. Monks, Horticultural Science Dept., NC
10:00 a.m.	Irrigation and Fertigation of Fresh Market Tomatoes • Dorota Z. Haman, Agric. Engineering Dept., Univ. of Florida
10:30 a.m.	Can You Reduce Irrigation Water Inputs While Maintaining High Yield and Quality? • Mathieu Ngouajio, Horticulture Dept., MSU

Tomato: Bacterial Diseases and Late Blight

Dr. M.K. Hausbeck (517-355-4534, hausbec1@msu.edu)
Michigan State University, Department of Plant Pathology

Bacterial canker

Bacterial canker was diagnosed in several fields of processing tomatoes in Michigan in 2004. Bacterial canker is caused by the bacterium, *Clavibacter michiganensis* subsp. *michiganensis*, and causes plant stunting, wilting and fruit spotting. This year, symptoms on fruit appeared early and became severe in some fields. Although yield losses vary among years, bacterial canker has the potential to be devastating. Young plants are more susceptible than older plants. Bacterial canker can be introduced into a clean field via transplants, machinery and wooden stakes or other equipment that has been previously used in an infected field.

Unilateral wilting

Bird's-eye spotting

Once a greenhouse or field is contaminated with bacterial canker, steps must be taken to assure that future crops remain disease free. If a greenhouse is contaminated, remove all plant material from the greenhouse (including weeds and dead plant tissue on the floor), wash and disinfect floor surfaces, hoses, equipment, etc. with a 10% solution of bleach or a commercial disinfestant (GreenShield is an example). Wooden structures such as benches or trays should be soaked in a disinfestant such as bleach (10%) or GreenShield for a minimum of an hour and preferably overnight. A simple washing of wooden surfaces is inadequate because of the cracks and crevices that may allow the bacteria to escape a surface wash. Bacteria that overwinter on a wooden surface may be carried to the plants in water droplets next season during the splashing of overhead irrigation.

A contaminated field should be rotated out of tomatoes for at least three years. At one time it was believed that a rotation of at least five years was necessary, however, it is now known that the level of bacteria in a contaminated field drops dramatically after the first year of rotation. Any equipment used in the problem field should be washed and disinfected prior to entering a clean field. Equipment and workers should begin work in the cleanest field and finish with the contaminated field.

Copper sprays every five to seven days may help reduce the spread of bacterial canker. However, if the environment is favorable for bacterial canker (75 - 90°F with rain) coppers may be limited because the bacteria has a decided advantage in a wet environment.

Avoid working in a diseased field when it is wet to avoid spreading the disease. Bacteria may enter the plant through natural openings, or wounds created by wind, pesticide spraying or insects. A film of water on the leaf surface allows the bacteria to remain viable and move. If workers are moving within a wet field and creating new wounds on the plants, new infections are likely. If plants have been staked, all stakes should be treated as discussed previously for wooden trays and benches.

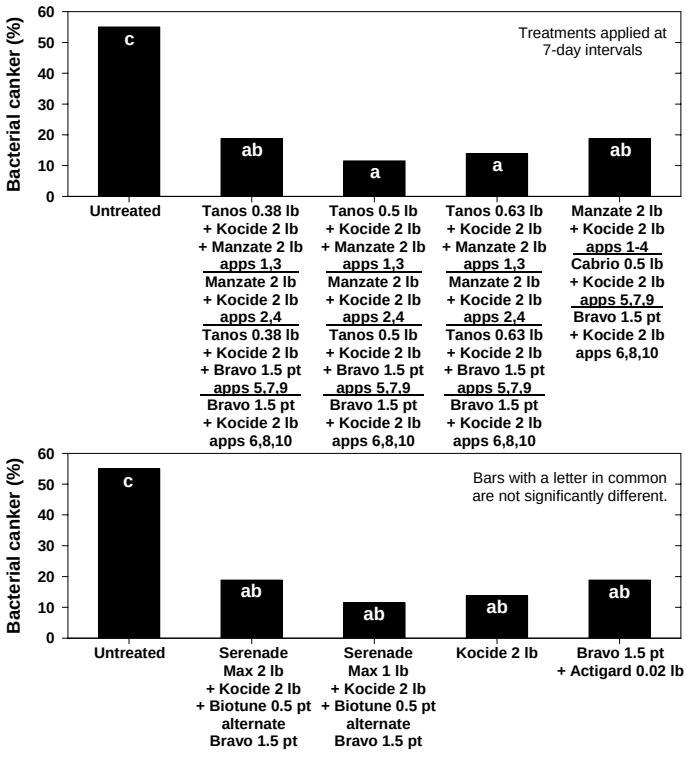
Table 1. Products used in tomato trials.

Product	Active ingredient	Company	Registered
Acrobat 50WP	dimethomorph	BASF Ag Products	yes
Actigard 50WG	acibenzolar-S-methyl	BASF Ag Products	no
Amistar 80WG	azoxystrobin	Syngenta Crop Protection Inc.	yes
BAS 55007F 4.17SC	experimental	BASF Ag Products	no
Bravo Weather Stik 6SC	chlorothalonil	Syngenta Crop Protection Inc.	yes
Cabrio 20WG	pyraclostrobin	BASF Ag Products	yes
Dithane 75DF	mancozeb	Dow Agrosciences LLC	yes
Kocide 61.4DF	copper hydroxide	Griffin LLC	yes
Kocide 2000 54DF	copper hydroxide	Griffin LLC	yes
Ranman 3.3SC	cyazofamid	ISK Biosciences	no
Ridomil Gold Bravo 76.5WP	mefenoxam + chlorothalonil	Syngenta Crop Protection Inc.	yes
Serenade Max 20WP	*Bacillus subtilis*	AgraQuest Inc.	no
Tanos 50WG	famoxadone + cyazofamid	du Pont	yes

New Product Test for Bacterial Canker

A study of bacterial diseases on tomato was conducted at the Plant Pathology Farm of Michigan State University on a clay loam soil that was previously planted to tomatoes. The field was chiseled plowed and field cultivated on 26 April. Forty-three raised beds, with 1.5 mil black-plastic mulch and drip-irrigation tube, were formed on 3 May. The drip tube had an emitter spacing of 12 in. and delivered 0.4 GPM per 100 ft of tube. Raised beds were spaced 8 ft apart and were 6 in. high and 24 in. wide at the top. Planting holes were punched in the tops of the beds using a water wheel with a hole spacing of 18 in. on 8 June and one 'Mt Spring' transplant from a 72-cell plug tray was planted in each hole. Treatment plots consisted of 20 ft of row with a 2 ft buffer space between treatments within the row, and one buffer row between each treatment row. Treatments were replicated four times in a randomized complete block design. Insects were controlled with a drip irrigation application of Admire (24 fl oz/A) on 9 June. The plot received applications of 20-20-20 (5 lb/A) weekly through the drip tube. After plant establishment, plots were watered via drip irrigation 4 hours per day two times a week. Mist irrigation was also applied to the plot three times per week to promote foliar disease after 1 August. Fungicide sprays were applied using a CO_2 backpack sprayer with three 8003XR nozzles spaced 19 in apart. The sprayer was operated at 50 psi and was

Fig. 1. Bacterial Canker Infection of Tomato Foliage



calibrated to deliver 50 gal/A. Ten sprays were made to the 7-day treatments on 26 June; 2, 9, 16, 23, and 31 July; 7, 14, 21, and 25 August. Plots were evaluated for foliar bacterial infection (based on a rating of 0 to100%) on 2 and 14 September. Yields were taken from the inner five ft of plants on 7 and 15 September. Harvested fruit were held in the dark at room temperature for seven days before being evaluated for bacterial infection.

Defoliation was caused by both bacterial canker and bacterial speck. Canker symptoms caused a blighting and yellowing that resulted in death of entire petioles on one side of the stem. Bacterial speck lesions were small dark black spots that coalesced and then caused death of single leaves on a petiole. All treatments had less bacterial canker and bacterial speck than the untreated control for the last foliar rating (Fig. 1). There were some significant differences in yields of infected fruit among treatments, but theft of fruit from the plot on several occasions limits the reliability of the yield data.

Late Blight

Late blight is a fungal disease that most commonly affects potatoes, but can affect tomatoes in some years. When the weather is favorable, late blight can be a very serious disease. Although this disease was not a reported problem in Michigan this year, it occurred in several eastern states. Late blight symptoms include blighting on all aboveground parts of the tomato plant. Lesions on leaves often appear dark and oily with production of spores occurring on the undersides of the leaves resulting in a purplish appearance especially when conditions are wet and humid. Blackened lesions on the stems also occur and are unique to late blight disease. Late blight affects green and ripened tomato fruit. The blighting on fruit appears as dark, greasy areas that enlarge rapidly encompassing the entire fruit. During wet and humid conditions, white threads (mycelium) can be seen on the fruit.

Between cropping seasons, the fungus survives on volunteer and abandoned potato and tomato plants in fields, cull piles, and homeowner gardens. Cool nights and warm days are ideal for late blight development. The spores can be carried from diseased plants to nearby healthy plants via wind.

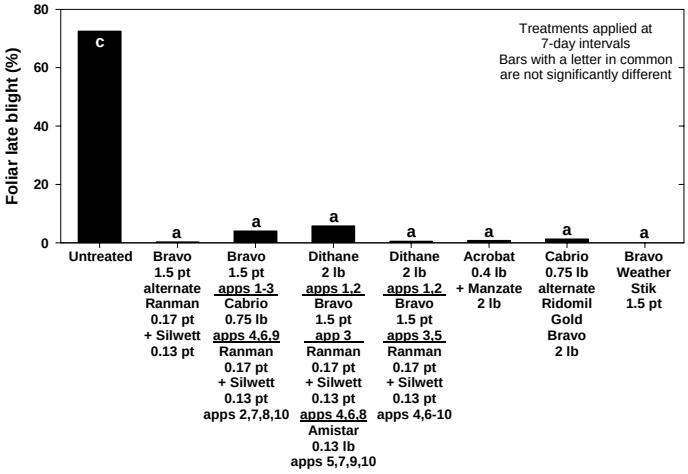
Control measures include eliminating all potato cull piles in the vicinity of tomato plantings and destroying volunteer potato plants that grow from overwintered tubers. All tomato varieties are susceptible to late blight. When late blight on potatoes has been reported in the state, fungicides that control late blight are recommended for tomatoes.

New Product Test for Late Blight

A tomato late blight study was conducted at a grower cooperator's farm in Calhoun County, MI, on a sandy clay loam soil that was previously planted to winter wheat. The field was prepared by plowing, discing, forming beds and covering with black plastic. Plots consisted of one 20-ft row spaced 8 ft apart, with 18 in. between plants. On 9 June, 72-cell 'Mt. Spring' tomato plugs were transplanted into the field. Eighteen treatments were replicated four times in a randomized complete block design. Fertilizer 10-50-10 (5 lb/A) was applied via drip irrigation weekly from 9 to 30 June, and 20-20-20 (5 lb/A) + 6% calcium (2 pt/A) was applied weekly from 1 July to 7 September. Insects were controlled with an application of Admire (24 fl oz/A) applied through the drip on 9 June and a foliar applications of Asana (9.6 fl oz/A) on 3 August. Weeds were controlled with an application of Sandea 75DF (0.66 oz/A) and Dual Magnum (1 pt/A) on 10 June, and Sencor 75DF (10 oz/A) and Fusilade DX (24 fl oz/A) on 19 July. A spore suspension (1×10^5 spores/ml) was prepared from 11-day old cultures of *Phytophthora infestans* (US-6, A1) grown on rye agar and applied to plants in the field on 31 July, 7, 14, and 21 August. Plots were kept wet 24 hr after inoculation with a mist irrigation system. Tomato early blight (*Alternaria solani*) infection was suppressed by applications of Endura 70WG (4 oz/A) on 17 July and again on 5 August. Fungicide sprays were applied using a CO_2 backpack boom sprayer equipped with three 8003XR nozzles spaced 19 in. apart, operated at 50 psi to deliver 50 gal/A. Sprays were applied on a 7-10 day schedule

on 9, 20, and 25 July; 5, 11, 19, and 27 August; and 4 September. Plants were visually assessed for foliar disease on 26 August and 9 September. Yields were taken by stripping the fruit from the three center plants of each treatment plot and the fruit was sorted by disease on 13 September.

Fig 2. Late Blight on Tomato



Disease developed 7 days after the first inoculation and spread across the plot by the last evaluation date. All treatments provided significant disease control compared to the untreated on the first evaluation date (Fig. 2). All treatments provided significantly better foliar blight control than the untreated on the last observation date. BAS 55007F 4.17SC applied alone did have a significantly higher level of disease than the other treatments. All other treatments were very effective in controlling foliar late blight symptoms. As with the foliar ratings, all treatments had less infected fruit than the untreated. The treatment of BAS 55007F 4.17SC applied alone had a higher level of infected fruit than the other chemical treatments. The remaining treatments were very effective in controlling late blight fruit infections. There were no significant differences in total yield among treatments and the untreated.