Tomato

Tuesday morning 9:00 am

Where: Grand Gallery (lower level) Room E-F
Recertification credits: 1 (1B, PRIV CORE)
CCA Credits: SW(0.5) PM(0.5) CM(1.0)
Moderator: Ron Goldy, District (Vegetables Educator, MSU Extension

9:00 a.m. Tomato Disease Update

- Mary Hausbeck, Plant Pathology Dept., MSU

9:30 a.m. Irrigation of Fresh Market Tomatoes

- Jeff Andresen, Geography Dept., MSU

10:00 a.m. High-Tunnel Tomato Production

- Ron Goldy, District (Vegetables Educator, MSU Extension

10:30 a.m. Growing and Marketing Heirloom Tomatoes

- Jeanine Davis, Horticultural Science Dept., North Carolina State Univ.

Tomato Disease Update

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Bacterial Canker

Bacterial canker is diagnosed yearly in Michigan tomato fields. Bacterial canker is caused by the bacterium, *Clavibacter michiganensis* subsp. *michiganensis* (*Cmm*), and causes plant stunting, wilting and fruit spotting. 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 infested field.

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 (75-90ºF 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.

New Product Test for Bacterial Canker

Bacterial canker is a seedborne disease that has caused great economic losses for the Michigan tomato industry. On 30 May, tomato ‘Mountain Spring’ transplants were hand-transplanted 18-inches apart into raised beds covered with black plastic. The plot was located at the Michigan State University Muck Soils Research Farm in Laingsburg, MI. The plot followed a fresh market planting design and drip irrigation was provided. The beds were 2 ft wide, 6 in. high and 50 ft long with rows spaced at 5.5 ft apart. Each

row comprised of two treatments, 22.5 ft long with a 5-ft section in the middle that was reserved for inoculated plants. Treatments were arranged in a complete randomized block design.

Treatments consisted of Kocide 2000 (copper hydroxide) at 2 lb/A alternated with Kocide 2000 at 1.5 lb/A; OxiDate (hydrogen dioxide) at 4 pt/A; Tanos (famoxadone and cymoxanil) at 0.5 lb/A alternated with Kocide 2000 at 1.5 lb/A; Actigard (acibenzolar-S-methyl) at rates of 0.02, 0.03, and 0.05 lb/A with remaining applications at 0.05 lb/A alternated with Kocide 2000 at 1.5 lb/A; untreated control. On 6 June, treatments were applied preventively and then reapplied every 5 days through 2 September. All treatments received alternating Bravo Weather Stik (chlorothalonil) at 1.5 pt/A and Manzate (mancozeb) at 2 lb/A applications to prevent fungal infections and were applied at the same time as the bactericidal treatments. All treatments were sprayed from the center of the row outward to encourage natural spread of *Cmm* from the inoculum source.

On 7 June, transplants were inoculated with *Cmm* and incubated in a greenhouse. On 9 June, three inoculated transplants were hand placed adjacent to the first plant in each treatment to serve as a source of inoculum. On 30 June, 21 July, 11 August, and 2 September, ten asymptomatic leaflets of approximately the same age and size were randomly selected from the tomato plant at each of the three sample sites that were located 0, 9 and 18 ft from the inoculum source.

In our study, *Cmm* spread 18 ft in 3 weeks (data not shown). *Cmm* populations for the Actigard-, Kocide 2000- and Tanos-treated plants were generally lower compared to plants treated with OxiDate or the untreated control, but numbers may not be statistically different. Foliar disease symptoms of OxiDate-treated plants were statistically similar to the untreated control. Actigard and Kocide 2000 offered statistically superior control of bacterial canker foliar symptoms compared with either OxiDate or the untreated control. Tanos alternated with Kocide 2000 effectively suppressed disease symptoms and was shown to be helpful in managing bacterial canker.

Table 1. Evaluation of bactericides for *Cmm* symptoms.

Treatments	Leaf incidence[z]	Unilateral wilting[y]	Plant vigor[x]
Untreated control.....	30.00 a[w]	69.75 a	5.00 a
OxiDate	40.00 a	72.75 a	4.00 a
Kocide 2000.....	10.00 bc	40.25 b	7.25 bc
Tanos alternate Kocide 2000.....	21.25 b	18.25 ab	6.00 b
Actigard alternate Kocide 2000 ..	7.50 c	18.25 b	8.00 c

[z]Percent of leaf exhibiting marginal leaf necrosis.
[y]The number of strikes exhibiting unilateral wilting over a 22.5 ft treatment row.
[x]Overall plant vigor was rated on a 1 to 10 scale with 10 being a completely disease free plant, 8: showing <10% marginal necrosis and/or minor unilateral wilting; 6: increased marginal leaf necrosis but <30% and/ or moderate unilateral wilting; 4: increased marginal leaf necrosis but less than <50% and/or severe unilateral wilting; 2: increased marginal leaf necrosis but less than <70% and/or entire plant showing unilateral wilting symptoms; and 1: dead plant.
[w]Different lower case letters within the same column denote statistical difference ($p < 0.05$).

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.

Fungal Leaf and Fruit Rots

Anthracnose is caused by the fungus *Colletotrichum coccodes* and causes a rotting of ripe fruit which reduces yield and fruit quality. Disease symptoms do not appear on the foliage. Early symptoms include slightly depressed, water-soaked circular spots that increase in size (up to 1/2"), become further sunken and may contain a pattern of concentric rings. As the fungus spreads within the fruit, a semi-soft decay occurs. Lesion development is most rapid at 80ºF and disease development is greatest during wet, rainy weather. To control the disease, a 2- or 3-year crop rotation is suggested. Also, avoidance of sandy soil sites to minimize injury from blowing sand particles will reduce anthracnose.

Early Blight is caused by the fungus *Alternaria solani* and infects foliage and ripening fruit. Infection can occur at the point of attachment to the stem and through growth cracks and wounds on the fruit. The early blight fungus causes dark brown, leathery sunken spots with concentric rings. When young fruits become infected, they may drop off prematurely. Infection is greatest in warm weather (75-85ºF). Heavy dews, extremely humid weather and abundant rainfall are essential for heavy disease pressure. To control the disease, a 3- or 4-year rotation will reduce the levels of the fungus in the soil.

Soil rot is caused by the fungus *Rhizoctonia solani* and causes slightly sunken brown spots about 1 inch in diameter on fruit that are in contact with the ground. Dark concentric markings are distinct within new spots and eventually the center of the spot may crack. Disease usually appears on ripe fruit in contact with soil. Disease is promoted by wet conditions. The pathogen is present in all field soil and affects tomato fruit whenever conditions are favorable.