Tomato Disease Workshop

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MHCREC, Mills River, NC
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Common NC Tomato Diseases & their Management

- Soilborne diseases
- Tomato spotted wilt
- Blossom end rot
- Bacterial diseases
- Leaf spots and blights
- Fungicide spray program
Bacterial wilt

(Ralstonia solanacearum)
Bacterial wilt
(Ralstonia solanacearum)
Southern stem blight (*Sclerotium rolfsii*)
Southern stem blight (*Sclerotium rolfsii*)
Southern stem blight (*Sclerotium rolfsii*)
Fusarium wilt

*(Fusarium oxysporum f.sp. lycopersici)*
Fusarium wilt
(Fusarium oxysporum fsp. lycopersici)
Verticillium wilt (Verticillium dahliae)
Verticillium wilt (*Verticillium dahliae*)
Root knot (*Meloidogyne incognita*)
Soilborne disease management practices

- Crop rotation
- Soil assay for nematodes
- Resistant varieties
- Soil fumigation
Tomato spotted wilt (tomato spotted wilt virus)
Tomato spotted wilt
(tomato spotted wilt virus)
Tomato spotted wilt (tomato spotted wilt virus)
Blossom end rot
Blossom end rot
Important Foliar Diseases

Early blight
Late blight
Powdery mildew
Bacterial spot
Bacterial speck
Bacterial canker
Early blight (Alternaria solani)
Early blight (Alternaria solani)

Early blight (Alternaria solani) is a common fungal disease that affects a wide range of crops, including tomatoes, potatoes, and sweet potatoes. It is characterized by dark brown lesions on leaves, stems, and fruit that spread quickly, leading to significant yield loss. The disease is particularly prevalent in warm, humid climates. Effective management strategies include sanitation, crop rotation, and the use of fungicides.
Early blight (*Alternaria solani*)
Collar rot - stem lesion
Powdery mildew
Specimen

For use in berries, bulb vegetables, cherry, cucurbit vegetables, fruiting vegetables, pistachios, root vegetables and strawberries

Active Ingredient:

Pyraclostrobin (carbamic acid, [2-[[1-(4-chlorophenyl)-1H-pyrazol-3-yl]oxy]methyl] phenyl)methoxy-, methyl ester) .............................................. 20.0%

Other ingredients ........................................................ 80.0%

Total ................................................................. 100.0%

EPA Reg. No.: 7969-187

Est. No.: 51036-GA-001

KEEP OUT OF REACH OF CHILDREN.

CAUTION/PRECAUCION
Late blight (*Phytophthora infestans*)
Late blight (*Phytophthora infestans*)
Late blight (*Phytophthora infestans*)
Bacterial spot on tomato

*(Xanthomonas perforans)*

*Perforans:* perforating, referring to the holes in the leaf following infection by the bacterium.
Bacterial spot on tomato

(Xanthomonas perforans)
Bacterial spot on tomato

(Xanthomonas perforans)
Bacterial Spot on Seedlings
Bacterial speck
(*Pseudomonas syringae pv. vesicatoria*)
Bacterial canker

(*Clavibacter michiganensis*)
### RECOMMENDED FOLIAR APPLICATIONS

#### Fruiting Vegetables

<table>
<thead>
<tr>
<th>Crop</th>
<th>Pest</th>
<th>Rate Per Application</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tomatoes</td>
<td>Bacterial Spot</td>
<td>Foliar application:</td>
<td>Begin applications within one week of transplanting or emergence; apply with ground equipment only. Make up to 6 weekly, sequential applications.</td>
</tr>
<tr>
<td></td>
<td>Bacterial Speck</td>
<td>1/3-3/4 oz./A</td>
<td>3/4 oz. per 100 gals. of water (minimum of 1/3 oz./A in early season and maximum of 3/4 oz./A by end of season). See table below.</td>
</tr>
</tbody>
</table>

**Notes:** Begin season with low water volumes; as plant canopy increases, the Actigard rate should increase to ensure activity. The table below provides guidance on increasing the rate through the season (a dilute carrier volume of 100 gals. of water per acre is assumed for fully grown tomato plants).

<table>
<thead>
<tr>
<th>Amount of Actigard (oz./A)</th>
<th>Gals./A</th>
<th>Weeks following transplanting</th>
</tr>
</thead>
<tbody>
<tr>
<td>1/3</td>
<td>30-50</td>
<td>0-2</td>
</tr>
<tr>
<td>1/2</td>
<td>60-70</td>
<td>3-4</td>
</tr>
<tr>
<td>3/4</td>
<td>70-100</td>
<td>5-8</td>
</tr>
</tbody>
</table>

**Notes:** (1) Use the higher rate over time, even if volume does not increase. If gallonage at any particular application is higher than in this example, increase Actigard accordingly, i.e., keep the concentration the same but do not exceed 3/4 oz./100 gals. concentration. (2) Allow 14 days between the last application and harvest. (3) Do not apply more than 6 times per crop per season. (4) Do not apply on less than 7-day interval. (5) Do not apply more than 4 oz. of Actigard per acre per season.

**Precaution:** Under certain conditions, this product, when used on tomatoes, may lead to reductions in yield. Novartis recommends that the user and/or grower test this product in order to determine its suitability for its intended use in tomatoes. Novartis makes this product available to the user and/or grower solely to the extent that the benefit and utility, in the sole opinion of the user and/or grower, outweigh the extent of potential reductions in yield of tomatoes following use of Actigard. The decision to use or not use Actigard in tomatoes must be made by each individual user and/or grower on the basis of possible reductions in yield, the severity of disease incidence, the cost of alternate disease control options, if any, and other factors.
Lower rates of Actigard in combination with bacterial spot tolerant varieties increased yield and enhanced disease suppression;

Copper was the most effective product at limiting bacterial spot severity in WNC trials; Combinations of Actigard, copper + mancozeb BMP;

Control of bacterial spot will require an integrated approach

- Cultural methods
- Chemical rotation and development of novel compounds
- Host resistance
- Seed decontamination / clean transplants
- Worker sanitation
2008 Foliar Fungicide Spray Guide for Tomatoes in NC

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Department of Plant Pathology, North Carolina State University

Tomato foliar diseases. There are several diseases that attack tomato leaves and fruit during fresh-market tomato production in North Carolina. Some diseases are caused by bacteria, such as bacterial canker (Clavibacter michiganensis subsp. michiganensis), bacterial spot (Xanthomonas perforans), and bacterial speck (Pseudomonas syringae pv. tomato). Other important foliar diseases are caused by fungi, such as early blight (Alternaria solani), late blight (Phytophthora infestans), and Septoria leaf spot (Septoria lycopersici) (see Fig. 1).

![Tomato diseases](http://www.ces.ncsu.edu/fletcher/programs/plantpath/)

**Fig 1.** Tomato diseases (from left to right): bacterial speck on fruit; bacterial spot on fruit; early blight leaf lesions; and Botrytis gray mold on fruit.

Effective chemicals. There is no SINGLE product that is effective against all important foliar tomato diseases. For example, mancozeb gives good control and chlorothalonil gives only fair control of early blight; however chlorothalonil and mixtures of mandipropamid + difenoconazole (Revus Top) are presently the best products for managing late blight. In addition, copper-based products are effective against bacterial canker, but some strains of the speck and spot bacteria have become resistant to copper. However, the use of Actigard has been shown to be effective in reducing all three bacterial diseases. And the product boscalid (Endura) has excellent activity against Botrytis gray mold and early blight. Therefore, it is necessary to use a combination of different products in a spray program to optimize management of the different tomato diseases that occur. One important consideration is that different products have different preharvest intervals (PHI). A product with a PHI greater than 1 day such as mancozeb (PHI = 5 days) cannot be used when harvests are done 2 or more times per week. Another important consideration is fungicide resistance management. For example, pathogens may develop insensitivity (resistance) to the strobilurins, i.e. Amistar, Cabrio, Quadris or Tano, if these products are used frequently. Early blight resistance to the QoI fungicides (most strobilurins) was detected in western North Carolina during the 2007 growing season.

Volume-based spray schedule. The following suggested weekly spray schedule (Table 1) takes into account the above considerations and label restrictions of different products and is based on many years of field research in NC. Labeled rates of products are usually listed on a per acre basis, but for staked tomatoes, these should be applied on a per volume basis. The reason for spraying on a per volume basis is that early in the season when plants are small, less volume (and thus, less product) is needed to obtain full coverage, than later in the season when plants are larger and more spray volume is needed to obtain full coverage. To determine your mixing rate, first determine the maximum spray volume per acre for your sprayer for fully-grown
### Table 1. Suggested weekly spray schedule and products\(^x\) for foliar tomato disease control in NC.

<table>
<thead>
<tr>
<th>Before harvest</th>
<th>Week 1</th>
<th>mancozeb (1)(^y) + copper + Actigard (1)(^y)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Week 2</td>
<td>mancozeb (2) + copper</td>
</tr>
<tr>
<td></td>
<td>Week 3</td>
<td>mancozeb (3) + strobilurin (1)(^y) + Actigard (2)</td>
</tr>
<tr>
<td></td>
<td>Week 4</td>
<td>mancozeb (4) + copper</td>
</tr>
<tr>
<td></td>
<td>Week 5</td>
<td>mancozeb (5) + Actigard (3)</td>
</tr>
<tr>
<td></td>
<td>Week 6</td>
<td>mancozeb (6) + copper</td>
</tr>
<tr>
<td></td>
<td>Week 7</td>
<td>mancozeb (7) + strobilurin (2) + Actigard (4)</td>
</tr>
<tr>
<td></td>
<td>Week 8</td>
<td>mancozeb (8) + copper + Endura (1)(^y)</td>
</tr>
<tr>
<td>During harvest</td>
<td>Week 9</td>
<td>chlorothalonil (1)</td>
</tr>
<tr>
<td></td>
<td>Week 10</td>
<td>Revus Top (1)(^y)</td>
</tr>
<tr>
<td></td>
<td>Week 11</td>
<td>chlorothalonil (2) + strobilurin (3)</td>
</tr>
<tr>
<td></td>
<td>Week 12</td>
<td>Revus Top (2)</td>
</tr>
<tr>
<td></td>
<td>Week 13</td>
<td>chlorothalonil (3)</td>
</tr>
<tr>
<td></td>
<td>Week 14</td>
<td>Revus Top (3)</td>
</tr>
<tr>
<td></td>
<td>Week 15</td>
<td>chlorothalonil (4) + strobilurin (4)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Finish season with chlorothalonil</td>
</tr>
</tbody>
</table>

\(^x\) Mancozeb, copper, chlorothalonil, and strobilurin are common names for products sold under various trade names (see Table 2). Actigard, Endura and Revus Top are trade names of products from Syngenta, BASF and Syngenta respectively. Refer to labels, Table 2 below and the discussion in the text for rates to use in volume-based spraying.

\(^y\) Total number of applications per season is restricted by the label.

\[ \frac{1}{2} \times \text{Actigard} = 0.37 \text{ oz/Acre} \]
Submitting vegetable samples to my lab:

Call first to let us know we should be expecting sample (Fridays bad days).

Collect entire plant if possible; Multiple plants best.

Can do digital diagnosis sometimes: take pics of entire plant and symptoms, topside and bottom side of leaves.
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