Diseases of Peppers
Phytophthora Crown and Root Rot
Bacterial Spot
TSWV

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**Phytophthora capsici**

**Broad Host Range**
- Tomatoes
- Peppers
- Melons
- Squash
- Weeds?

**Diseases:**
- Post-emergence damping-off
- Crown and Root Rot
- Blight (foliar)
- Fruit Rot
Crown and Root Rot
Foliar infections (blight)

- Vine blight - pumpkin

- More of a problem in climates with higher humidity or summer rainfall
Fruit Rots
Disease spread and soil survival

*Phytophthora capsici* produces:
- sporangia and motile zoospores
- oospores which survive up to 3 years in field soil
Aggravating conditions

- Saturated soil (as few as 5 to 6 hours!!)
- Heavy soils, compacted soils
- Warm, wet conditions
- Soil salinity or other plant stress
2008 Field Trial

- UCD Plant Pathology Farm
- Sweet Bell cv. ‘Wizard’
- Soil inoculated with *Phytophthora capsici*
- Four fungicides (plus non-treated control) evaluated in replicated design
- Fungicides applied as a soil drench (450 gallons per acre) at roughly 2-wk intervals (total of four applications)
- Furrow-irrigated weekly
# Fungicide Programs Evaluated in 2008

<table>
<thead>
<tr>
<th>Fungicide Program</th>
<th>Product(s)</th>
<th>Rate/acre</th>
<th>Active ingredient(s)</th>
<th>Timings</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>untreated control</td>
<td>–</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>2</td>
<td>Presidio +</td>
<td>3 oz</td>
<td>fluopicolide</td>
<td>AC</td>
</tr>
<tr>
<td></td>
<td>Fosphite</td>
<td>4 qt</td>
<td>phosphorous acid</td>
<td>AC</td>
</tr>
<tr>
<td></td>
<td>alt. Ridomil Gold</td>
<td>1 pt</td>
<td>mefenoxam</td>
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<td>4</td>
<td>Ridomil Gold</td>
<td>1 pt</td>
<td>mefenoxam</td>
<td>ABCD</td>
</tr>
<tr>
<td></td>
<td>alt. Fosphite</td>
<td>4 qt</td>
<td>phosphorous acid</td>
<td>AC</td>
</tr>
<tr>
<td>5</td>
<td>Ridomil Gold</td>
<td>1 pt</td>
<td>mefenoxam</td>
<td>AD</td>
</tr>
<tr>
<td></td>
<td>alt. Revus *</td>
<td>8 oz</td>
<td>mandipropamid</td>
<td>BC</td>
</tr>
</tbody>
</table>

*z Not registered for use on tomatoes California  * Ridomil Gold applied at 1 pt per application
Pepper survival in inoculated soil

Fungicide Programs and Timings

- Untreated control
- Presidio 3oz + Fospbate (AC) alt Ridomil Gold (BD)
- Presidio 4oz + Fospbate (AC) alt Ridomil Gold (BD)
- Ridomil Gold + Fospbate (AC) alt Ridomil Gold (BD)
- Ridomil Gold (A) Revus (B) Revus (C) Ridomil Gold (D)

2008 trial
2009 Field Trial

- Similar to 2008 trial except:
  - Less Phytophthora inoculum applied to soil
  - Sweet Bell cv. ‘Baron’
  - Chemicals (and irrigation) applied via surface drip system
  - Chemicals applied monthly (3 applications total)
- In addition to chemical control programs, Phytophthora-tolerant pepper cultivars were also evaluated in an adjacent trial
## Fungicide Programs Evaluated in 2009

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<td>Ridomil Gold</td>
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<td>ABC</td>
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<tr>
<td>4</td>
<td>Fosphite</td>
<td>3 qt</td>
<td>phosphorous acid</td>
<td>ABC</td>
</tr>
<tr>
<td>5</td>
<td>BAS651(^\text{y})</td>
<td>13.7 fl oz</td>
<td>?</td>
<td>ABC</td>
</tr>
<tr>
<td>6</td>
<td>Ridomil Gold</td>
<td>1 pt</td>
<td>mefenoxam</td>
<td>AC</td>
</tr>
<tr>
<td></td>
<td>alt. Revus(^z)</td>
<td>8 oz</td>
<td>mandipropamid</td>
<td>B</td>
</tr>
<tr>
<td>7</td>
<td>Forum</td>
<td>6 oz</td>
<td>dimethomorph</td>
<td>ABC</td>
</tr>
</tbody>
</table>

\(^\text{y}\) Experimental, not registered by US EPA

\(^\text{z}\) Not registered for use on tomatoes in California

Note: Ridomil Gold applied at 1 pt per application
Pepper survival in inoculated soil

Survival

Fungicide Programs
- Ridomil DC
- Revus
- Ridomil
- Presidio
- UTC
- BAS651
- Forum

Transplanted June 5th

2009 trial
2009 Trial Results

Yield (tons per acre):

- **Ridomil alt. Revus**: 19.03
- **Ridomil**: 19.05
- **Presidio**: 14.52
- **non-treated control**: 12.20
- **BAS651**: 12.97
- **Forum**: 11.39
- **Foshite**: 12.36

Survival at 90 days after transplanting:
## Survival of Phytophthora-tolerant varieties in inoculated soil

<table>
<thead>
<tr>
<th>Variety/line</th>
<th>Pepper survival at 90 days</th>
<th>Yield (tons/acre)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Baron</td>
<td>77.4% +/- 5.9%</td>
<td>9.74 +/- 1.5</td>
</tr>
<tr>
<td>Prophet</td>
<td>95.0% +/- 3.3%</td>
<td>15.87 +/- 1.7</td>
</tr>
<tr>
<td>Sakata 77824</td>
<td>97.4% +/- 1.6%</td>
<td>15.15 +/- 1.3</td>
</tr>
<tr>
<td>Sakata 77827</td>
<td>100.0%</td>
<td>not harvested</td>
</tr>
<tr>
<td>Sakata 77825</td>
<td>100.0%</td>
<td>12.94 +/- 0.6</td>
</tr>
<tr>
<td>Sakata 77826</td>
<td>98.5% +/- 0.9%</td>
<td>19.16 +/- 0.7</td>
</tr>
</tbody>
</table>
## Chemical Control of Phytophthora

<table>
<thead>
<tr>
<th>Chemical</th>
<th>FRAC group</th>
<th>Products</th>
</tr>
</thead>
<tbody>
<tr>
<td>Metalaxyl/mefenoxam</td>
<td>4</td>
<td>Ridomil, Ridomil Gold, Ridomil Gold Bravo, Ridomil Gold MZ &amp; many others</td>
</tr>
<tr>
<td>fluopicolide</td>
<td>43</td>
<td>Presidio</td>
</tr>
<tr>
<td>fenamidone</td>
<td>11</td>
<td>Reason (suppression only – foliar blight on foliage &amp; fruit)</td>
</tr>
<tr>
<td>phosphorous acid materials</td>
<td>33</td>
<td>Various products</td>
</tr>
</tbody>
</table>

Always check labels before making recommendations or applications!
Chemical control of Phytophthora

- Resistance concerns

- Metalaxyl/mefenoxam may degrade rapidly in soils with a history of repeated use

- How to get the materials to where they need to be to prevent infection?
Cultural Control

- Rotation out of tomatoes, peppers and cucurbits for 3+ years
- Clean equipment of soil when leaving infested fields
- Don’t reuse water draining from problem fields
- Plant susceptible crops on well-drained soils
- In heavy soils, use alternate furrow irrigation or well-managed drip irrigation
- Tolerant pepper varieties (cv. ‘Revolution’, cv. ‘Prophet’)
Bacterial Spot
TSWV
Feeding Damage

Non-Viruliferous Male

Non-Viruliferous Female

Viruliferous Male

Viruliferous Female
Electrical Penetration Graph (EPG)
8 Hour EPG Overview

Non-Viruliferous Male

Non-Viruliferous Female

Viruliferous Male

Viruliferous Female
Conclusion

- Viruliferous males spend more time feeding than non-viruliferous males

- Viruliferous females spend less time feeding (and more time searching for new feeding sites) than non-viruliferous females