Managing Phytophthora blight
(*Phytophthora capsici*)
in Pumpkins

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Phytophthora Blight of Pumpkins
(*Phytophthora capsici*)

- Worldwide occurrence
- *P. capsici* affects >50 species in 15 plant families
- The most important hosts: cucurbits and peppers
- Plant infection: any time during growth and after harvest
Phytophthora Blight of Pumpkins
(Phytophthora capsici)

- Crop losses: Up to 100%
- Resistance: No resistant variety
- Management: No single method with adequate control; integrated management needed
- With heavy rains: No effective fungicides

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Phytophthora blight of pumpkin
Managing Phytophthora Blight of Pumpkins

- Manage seedling death
- Manage vine, leaf, and fruit infection in the field
- Manage fruit infection during and after harvest
Managing Phytophthora Blight of Pumpkins

Management tactics

- Use field with no history of Phytophthora blight
- Crop rotation
- Seed treatment
- Scouting field
- Removing infected plants in low area
Managing Phytophthora Blight of Pumpkins

- Management tactics
  - Low soil moisture (good drainage)
  - Avoid contaminated irrigation water
  - Apply effective fungicides
  - Sanitation
  - Rely on local research (genetic variation of the pathogen)
Managing Phytophthora Blight of Pumpkins

- Step-wise management
  - Use field with no history of Phytophthora blight
  - Crop rotation: know host range and pathogen survival
# Phytophthora Blight Management

Host range: 36 crops and 9 weed species

<table>
<thead>
<tr>
<th>Host</th>
<th>Non-Host</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cantaloupe</td>
<td>Corn</td>
</tr>
<tr>
<td>Cucumber</td>
<td>Pigweed</td>
</tr>
<tr>
<td>Gourd</td>
<td>Soybean</td>
</tr>
<tr>
<td>Eggplant</td>
<td>Broccoli</td>
</tr>
<tr>
<td>pepper</td>
<td>Kale</td>
</tr>
<tr>
<td>Beet</td>
<td>Cabbage</td>
</tr>
<tr>
<td>Pumpkin</td>
<td>Crabgrass</td>
</tr>
<tr>
<td>Squash</td>
<td>Basil</td>
</tr>
<tr>
<td>Radish</td>
<td>Chive</td>
</tr>
<tr>
<td>Zucchini</td>
<td>Sandbur</td>
</tr>
<tr>
<td>Watermelon</td>
<td>Celery</td>
</tr>
<tr>
<td>Turnip</td>
<td>Dill</td>
</tr>
<tr>
<td>Honeydew</td>
<td>Wheat</td>
</tr>
<tr>
<td>Swiss-chard</td>
<td>Water hemp</td>
</tr>
<tr>
<td>Carrot</td>
<td>Barley</td>
</tr>
<tr>
<td>Spinach</td>
<td>Cocklebur</td>
</tr>
<tr>
<td>Nightshade</td>
<td>Lamb’s-quarters</td>
</tr>
<tr>
<td>Onion</td>
<td>Mustard</td>
</tr>
<tr>
<td>Green bean</td>
<td>Cauliflower</td>
</tr>
<tr>
<td>Lima bean</td>
<td>Parsley</td>
</tr>
<tr>
<td>Tomato</td>
<td>Puncture</td>
</tr>
<tr>
<td>Velvet-leaf</td>
<td>vine</td>
</tr>
</tbody>
</table>
Phytophthora Blight Management

Survival of *Phytophthora capsici* in soil

- 5,000 oospores/g soil
- 4 soil type x 3 depths (2, 10, 25 cm) for 4 years
% Oospores recovered

Oospore survival in soil

5,000 Oospores/g soil

Depth:
- 2 cm
- 10 cm
- 25 cm
- Average

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Germination of oospores recovered

5,000 Oospores/g soil

Germination of oospores recovered

Depth:
- 2 cm
- 10 cm
- 25 cm
- Average
Managing Phytophthora Blight of Pumpkins

- Step-wise management
  - Crop rotation: ≥3 years with non-host crops
    - And EFFECTIVE Weed Control
Managing Phytophthora Blight of Pumpkins

- Step-wise management
  - Seed treatment to prevent seedling death
Seedling death of pumpkins by *P. capsici*
Managing Phytophthora Blight of Pumpkins

- Prevent seedling infection
  - Seed treatment with Apron XL LS (0.64 fl oz/100 lb seed)
  - Seed treatment prevent seedling infection for 5 weeks from sowing seed

No longer seedling death in Illinois since 2003
Managing Phytophthora Blight of Pumpkins

Management tactics

- Scout field
- Remove infected plants in low areas in early season
Managing Phytophthora Blight of Pumpkins

- Minimize inoculum build up (early season)
  - Remove or disk small area with Phytophthora infection
Managing Phytophthora Blight of Pumpkins

- **Management tactics**
  - Low moisture (good drainage)
  - Avoid contaminated water
Managing Phytophthora Blight of Pumpkins

Management tactics

- Apply effective fungicides for managing vine, leaf, and fruit infection in the field
Pumpkin vine infection by *P. capsici*
Pumpkin leaf infection by *P. capsici*
Pumpkin fruit infection by *P. capsici*
## Fungicides for Phytophthora blight

<table>
<thead>
<tr>
<th>Name</th>
<th>FRAC Code</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cyazofamid (Ranman)</td>
<td>21</td>
</tr>
<tr>
<td>Dimethomorph (Forum)</td>
<td>40</td>
</tr>
<tr>
<td>Dimethomorph + Ametoctradin (Zampro)</td>
<td>40, 45</td>
</tr>
<tr>
<td>Famoxadon + Cymoxanil (Tanos)</td>
<td>11, 27</td>
</tr>
<tr>
<td>Fluazinam (Omega 500F)</td>
<td>29</td>
</tr>
<tr>
<td>Fluopicolide (Presidio)</td>
<td>43</td>
</tr>
<tr>
<td>Mandipropamid (Revus)</td>
<td>40</td>
</tr>
<tr>
<td>Mefenoxam (RG EC, RG Copper)</td>
<td>4</td>
</tr>
<tr>
<td>Oxathiapiprolin (Orondis)</td>
<td>U15</td>
</tr>
<tr>
<td>Phosphonates (ProPhyt, ...)</td>
<td>33</td>
</tr>
<tr>
<td>Zoxamide + mancozeb (Gavel 75DF)</td>
<td>22, M</td>
</tr>
</tbody>
</table>
# ACROBATE MZ in a Commercial Pumpkin Field – 2001

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Disease Incidence (%)</th>
<th>Yield (T/A)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Leaves</td>
<td>Vines</td>
</tr>
<tr>
<td>Sprayed</td>
<td>7.5</td>
<td>13</td>
</tr>
<tr>
<td>Control</td>
<td>34.4</td>
<td>40</td>
</tr>
</tbody>
</table>
Pumpkin Phytophthora Trial-2017

- Location: South Pekin, Illinois
- Seed sowing: 15 May
- Fungicide sprays:
  - 20 Jun, 4 Jul, 11 Jul, 18 Jul, 1 Aug, 8 Aug, 15 Aug
- First note of infection
  - Vines: 15 July
  - Fruits: 29 July
## Pumpkin Phytophthora Trial - 2017

<table>
<thead>
<tr>
<th>Fungicides</th>
<th>Disease Incidence (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Vine (8/12)</td>
</tr>
<tr>
<td>Control</td>
<td>45.00 a</td>
</tr>
<tr>
<td>Elumin <em>alt</em> Presidio</td>
<td>6.25 c</td>
</tr>
<tr>
<td><em>alt</em> Revus</td>
<td></td>
</tr>
<tr>
<td>Presidio <em>alt</em> Revus</td>
<td>7.50 c</td>
</tr>
<tr>
<td>Orondis Gold 200 (4.8 fl oz) <em>alt</em> Revus</td>
<td>11.25 c</td>
</tr>
<tr>
<td>Ranman + Silwet</td>
<td>10.00 c</td>
</tr>
<tr>
<td>Ranman</td>
<td>8.75 c</td>
</tr>
<tr>
<td>Revus <em>alt</em> Ranman</td>
<td>12.50 c</td>
</tr>
<tr>
<td><em>alt</em> Orondis Opti (1.75 pt)</td>
<td></td>
</tr>
<tr>
<td>Revus <em>alt</em> Ranman</td>
<td>7.50 c</td>
</tr>
<tr>
<td><em>alt</em> Orondis Opti (2.5 pt)</td>
<td></td>
</tr>
<tr>
<td>Fungicides</td>
<td>Disease Incidence (%)</td>
</tr>
<tr>
<td>----------------------------------</td>
<td>-----------------------</td>
</tr>
<tr>
<td></td>
<td>Vine (8/12)</td>
</tr>
<tr>
<td>Revus</td>
<td>5.00 c</td>
</tr>
<tr>
<td>Revus + Activator-90</td>
<td>6.25 c</td>
</tr>
<tr>
<td>Revus + Kocide <em>alt</em></td>
<td>12.50 c</td>
</tr>
<tr>
<td>Orondis Opti + Kocide</td>
<td>8.75 c</td>
</tr>
<tr>
<td>Orondis Opti (2.5 pt)</td>
<td>6.25 c</td>
</tr>
<tr>
<td>Forum</td>
<td>23.75 b</td>
</tr>
<tr>
<td>Gavel</td>
<td>8.75 c</td>
</tr>
<tr>
<td>Omega</td>
<td>6.25 c</td>
</tr>
<tr>
<td>Tanos</td>
<td>15.00 bc</td>
</tr>
<tr>
<td>Orondis Gold-200 (9.6 floz)</td>
<td>10.00 c</td>
</tr>
</tbody>
</table>
Managing Phytophthora Blight of Pumpkin

- Effective Fungicides
  - Revus + Kocide + Activator-90
  - Orondis Opti (high rate)
  - Orondis Ultra
  - Ranman + Kocide + Silwet
  - Elumin
  - Omega
New Fungicides

- **Orondis** (oxathiapiprolin)
  - **Orondis Gold-200** (oxathiapiprolin) (FRAC: U15)
  - **Orondis Apti** (oxathiapiprolin + chlороthalonil) (FRAC: U15, M5)
  - **Orondis Ultra** (oxathiapiprolin + mandipropamid) (FRAC: U15, 40)
Orondis (oxathiapiproloin) fungicides (FRAC: U15)

- Alternate application of Orondis fungicides with fungicides with different modes of actions.
- Not more than 1/3 of fungicide applications should be Orondis (e.g., 1/3, 2/6, 3/9)
Managing Phytophthora Blight of Pumpkins

A recommendation (up to 6 sprays)

1) Orondis Ultra
2) Ranman + Silwet
3) Revus + Activator-90
4) Orondis Ultra
5) Ranman + Silwet
6) Revus + Activator-90
Managing Phytophthora Blight of Pumpkins

- 2nd recommendation (up to 6 sprays)
  1) Revus + Activator-90
  2) Orondis Opti (high rate)
  3) Ranman + Silwet
  4) Revus + Activator-90
  5) Orondis Opti (high rate)
  6) Ranman + Silwet
Managing Phytophthora Blight of Pumpkins

- 3rd recommendation
  1) Revus + Activator-90
  2) Ranman + Silwet

I need an additional year of testing with Elumin in Illinois
Omega can be considered
Managing Phytophthora Blight of Pumpkins

- Management tactics
  - Sanitation
Pumpkin fruit rot in the field, caused by *Phytophthora capsici*
Pumpkin fruit rot in bins in storage, caused by *Phytophthora capsici*
A sanitation problem: disinfect your hands after touching infected fruit and before touching uninfected fruits – Use ethanol
Managing Phytophthora Blight of Pumpkins

- Management tactics
  - Rely on local research
    - (genetic variation of the pathogen)
Phytophthora capsici
Managing Phytophthora Blight Using Cover Crops

Cultural practices

- **Cover crop (mustard)**
  - Mustard extracts reduced colony growth and oospore germination
  - Mustard cover crop did not reduce *P. capsici* infection in the fields
Drip-Delivery
Managing Phytophthora Blight

- **Recommended practices**
  - ≥3 years of crop rotations/weed control
  - Seed treatment with Apron XL LS (0.64 fl oz/100 lb seed)
  - Avoid using contaminated water
  - Disk localized infected plants (areas)
  - Fungicide applications (spray)
  - Sanitation during harvest
Crown infection of a squash plant by *P. capsici*
Squash fruit infection by *P. capsici*
Cucurbit fruit infection by *P. capsici*
Pepper plants infected by *P. capsici*
Pepper fruit infected by *P. capsici*
Questions/Comments