

# **Disease Management in Tomatoes and Peppers**

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# Major Diseases of Tomatoes and Peppers in Illinois

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## Tomatoes

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- **Septoria Blight**
- **Late Blight**
- **Leaf Mold**
- **Bacterial Diseases**

## Peppers

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- **Phytophthora Blight**

# Major Diseases of Tomatoes

## (Septoria Leaf Blight)

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- Fungal Disease: *Septoria lycopersici*
- Causing rapid foliage blight
- Seed- and residue-borne disease
- Occurs throughout the season



**Septoria Blight of Tomato**

# Septoria Leaf Blight of Tomato

## (Disease Management)

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- Plant pathogen-free seed
- Crop rotation: 3 years
- Remove plant debris after harvest
- Control weeds
- Chemical control:
  - Quadris, Amistar, Quadris Opti, Cabrio
  - Reason, Scala, Gavel, Endura
  - Maneb, Mancozeb, Chlorothalonil, Ziram

# **Septoria Leaf Blight of Tomato**

## **(Disease Management)**

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➤ **Effective Chemical Control:**

**Quadris + Kocide-3000**

**alternated with**

**Bravo Weather Stik + Kocide-3000**

**Weekly intervals**



# Major Diseases of Tomatoes

## (Late Blight)

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- First report in Europe in 1845
- Now, occurs all over the world
- Pathogen: *Phytophthora infestans*
- A disease of cool and wet conditions
- Common disease in northern US
- Not a common diseases in Illinois
- Occurred in 2009, but NOT in 2010



**Late blight on tomato leaves**





**Late blight on  
tomato stems**





# Late blight of tomato plants



# Late Blight of Tomato

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- **Management: Cultural and Chemical**
  - ❖ **Cultural management**
    - Avoid inoculum
    - Keep plants as dry as possible
    - Remove and destroy infected plants
    - Clean up the site after harvest
    - Resistance: no reliable tomato cultivar



# Late Blight of Tomato

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## ➤ Management: Cultural and Chemical

### ❖ Chemical control

- Commercial fields: Maneb, Mancozeb, Chlorothalonil, Coppers Forum, Gavel, Ranman, Reason, Revus, Tanos, Ridomil Gold
- Organic fields: Serenade, Sonata, Coppers
- Home gardens: Maneb, Mancozeb, Chlorothalonil, Coppers



# Major Diseases of Tomatoes

## (Leaf Mold)

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- A major disease in indoor production
- A worldwide disease
- Causal agent: fungus *Fulvia fulva*
- A diseases of high humidity
- Occurred in 2009 and 2010 in high tunnels
- Not common in open fields

# Leaf mold of tomato

- ❖ Pale green lesions on upper leaf surface
- ❖ Fungus sporulate on lower leaf surface
- ❖ Infection first on old leaves and moves up
- ❖ Leaves weather, plant dies



**Upper leaf surface**



**Lower leaf surface**





**Leaf mold of tomato in a high tunnel**

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# Leaf Mold of Tomato

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- **Notes on the pathogen the disease:**
  - ❖ **Fungus may survive as conidia and as sclerotia on plant debris, seed, and soil**
  - ❖ **Sclerotia produce conidia**
  - ❖ **Conidia initiate infection**
  - ❖ **Conidia spread by water-splash, air current, mechanical means, insects**
  - ❖ **Spore germination: in water or >85% RH, at 40-94°F (optimum 75-78°F)**
  - ❖ **Symptoms appear 10 days after infection**



# Leaf Mold of Tomato

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## ➤ Management: **Cultural** and **Chemical**

### ❖ **Cultural practices**

- Reduce primary inoculum
- Good air circulation
- Keep temperatures above 60°F
- Avoid wetting leaves
- Avoid excessive shading of plants
- Remove and destroy plant debris
- Steam greenhouse at 135°F for 6 hours

# Leaf Mold of Tomato

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- **Management: Cultural and Chemical**
  - ❖ **Chemical control:**
    - Cover the foliage thoroughly with fungicides
    - Available fungicides:  
**Termil (chlorothalonil), Flint, Quadris**

# Major Diseases of Tomatoes (Bacterial Diseases)

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➤ **Bacterial Canker:**

*Clavibacter michiganense* pv. *michiganense*

➤ **Bacterial Spot**

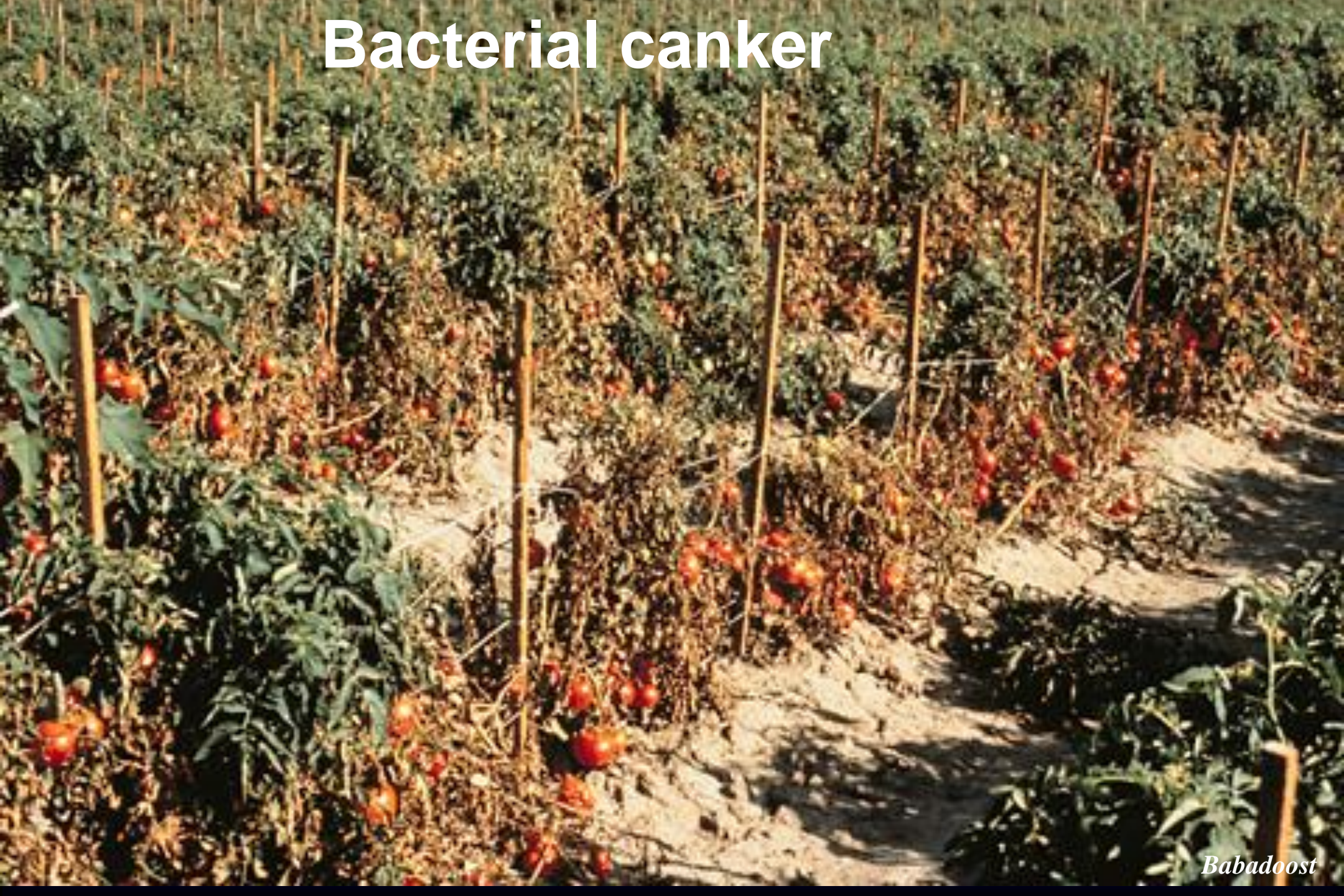
*Xanthomonas campestris* pv. *vesicatoria*

➤ **Bacterial Speck**

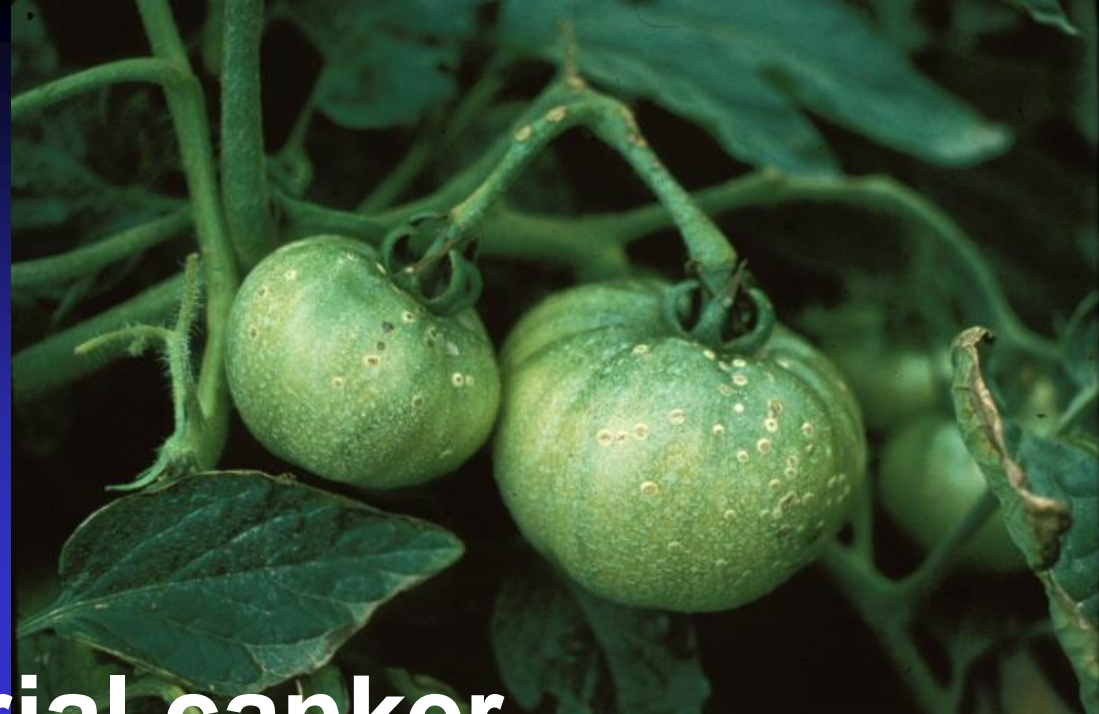
*Pseudomonas syringae* pv. *tomato*



# Bacterial canker







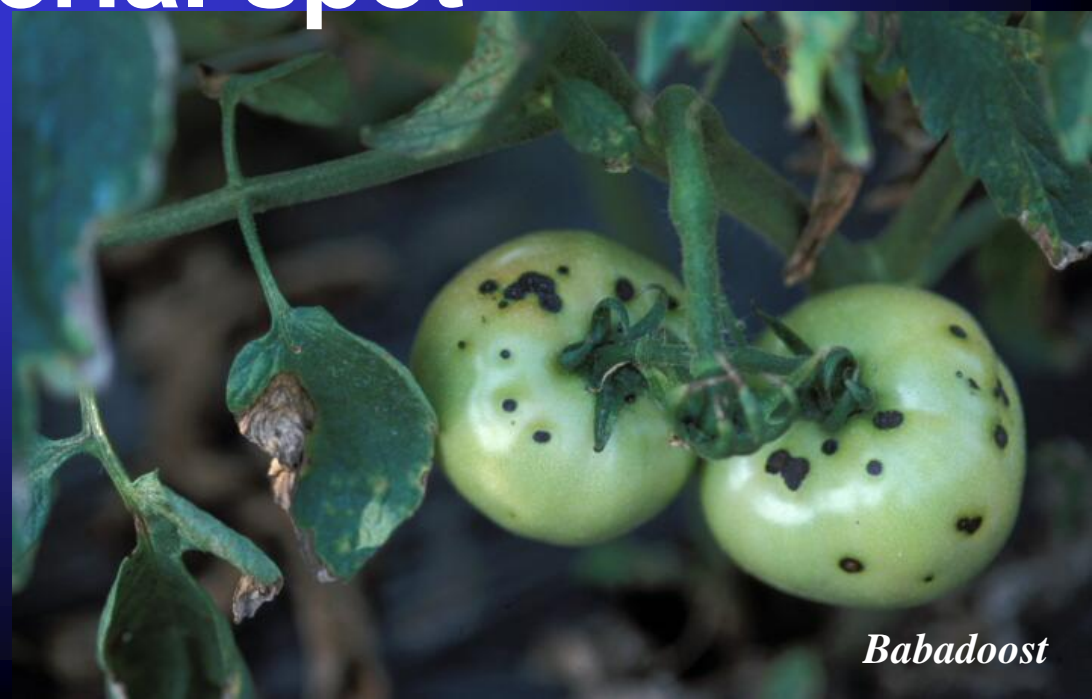
# Bacterial canker







# Bacterial spot



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**Bacterial spot**





# Bacterial speck







**Bacterial speck**



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# Managing Bacterial Diseases of Tomatoes

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## ➤ Seed and Seedlings:

- ✓ Purchase certified pathogen-free seed or disease-free seedlings
- ✓ Select resistant/tolerant varieties, if available
- ✓ Purchase treated seed

# Managing Bacterial Diseases of Tomatoes

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## ➤ Greenhouse Practices:

- ✓ Clean the building, tables, flats, hoes, .....
- ✓ Soil sterilization with steam, not with methyl bromide.
- ✓ Scout weekly. If a bacterial disease is detected, consider all plants at the location to be contaminated.
- ✓ Keep varieties separated.
- ✓ Destroy all volunteer tomatoes and other plants.
- ✓ Use new crates and boxes OR clean the old ones.
- ✓ Low moisture, avoid splashing.
- ✓ Transplant when the foliage is dry.



# Managing Bacterial Diseases of Tomatoes

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## ➤ Field Sanitation:

- ✓ Remove all plastics from field before starting the new crop.
- ✓ Remove all old stakes and ties from field before starting the new crop.
- ✓ Use new stakes and ties OR wash and bleach if they are to be reused.

# Managing Bacterial Diseases of Tomatoes

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## ➤ Field Practices:

- ✓ **A 3-year rotation with a non-host.**
- ✓ **Do not enter the field if the foliage is wet.**
- ✓ **Do not prune/clip plants if the foliage is wet.**
- ✓ **Clippers and pruning tools should be disinfested between plantings and rows.**
- ✓ **Clean transplanting equipments before and after each use.**
- ✓ **Remove infected plants or plow in the spot.**

# Managing Bacterial Diseases of Tomatoes

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## ➤ Field Practices:

- ✓ **Avoid cull pile in the field.**
- ✓ **Control weeds & volunteer plants.**
- ✓ **Copper spray (start spray before disease starts).**
- ✓ **Actigard (low rate early season, high rate late season)**
- ✓ **Tanos – tank mix/alternate with another compound**
- ✓ **Quintec fungicide – NOT Sufficient Data**



# Phytophthora Blight of Peppers

## *(Phytophthora capsici)*

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### Importance:

- Worldwide occurrence
- Affects >50 species in 15 plant families
- The most important disease of peppers and cucurbits in the US
- Causes up to 100% crop losses



**Phytophthora blight of bell pepper**

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PER PLANT (ROOT AND  
CROWN INFECTION)

# Phytophthora crown infection of peppers

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**Phytophthora blight of pepper**

# Phytophthora Blight of Peppers (Management)

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- **Resistant cultivars**
- **Chemical control**
- **Cultural practices**



# Phytophthora Blight of Peppers (Management)

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- **Resistant cultivars**

# Evaluating pepper cultivars for resistance to *Phytophthora capsici*





# Pepper Cultivars Resistant to Phytophthora Blight

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## Results of greenhouse and field trials

- Alliance
- Aristotle
- Emerald Isle
- Enza
- Paladin
- Reinger
- Revolution



# Phytophthora Blight of Peppers (Chemical Control)

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- Since 2000, we have tested more than 40 fungicides for their efficacy for control of *Phytophthora capsici*

# Phytophthora Blight Management (Chemical Control)

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- 2000-2009: Spray application
- 2010: Drip-irrigation delivery







# Fungicides for Control of *Phytophthora capsici*

## ➤ Effective Fungicides

- \*\* **Cyazofamid** (Ranman 400SC)
- \*\* **Captan** (Maestro 80DF)
- \* **Dimethomorph** (Forum 4.16SC )
- \*\* **Famoxadon + Cymoxanil** (Tanos 50WDG)
- \* **Fluopicolide** (Presidio 4SC)
- \*\* **Mandipropamid** (Revus 2.09SC)
- \* **Mefenoxam** (Ridomil G. EC 4SC, R. G. Copper 65WP)
- **Phosphorous acid** (ProPhyt) – **inconsistent results**
- **Zampro 525SC** – **further studies needed**

**No fungicide is effective with heavy rainfalls**

# Fungicides for Control of Phytophthora Blight of Peppers

<u>Fungicide Name</u>	<u>FRAC Code</u>
<b>Cyazofamid (Ranman 400SC)</b>	<b>21</b>
<b>Dimethomorph (Forum)</b>	<b>40</b>
<b>Famoxadon + cymoxanil (Tanos)</b>	<b>11, 27</b>
<b>Mandipropamid (Revus)</b>	<b>40</b>
<b>Mefenoxam (RG EC, RG Copper)</b>	<b>4</b>
<b>Fluopicolide (Presidio)</b>	<b>43</b>
<b>Phosphonates (ProPhyt, .....)</b>	<b>33</b>



# Phytophthora Blight of Peppers (Cultural Methods)

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- **Crop rotation**
  - ❖ **Host range of the pathogen**
  - ❖ **Survival of the pathogen in soil**
- **Sanitation**

# Phytophthora Blight Management

(Host Range: 36 Crops and 9 Weed Species)

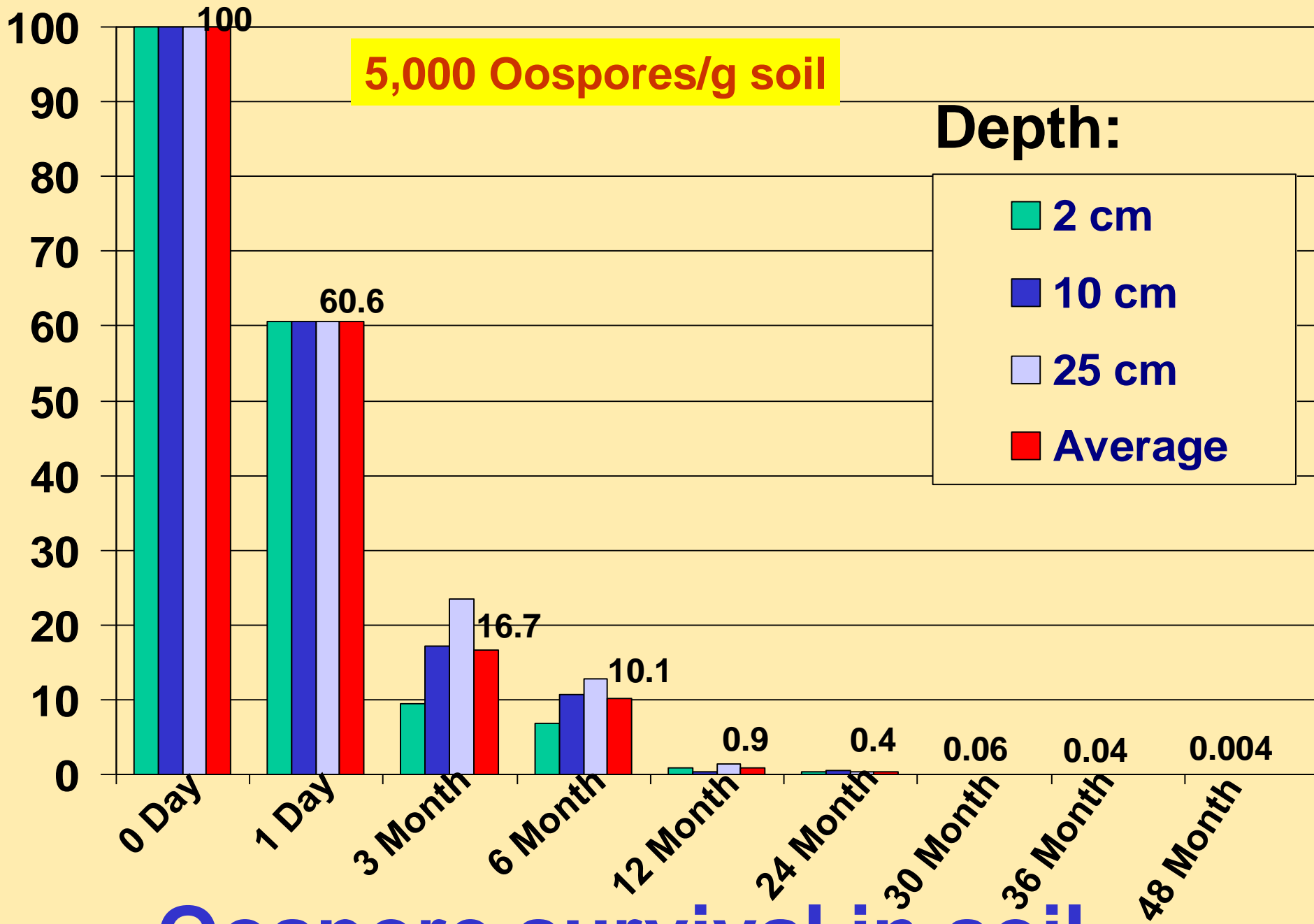
## Host

## Non-Host

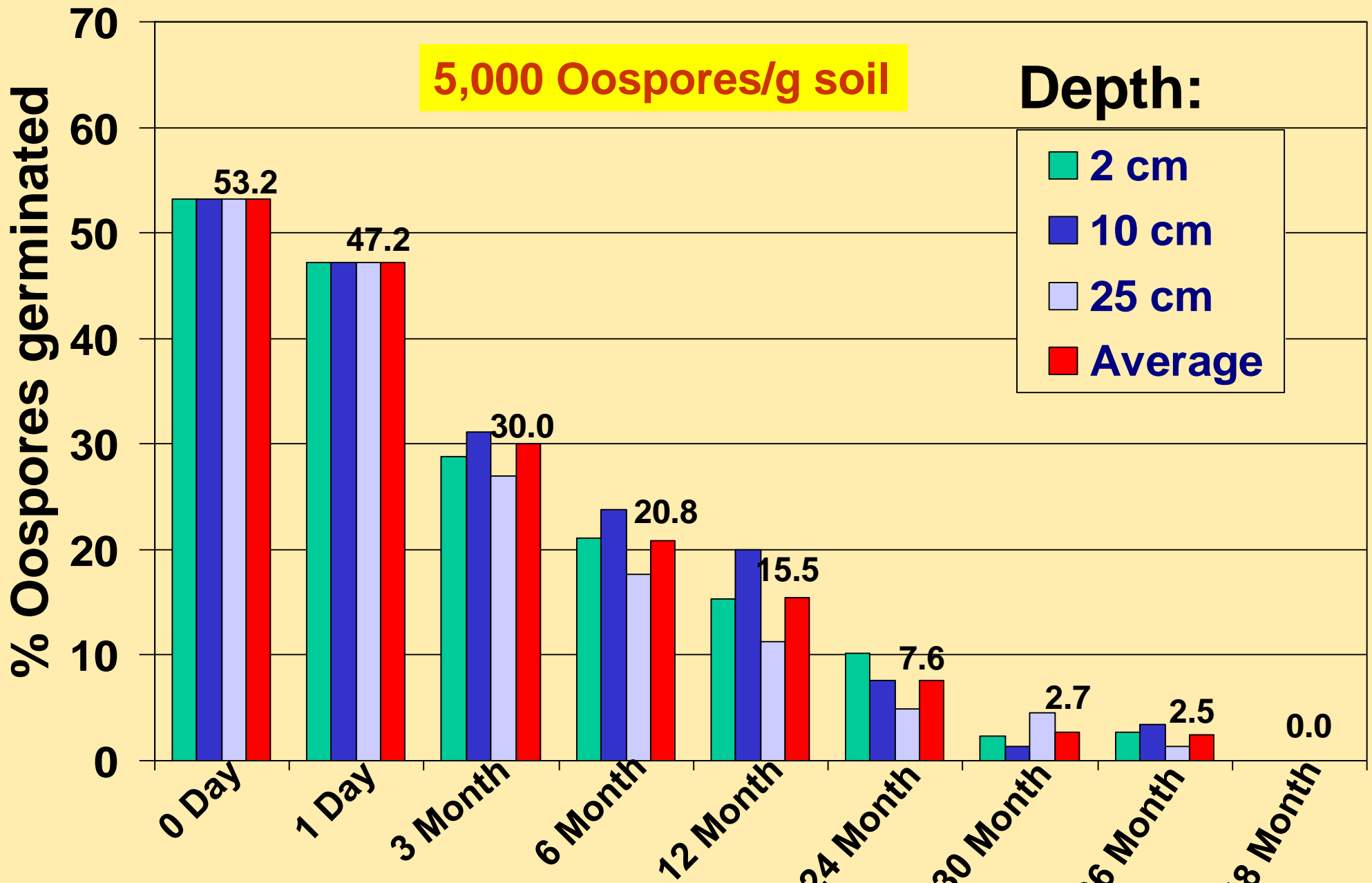
Cantaloupe	Cucumber	Gourd	Corn	Pigweed	Soybean
Eggplant	pepper	Beet	Broccoli	Kale	Cabbage
Pumpkin	Squash	Radish	Crabgrass	Basil	Chive
Zucchini	Watermelon	Turnip	Sandbur	Celery	Dill
Honeydew	Swiss-chard	Carrot	Wheat	Water hemp	Barley
Spinach	Nightshade	Onion	Cocklebur	Lamb's-quarters	
Green bean	Lima bean	Tomato	Mustard	Cauliflower	Velvet-leaf
Snow pea	Tobacco	Parsley	Puncture vine		



**% Oospores recovered**



# Oospore survival in soil



# Germination of oospores recovered



# Managing Phytophthora Blight

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- **Recommended practices**
  - ❖ **Plant resistant cultivars**
  - ❖ **≥3 years of effective crop rotations**
  - ❖ **Grow on raised beds**
  - ❖ **Avoid using contaminated water**
  - ❖ **Sanitation to prevent pathogen spread**
  - ❖ **Fungicide applications (7-day, alternate)**
  - ❖ **Tolerant cultivars with fungicides**

# QUESTIONS