

# Diagnosing Common Vegetable Diseases

Inga Meadows, NC State University  
Extension Vegetable Pathologist

Mountain Horticultural Crops Research & Extension Center  
2016 Organic Growers School

# Introduction

## Topics:

- **Disease Triangle**
- **Foliar & Fruit Diseases**
- **Soilborne Diseases**
- **Greenhouse Diseases**

## Covering:

- **Tomatoes, Peppers, Cucurbits, Brassicas/Cole crops**
- **Management**

# Disease Triangle

Soil moisture  
Soil type  
Drainage  
Leaf wetness  
Humidity  
Air flow

**Environment**

**Pathogen**

Exclusion  
Fungicides

**Disease**

**Host**

Resistance, Crop rotation

# Family Rotation

## Solanaceous

Tomato

Pepper

Eggplant

## Cucurbit

Cucumber

Squash

Watermelon

Pumpkin

Zucchini

## Brassicas

Cabbage

Broccoli

Collards

Kale

Cauliflower

Turnip

# Foliar & Fruit Diseases



# Bacterial spot (speck/canker)



# Bacterial spot/speck/canker

- **Hosts:**
  - Tomato, pepper
- **Spreads rapidly**
- **Management**
  - Treat seed – hot water (specific temp & time)
  - Clean greenhouse production
  - Avoid leaf wetness when handling plants
  - Fixed coppers, Regalia, Serenade
    - Resistance to copper present
    - copper accumulation in soil is a concern
  - Host resistance – not yet

# Early blight

(*Alternaria linariae* = *tomatophila* or *A. solani*)



# Early blight

(*Alternaria linariae* = *tomatophila*)

- Hosts: tomato, (potato)
- Soilborne
- Leaves, stem, fruit
- Management
  - Rotation – 2-3 years
  - Tolerant varieties
    - E.g., Mountain Magic
  - Adequate nutrition
  - Fresh potting mix, new trays
  - Double Nickel, Serenade – ok control



# Late blight

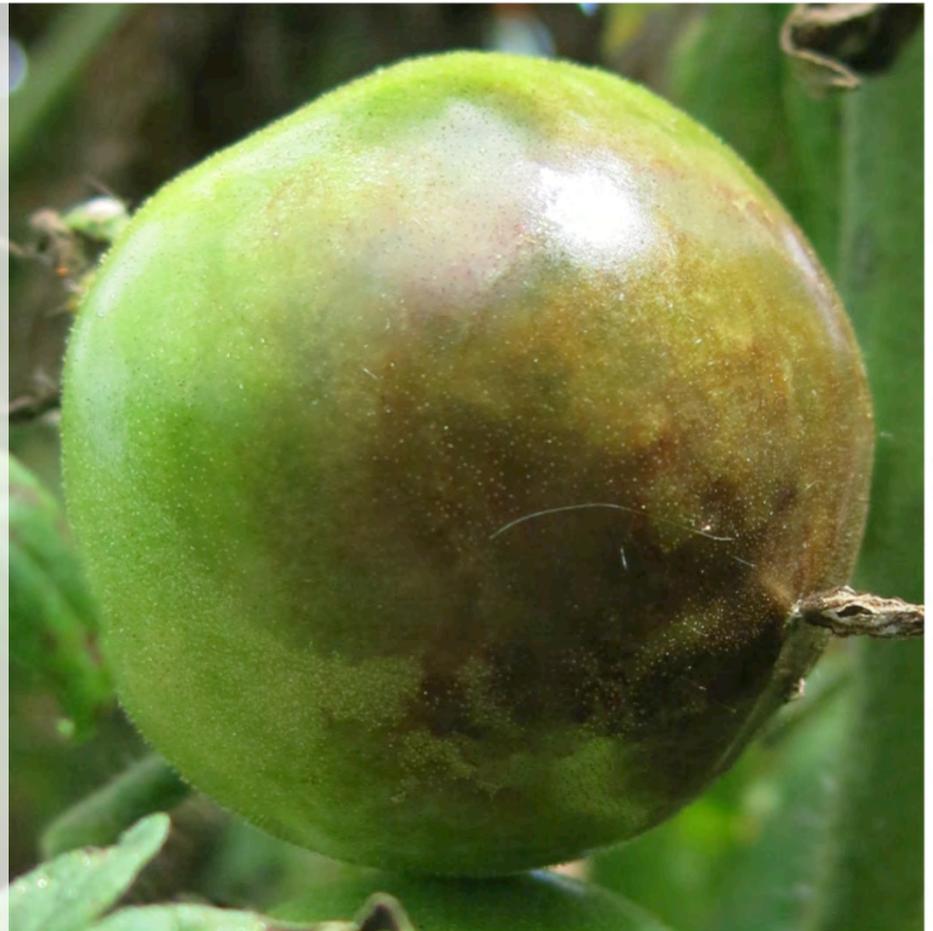
*(Phytophthora infestans)*



# Late blight

*(Phytophthora infestans)*

- Hosts: tomato, potato
- Early July
- Prolific sporulation
- Cool temps, fog, rain
- Resistant variety
  - “Ph2 & Ph3”
    - Iron Lady
    - Mtn. Magic
    - Mtn. Merit
- Copper fungicides





# USAblight

A NATIONAL PROJECT ON TOMATO & POTATO LATE BLIGHT IN THE UNITED STATES

- [About Late Blight ▼](#)
- [Occurrence Map ▼](#)
- [Reporting Outbreaks ▼](#)
- [Managing Late Blight ▼](#)
- [Cornell DSS](#)
- [Publications](#)
- [About Us ▼](#)
- [Internal Users ▼](#)

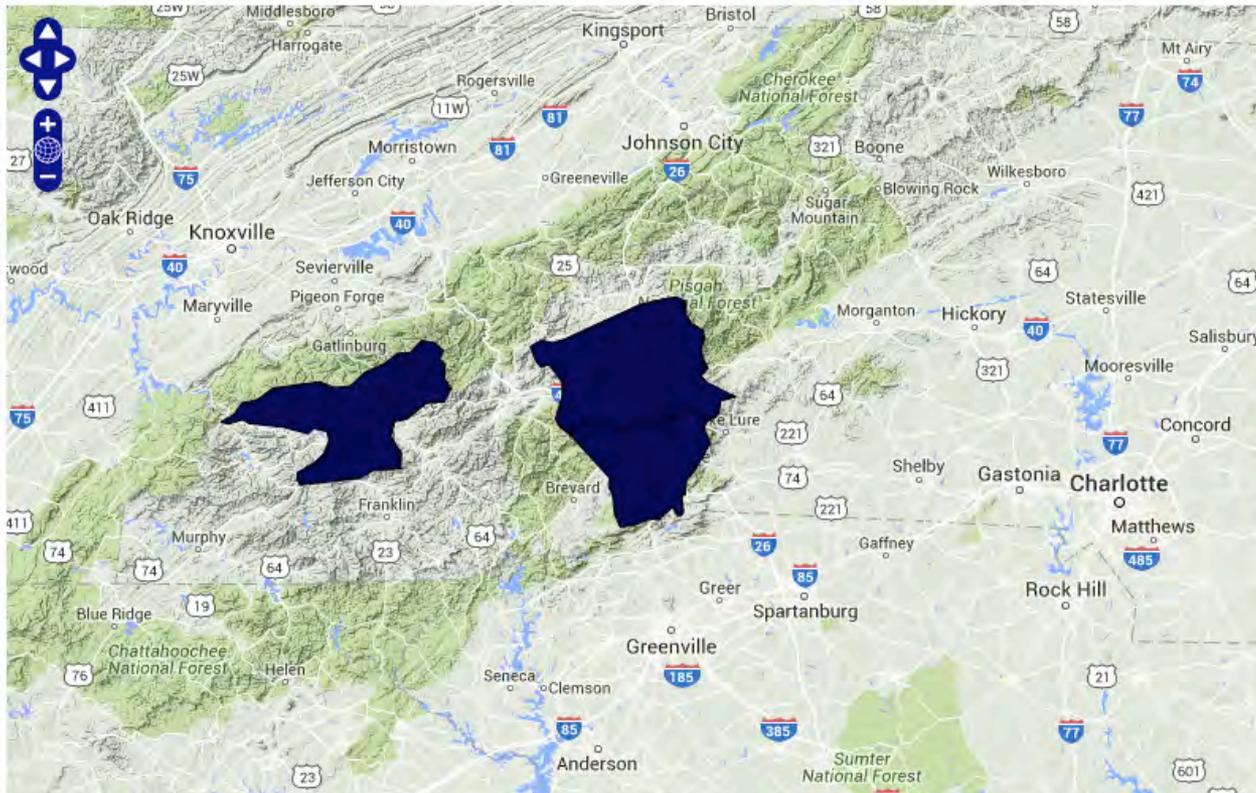
News Item: [Late blight and other Phytophthora diseases emerging in India](#)    [Phytophthora diagnostics workshop held in India](#)

Occurrence Map ▼

## Late Blight Map

Note: Not all states/regions currently report late blight to our web site. We encourage you to ask your local extension agent to report the disease.

Click on a county below for more report information.



### Henderson County, NC

[Back to County List](#)

#### 2015-09-15

Observed 64 days ago  
 Date Reported: 2015-09-28  
 Host(s) Tomato

#### Sample Analysis:

Genotype: [US-23](#)  
 Metalaxyl Sensitive

#### 2015-08-11

Observed 99 days ago  
 Date Reported: 2015-08-26  
 Host(s) Tomato

#### Sample Analysis:

Genotype: [US-23](#)  
 Metalaxyl Sensitive

#### 2015-08-11

Observed 99 days ago  
 Date Reported: 2015-08-26  
 Host(s) Tomato

#### Sample Analysis:

Genotype: [US-23](#)  
 Metalaxyl Sensitive

#### 2015-07-15

Observed 126 days ago

# Phytophthora blight, crown/root rot



# Phytophthora blight, fruit rot, crown rot, root rot



# Phytophthora blight, crown/root rot

- **Wide host range**
  - **Cucurbits, peppers, tomatoes, eggplant**
    - Wild geranium, black nightshade
  - **Fruit, roots, crown**
    - Depends on host
- **Brought in by transplants, soil, contaminated equip.**
- **Soilborne & persistent**
- **Extended periods of heavy rain, humidity**
- **Poorly drained soils**

# Phytophthora blight, crown/root rot

- **Management**
  - **Resistant varieties**
  - **Improve drainage**
  - **Raised beds**
  - **Drip irrigation**
  - **Non-infested water source**
  - **Rotation: 2-4 years**
  - **Copper-based fungicides**



# Powdery Mildew



# Powdery Mildew



# Powdery Mildew

- **\*\*Cucurbit, \*Tomato, (Pepper, Brassicas)**
- **Different host - Different species of fungus**
- **Vine run, fruit onset – most susceptible**
- **Increases susceptibility to other diseases**
- **Management**
  - **Increase spacing between plants**
  - **Resistant variety**
  - **Sulfur, coppers**
    - **Coverage is key**

# Downy Mildew



# Downy Mildew



# Basil Downy Mildew



# Downy Mildew

- **\*\*Cucurbits, \*\*basil, broccoli, lettuces**
- **Different host = different species**
- **Does not overwinter in NC**
  - **Late July, August**
- **Management**
  - **Reduce canopy density**
  - **Avoid overhead irrigation**
  - **Resistant variety**
  - **Organics:**
    - **Copper, Ammonium or potassium bicarbonate**
    - **Serenade, Regalia, MilStop, Double Nickel (marginal control)**

# Basil Downy Mildew

- **Yellowing leaves, necrosis**
  - black/gray spores on underside
- **Other hosts: coleus, salvia**
- **Source:**
  - Year-round production
  - Seed
- **Plant tolerant varieties**
- **Treated seed**



M. McGrath

# Tomato Spotted Wilt Virus



# Tomato Spotted Wilt Virus & Tobacco Mosaic Virus



# Tomato Spotted Wilt Virus

- Tomatoes, peppers, eggplant, cucumber
- **WIDE** host range including many weeds
- Bronzed areas on leaves, light green/yellow rings
- Stunted, wilted
- Transmitted by thrips
- Management: exclude thrips = exclude the virus

# Blossom end rot



# Blossom end rot



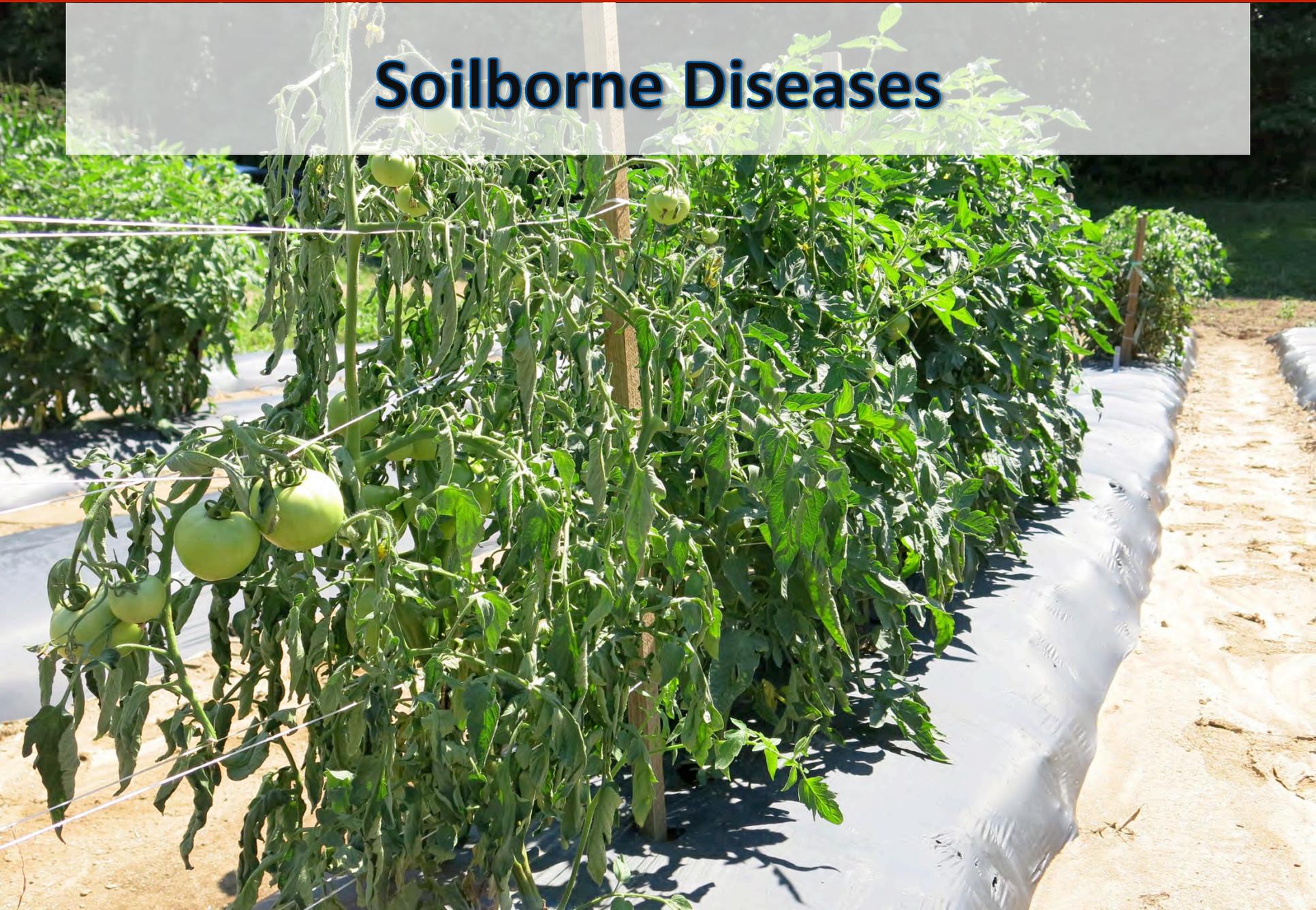
# Blossom end rot/Ca deficiency



# Blossom end rot/Ca deficiency

- **Tomato, crucifers, pepper, cucurbits**
- **Calcium deficiency in the plant**
- **Exacerbated by**
  - **Water stress x fruit development**
  - **high heat**
  - **acidic soils**
- **Regulate moisture**
- **Get your soil tested (NCDA)**

# Soilborne Diseases



# Bacterial Wilt – Solanaceous Crops



# Bacterial Wilt Diagnosis



# Bacterial Wilt – Solanaceous Crops

- **Tomato, eggplant, potato, pepper**
  - **Woody nightshade**
  - **Tobacco, banana, geranium, olive, rose**
- **Survives in soil long-term**
- **Spotty in mountains; can be severe elsewhere in NC**
- **Management**
  - **Rotation away from hosts, 2-3 years**
  - **Grafted tomatoes**

# Fusarium wilt, crown, foot rot, fruit rot- Cucurbits



# Fusarium wilt, crown, foot rot - Cucurbits

- **Multiple species of Fusarium**
- **Soilborne, persistent**
- **Seed-transmitted**
- **Damping-off, stem collapse**
- **Some can cause fruit rot**
- **Management**
  - **Use clean seed**
  - **Rotate away from cucurbits**
  - **Host resistance is race specific**

# Fusarium wilt



# Fusarium wilt on tomato

- **Unilateral yellowing, wilting**
- **Soilborne & persistent**
- **Management:**
  - **Resistant varieties**
    - Race 1, 2 common
    - Race 3 resistance - few
  - **Rotate – 3-5 years**



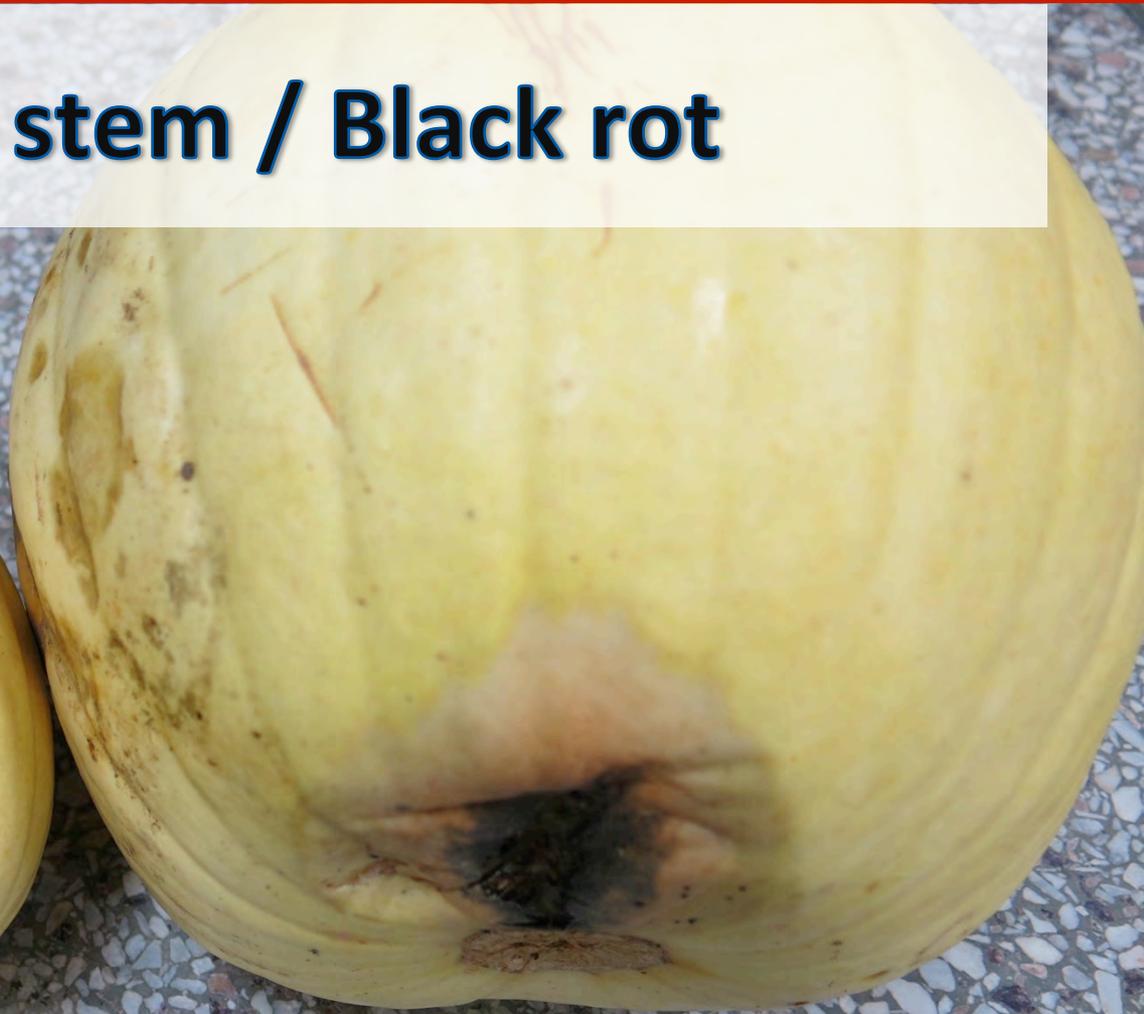
# Verticillium wilt



# Verticillium wilt

- **V-shaped lesions on leaves**
- **Dark brown vascular staining**
- **Large host range (400): annuals, perennials, woody**
- **Management:**
  - **Rotate away 2-3 years**
  - **Resistant varieties:**
    - **Race 1 - yes**
    - **Race 2 - not yet**

# Gummy stem / Black rot



# Gummy stem / Black rot

- Cucurbits – symptoms vary
- Stem blight (oozing), blackish fruit rot
- Seed, soilborne
- Cuc. Beetle & powdery mildew increase susceptibility
- Management
  - Rotate: 2 years
  - Disease-free seed



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# Greenhouse Diseases



# Damping-off fungi

(*Rhizoctonia*, *Pythium*, *Fusarium*)



# Damping-off fungi

(Rhizoctonia, Pythium, Fusarium)



# Damping-off fungi

(Rhizoctonia, Pythium, Fusarium)

In the greenhouse...

- Avoid cool & wet conditions
- Older seedlings not affected
- Cull diseased immediately
- Avoid saturated soil & high nitrogen
  - (fertilize after first true leaves emerge)
- Use new soil, trays

# Botrytis gray mold

(*Botrytis cinerea*)

- Greenhouse & field
- Favors humid, cool conditions
- Management:
- \*Reduce humidity
- \*Increase air movement
- Sanitation
  - Pruning
  - Remove debris



M. Ferguson

# Resources

- **2016 SE US Vegetable Crop Handbook**
  - [www.thepacker.com/sites/produce/files/SEVegGuide\\_2016.pdf](http://www.thepacker.com/sites/produce/files/SEVegGuide_2016.pdf)
- **NC AG Chem Manual**
- **NCSU Plant Pathology Extension Portal**
  - Late blight, downy mildew, disease updates
  - Disease notes
- **USABlight, IPMPipe**
- **UGA Extension - Comm. Prod. Veg. Transplants**
- **Greenhouse Sanitation**
  - University extension programs

**Get your soil tested - NCDA**  
**Get proper disease diagnoses**  
**NCSU Plant Disease and Insect Clinic:**  
**[www.cals.ncsu.edu/plantpath/extension/clinic/](http://www.cals.ncsu.edu/plantpath/extension/clinic/)**

