

## Advanced Master Gardener Training

### Vegetable Diseases

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### Vegetable Diseases Damping-Off/Seedling Blights

- **Causes**
  - *Pythium* spp.
  - *Rhizoctonia solani*
  - *Fusarium* spp.
- **Hosts:** Any vegetable
- **Favorable environment:** Cool, wet soils

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### Vegetable Diseases Damping-Off/Seedling Blights

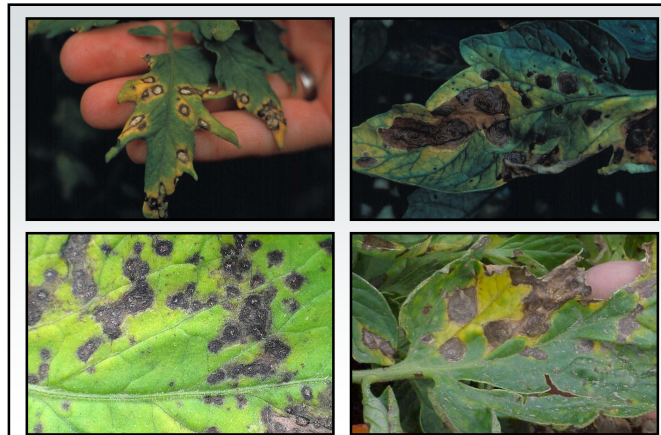
- **Control**
  - Use a pasteurized soil mixture
  - Decontaminate pots/working surfaces/tools (10% bleach, 70% alcohol, disinfectants)
  - Moderate soil moisture
    - Use a soil with adequate drainage
    - DO NOT overwater
  - Germinate seeds at higher temperatures

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### Vegetable Diseases Fungal Leaf Blights

- **Causes**
  - *Septoria lycopersici* (Septoria leaf spot)
  - *Alternaria solani* (early blight)
  - *Phytophthora infestans* (late blight)
- **Hosts**
  - Tomato
  - Potato (early blight, late blight)
- **Favorable environment:** Cool, wet weather

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## Vegetable Diseases Fungal Leaf Blights

- **Control (early blight, Septoria leaf spot)**
  - Remove and destroy contaminated debris
    - Burn (where allowed)
    - Deep bury
    - Hot compost
  - Move tomatoes to new location

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## Vegetable Diseases Fungal Leaf Blights

- **Control (early blight, Septoria leaf spot)**
  - Plant resistant varieties
  - Space plants far apart
  - Mulch around the base of plants
  - DO NOT overmulch

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## Vegetable Diseases Fungal Leaf Blights

- **Control (early blight, Septoria leaf spot)**
  - DO NOT overhead water
  - Thin plants as they grow
  - Use fungicides to prevent infections
    - Chlorothalonil, mancozeb
    - Copper
    - Alternate active ingredients (FRAC codes)
    - Apply at 7-14 days intervals

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## Vegetable Diseases Fungal Leaf Blights

- **Control (late blight)**
  - Remove any infected plants and plant parts
    - Infected tomato/potato plants including fruits and tubers
    - Volunteer tomato and potato plants
    - Weed hosts
  - Destroy any infected plants and plant parts
    - Burn (where allowed)
    - Double bag and landfill

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## Vegetable Diseases Fungal Leaf Blights

- **Control (late blight)**
  - DO NOT use last year's potatoes as seed
  - DO use certified seed potatoes
  - Grow resistant tomato varieties
    - "Late Blight Management in Tomato with Resistant Varieties"  
(<http://www.extension.org/pages/72678/late-blight-management-in-tomato-with-resistant-varieties#.VVNSsPIVhBd>)

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## Vegetable Diseases Fungal Leaf Blights

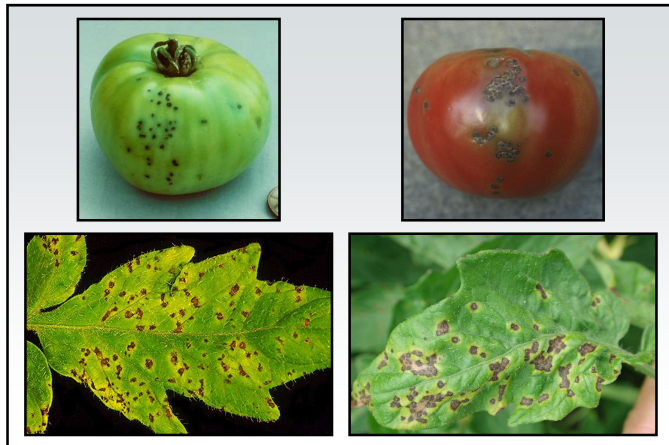
- Control (late blight)
  - Use fungicides to prevent infections
    - Chlorothalonil, mancozeb
    - Copper
    - Alternate active ingredients (FRAC codes)
  - Start applications based on Blitecast (<http://www.plantpath.wisc.edu/wivegdis/>)
  - Apply at 7-14 day intervals

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## Vegetable Diseases Bacterial Tomato Diseases

- Causes
  - *Pseudomonas syringae* pv. *tomato* (bacterial speck)
  - *Xanthomonas* spp. (bacterial spot)
- Host: Tomato
- Favorable environment
  - Cool, wet weather (bacterial speck)
  - Warm, wet weather (bacterial spot)

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## Vegetable Diseases Bacterial Tomato Diseases

- Control
  - Remove and destroy contaminated debris
    - Burn (where allowed)
    - Deep bury
    - Hot compost
  - Remove and destroy volunteer tomatoes

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## Vegetable Diseases Bacterial Tomato Diseases

- Control
  - Start with pathogen-free seeds and plants
  - Hot water treat seeds (122°F, 25 minutes)
  - Move tomatoes to new location
  - Space plants far apart
  - Mulch around the base of plants
  - DO NOT overmulch

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## Vegetable Diseases Bacterial Tomato Diseases

- Control
  - DO NOT overhead water
  - DO NOT handle plants when wet
  - Use bactericides to prevent infections
    - Copper
    - Apply at 7-14 days intervals
    - Tolerant bacterial strains are a problem

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## Vegetable Diseases Blossom End Rot

- Cause: Calcium deficiency
- Affected plants
  - Tomato
  - Pepper
  - Eggplant
  - Cucurbits (cucumber, squash, pumpkin, watermelon)
- Favorable Environment: Drought

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## Vegetable Diseases Blossom End Rot

- Management
  - Test soil to determine calcium level
  - Add calcium as needed
    - Bone meal
    - Egg shells
    - NOT lime (usually)
  - Water plants adequately and uniformly

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## Vegetable Diseases Vascular Wilts

- Causes
  - *Verticillium* spp. (Verticillium wilt)
  - *Fusarium oxysporum* (Fusarium wilt)
- Hosts
  - Solanaceous vegetables (tomato, potato, pepper, eggplant)
  - Cucurbits (pumpkin, squash, cucumber, watermelon)

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## Vegetable Diseases Vascular Wilts

- Favorable environment
  - Wet weather (for infection)
  - Dry weather (for symptom development)

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## Vegetable Diseases Vascular Wilts

- **Control**
  - Rotate crops to avoid pathogen build-up
    - DO NOT plant susceptible vegetables in infested areas
    - Plant non-hosts in infested areas
  - Plant resistant varieties (VFF)
  - DO NOT overwater
  - DO NOT overmulch
  - DO NOT use fungicides or biological controls

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## Vegetable Diseases Walnut Toxicity

- **Cause: Juglones**
  - Black walnut
  - Butternut
  - Hickory
- **Affected plants**
  - Many vegetables
  - Tomato, potato, pepper, eggplant
  - Asparagus, cabbage

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## Vegetable Diseases Walnut Toxicity

- **Management**
  - DO NOT plant sensitive vegetables near walnut trees
  - Plant tolerant vegetables
    - Beans
    - Corn
    - Parsnip
    - Beet
    - Melon
    - Squash
    - Carrot
    - Onion
  - Plant sensitive vegetables
    - in raised beds
    - in pots

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## Vegetable Diseases Walnut Toxicity

- **Management**
  - Keep walnut leaves and fruits out of your garden
  - DO NOT compost walnut leaves and fruits
  - Remove volunteer walnut trees
  - Remove mature walnut trees (?)

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## Vegetable Diseases Herbicide Injury

- **Causes**
  - Growth regulator herbicides
    - 2,4-D
    - Dicamba
  - Other herbicides
- **Affected plants**
  - All vegetables
  - Tomatoes

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### Vegetable Diseases Herbicide Injury

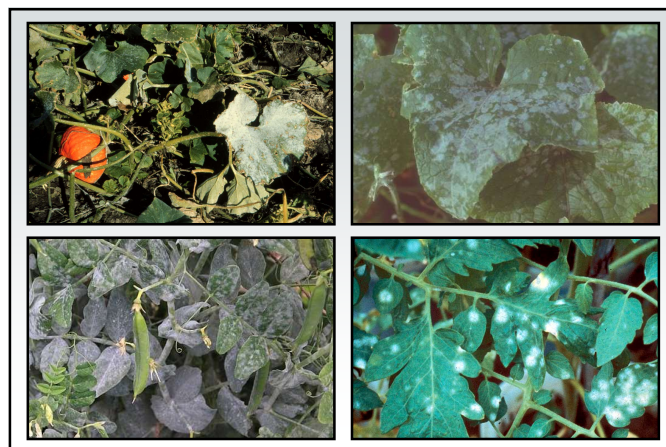
- **Management**
  - DO NOT use herbicides
  - If you or your neighbors do use herbicides, make sure that you or they
    - Follow application directions exactly
    - Apply herbicides at low wind speeds (< 5 mph)
    - DO NOT apply herbicides too close to sensitive plants
    - Apply herbicides at low pressure
    - Use amine rather than ester forms of herbicides

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### Vegetable Diseases Powdery Mildew

- **Causes**
  - Miscellaneous powdery mildew fungi
  - *Oidium* spp.
- **Hosts**
  - Cucurbits (cucumber, squash, pumpkin)
  - Other vegetables (pea, tomato)
- **Favorable environment: High humidity**

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### Vegetable Diseases Powdery Mildew

- **Control**
  - Remove and destroy plant debris
    - Burn (where allowed)
    - Deep bury
    - Hot compost
  - Reduce humidity
    - Plant less densely/thin existing stands
    - Grow vining plants on a trellis
  - Use resistant cultivars/varieties

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### Vegetable Diseases Powdery Mildew

- **Control**
  - Use fungicides to prevent infections
    - Dithiocarbamates, myclobutanil, propiconazole, tebuconazole, thiophanate-methyl
    - Sulfur, neem oil, other plant-based oils
    - 1.5 Tbsp baking soda + 3 Tbsp light-weight horticultural oil in 1 gal water
    - Alternate active ingredients (FRAC codes)
    - Apply when humidity is >60-70%
    - Apply every 7-14 days

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## Vegetable Diseases Downy Mildew

- **Causes**
  - *Pseudoperonospora cubensis*
  - *Peronospora belbahrii*
- **Hosts**
  - Cucurbits (cucumber, squash, pumpkin)
  - Basil

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## Vegetable Diseases Downy Mildew

- **Favorable environment**
  - High moisture
  - High humidity
  - Moderate/warm temperatures

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## Vegetable Diseases Downy Mildew

- **Control**
  - Start with clean seed and transplants
  - Grow less susceptible/resistant varieties
    - Red varieties of basil
    - Sweet basil 'Eleonora'
    - Certain cucumber and cantaloupe varieties with lesser success for squash and pumpkin varieties

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## Vegetable Diseases Downy Mildew

- **Control**
  - DO NOT overcrowd plants
  - DO NOT overhead water
  - Destroy diseased and asymptomatic plants
    - Burn (where allowed)
    - Double bag and landfill

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## Vegetable Diseases Downy Mildew

- **Control**
  - Use fungicides to prevent infections (cucurbits)
    - Chlorothalonil, mancozeb, phosphorus acids
    - Copper
  - Start applications based predictive models (<http://cdm.ipmPIPE.org/>)
  - Apply at 7-14 day application interval

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### Vegetable Diseases Bacterial Wilt

- Cause: *Erwinia tracheiphila*
- Hosts: Cucurbits  
(cucumber, squash, pumpkin)
- Favorable environment: None
- Transmission: Cucumber beetles

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### Vegetable Diseases Bacterial Wilt

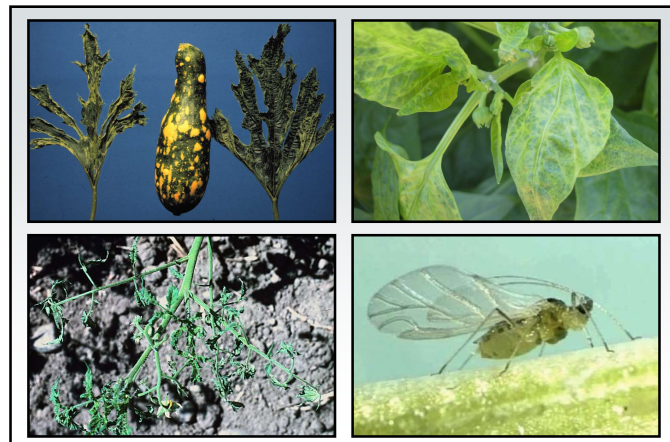
- Control
  - Use floating row covers
  - Apply insecticides to control cucumber beetles
  - Remove infected plants
  - If you decide to keep infected plants, water them adequately
  - DO NOT use bactericides or biological controls

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### Vegetable Diseases Cucumber Mosaic

- Cause: *Cucumber mosaic virus (CMV)*
- Hosts
  - Cucurbits
  - Pepper
  - Tomato
  - Other vegetables
- Favorable environment: None
- Transmission: Aphids

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### Vegetable Diseases Cucumber Mosaic

- Control
  - Plant resistant/tolerant varieties
    - Plant based resistance
    - Plant based tolerance
    - Genetically modified plants
  - Eliminate weed hosts
  - Apply insecticides to control aphids
  - DO NOT use chemical or biological controls

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## Vegetable Diseases Common Scab

- Cause: *Streptomyces scabies*
- Hosts
  - Potato
  - Carrot
  - Other root crops
- Favorable environment: High soil pH

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## Vegetable Diseases Common Scab

- Control
  - Plant scab-free potato stock
  - Routinely rotate crops
    - DO NOT grow host plants in an infested areas
    - Plant non-hosts in infested areas
  - Move potatoes to another location
  - Plant scab resistant varieties
  - Lower soil pH
  - DO NOT use chemical or biological controls

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## Vegetable Diseases Bacterial Soft Rot

- Cause: *Pectobacterium carotovorum*
- Hosts
  - Potato
  - Carrot
  - Other vegetables
- Favorable environment
  - Wet soils
  - Wet storage conditions

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## Vegetable Diseases Bacterial Soft Rot

- Control
  - Moderate soil moisture
  - DO NOT overhead water
  - Have good soil fertility (particularly calcium)
  - Harvest vegetables (potatoes) promptly
  - DO NOT bruise/injure vegetables
  - Keep harvested vegetables dry
  - Remove any rotted vegetables immediately

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## Vegetable Diseases Black Rot

- Cause: *Xanthomonas campestris* pv. *campestris*
- Hosts: Crucifers
  - Brussels sprouts, cabbage, collards
  - Broccoli, cauliflower, kale, kohlrabi, rutabaga, turnips
- Favorable environment: Wet weather

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## Vegetable Diseases Black Rot

- Control
  - Buy high quality (certified pathogen-free) seed or transplants
  - Heat treat seeds
    - 35 min, 122°F (Brussels sprouts, cabbage, collards)
    - 20 min, 122°F (broccoli, cauliflower, kale, kohlrabi, rutabaga, turnips)

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## Vegetable Diseases Black Rot

- Control
  - Routinely rotate crops
    - DO NOT grow host plants in an infested areas
    - Plant non-hosts in infested areas
  - Fertilize properly (particularly nitrogen)
  - DO NOT overhead water
  - DO NOT handle plants when wet

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## Vegetable Diseases Black Rot

- Control
  - Remove and dispose of contaminated plants
    - Burn (where allowed)
    - Deep bury
    - Hot compost
  - Decontaminate infested items (70% alcohol, disinfectants, 10% bleach)

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## Vegetable Diseases Black Rot

- Control
  - Use bactericides to prevent infections
    - Copper
    - Apply at 7-14 days intervals
    - Tolerant bacterial strains are a problem

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## Vegetable Diseases

### Aster Yellows

- Cause: Aster yellows phytoplasma
- Hosts
  - Carrot
  - Potato
  - Other vegetables
- Favorable environment: None
- Transmission: Aster leafhopper

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## Vegetable Diseases

### Aster Yellows

- Control
  - Remove diseased plant material and debris
    - Hot compost
    - Bury
    - Burn (where allowed)
  - Control leafhopper vector (?)

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## Vegetable Diseases

### Common Smut

- Cause: *Ustilago maydis*
- Host: Sweet corn
- Favorable environment
  - None (ear infections)
  - Hail (leaf and stalk infections)

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## Vegetable Diseases

### Common Smut

- Control
  - Plant resistant varieties
  - Reduce physical damage to corn plants
  - DO NOT use chemical or biological controls
  - Give up on your corn and eat the smut (huitlacoche)

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## Vegetable Diseases Corn Rusts

- Cause
  - *Puccinia sorghi* (common rust)
  - *Puccinia polysora* (Southern rust)
- Host: Sweet corn
- Favorable environment
  - Moderate temperatures
  - Wet weather

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## Vegetable Diseases Corn Rusts

- Control
  - Plant resistant varieties
  - Use fungicides to prevent infections
    - Chlorothalonil, mancozeb, propiconazole, tebuconazole
    - Alternate active ingredients (FRAC codes)
    - Apply at 7-14 days intervals

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## Vegetable Diseases Bean Leaf Diseases

- Causes
  - *Pseudomonas syringae* pv. *syringae* (bacterial brown spot)
  - *Xanthomonas campestris* pv. *phaseoli* (common blight)
  - *Pseudomonas syringae* pv. *phaseolicola* (halo blight)

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## Vegetable Diseases Bean Leaf Diseases

- Hosts
  - Snap bean
  - Kidney bean
  - Lima bean
- Favorable environment: Driving rain (?)

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## Vegetable Diseases Bean Leaf Diseases

- **Control**
  - Purchase high quality seed
  - Use resistant varieties where available
  - DO NOT overhead water
  - Use bactericides to prevent infections
    - Copper
    - Apply at 7-14 days intervals
    - Tolerant bacterial strains are a problem

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## Vegetable Diseases Root Rots

- **Causes**
  - *Pythium* spp. (Pythium root rot)
  - *Rhizoctonia solani* (Rhizoctonia root rot)
  - *Fusarium* spp. (Fusarium root rot)
  - *Thielaviopsis basicola* (black root rot)
  - *Phytophthora* spp. (Phytophthora root rot)
  - *Aphanomyces euteiches* (Aphanomyces root rot)

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## Vegetable Diseases Root Rots

- **Hosts**
  - Snap beans
  - Peas
  - Carrots
  - Other vegetables
- **Favorable environment:** Wet, cool soils

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## Vegetable Diseases Root Rots

- **Control**
  - Routinely rotate crops
    - DO NOT grow host plants in an infested areas
    - Plant non-hosts in infested areas
  - Improve soil drainage
  - DO NOT overwater
  - DO NOT overmulch

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## Vegetable Diseases Root Rots

- **Control**
  - Use biological control products
    - *Streptomyces lydicus*
    - Apply at seeding
    - Apply at 7-14 day intervals after emergence (spray/drench)

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## Vegetable Diseases

### White Mold

- Cause: *Sclerotinia sclerotiorum*
- Hosts
  - Snap beans
  - Carrots
  - Many other vegetables
- Favorable environment
  - Cool temperatures
  - High moisture (including high humidity)

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## Vegetable Diseases

### White Mold

- Control
  - Buy high quality vegetable seed
  - Prevent introduction through other seed
  - Routinely rotate crops
    - Avoid planting susceptible vegetables in infested areas (5-7 yrs)
    - Plant non-hosts in infested areas
  - Plant beans (and other vegetables) with wider row spacings

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## Vegetable Diseases

### White Mold

- Control
  - DO NOT overwater
  - DO NOT overmulch
  - DO NOT overfertilize
  - Control broad-leaf weeds
  - Use biological control products
    - *Coniothyrium minitans*
    - Parasitizes sclerotia

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## Vegetable Diseases

### Where to Go for Help

Plant Disease Diagnostics Clinic  
 Department of Plant Pathology  
 University of Wisconsin-Madison  
 1630 Linden Drive  
 Madison, WI 53706-1598  
 (608) 262-2863  
[pddc@wisc.edu](mailto:pddc@wisc.edu)  
<https://pddc.wisc.edu>  
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