PLANT DISEASES
CCA TRAINING

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COMPETENCY AREA 2

Management of Plant Diseases
Disease Identification

- Symptoms
- Signs
SYMPTOMS

- External and internal reactions or alterations of a plant as a result of a disease
The pathogen (disease causing agent) or its parts or products seen on a host plant
CLASSIFY DISEASES BY PATHOGEN

- FUNGUS
- BACTERIA
- VIRUS
- NEMATODE
EXAMPLES

- WHEAT
  - TAKE-ALL caused by a FUNGUS
  - BARLEY YELLOW DWARF caused by a VIRUS
KNOW CONDITIONS THAT FAVOR DISEASE DEVELOPMENT FOR EACH DISEASE

- CLIMATIC CONDITIONS
- CROPPING PRACTICES
DETERMINE CONTROL MEASURES FOR EACH DISEASE

- CULTURAL
- CHEMICAL
CULTURAL CONTROLS

- ROTATION
- VARIETY (HYBRID) SELECTION
- PLANTING DATE
- FERTILITY MANAGEMENT
- TILLAGE
- WEED CONTROL
Some diseases may require a number of cultural controls or combination of cultural and chemical controls.
CORN DISEASES
Lesion nematode
Symptom/Sign

- Lesions on roots
- Stunting of corn with uneven distribution in field
Lesion nematode
Control Methods

- Rotation but few non-hosts grown.
- Granular insecticide eg. Counter 15G
Maize dwarf mosaic (virus)

Symptom/Sign

- Yellow stripes between veins on youngest leaves
- Stunting
- Shortened internodes
- Sporadic distribution in field
Maize dwarf mosaic (virus) Conditions favoring development

- Johnsongrass alternate host
- Aphids transmit to corn
Maize dwarf mosaic (virus)
Control Methods

- Resistant variety
- Control Johnsongrass
Maize chlorotic dwarf (virus)
Symptom/Sign

- Chlorosis (yellowing) severe on young leaves
- Some reddening
- Severe stunting
Maize chlorotic dwarf (virus)
Maize chlorotic dwarf (virus)
Conditions favoring development

- Johnsongrass alternate host
- Leafhopper transmits to corn
Maize chlorotic dwarf (virus)
Control Methods

- Resistant variety
- Control Johnsongrass
Northern corn leaf blight (fungus)
Symptom/Sign

- Gray green elliptical (cigar-shaped) spots, 2-6 inches long on hybrids with no resistance.
- Lesion size can be affected by hybrid.
- Can be confused sometimes with Stewart’s wilt if certain resistance genes are present.
Northern Corn Leaf Blight (fungus)
Northern corn leaf blight (fungus)
Conditions favoring development

- Moderate temperature -- 65-85 F
- Long dew periods
- Overwinters on plant debris
- Windborne
Northern corn leaf blight (fungus)
Control Methods

- Resistant hybrids
- Crop rotation
- Tillage
Southern corn leaf blight (fungus)
Symptom/Sign

- Spots on leaf smaller and more numerous than Northern corn leaf blight
- Spots vary in size and shape due to the genetic background of the hybrid.
- Common race “O” produces tan, elongated spots between the veins that have limited parallel margins and possibly buff to brown borders.
Southern Corn Leaf Blight (fungus)
Southern corn leaf blight (fungus)
Conditions favoring development

- Warmer temperature -- 68-90°F
- High humidity
- Overwinters on plant debris
- Windborne
- Splashed by water
Southern corn leaf blight (fungus)
Control Methods

- Resistant hybrids
- Crop rotation
- Tillage
Carbonum (Northern corn) Leaf Spot
(fungus)
Symptom/Sign

- Race 3 produces very narrow spots often resembling “beads on a string”.
- Lesion (spot) type varies with the hybrid
- Often spreads after leaf tissue matures
Carbonum (Northern corn) Leaf Spot

Conditions favoring development

- Moderate temperatures and high humidity
- Spores are abundantly produced on old spots on mature leaves
- Minor importance, small impact on yield.
Carbonum leaf blight (fungus)
Control Methods

- Resistant hybrids
- Crop rotation
- Tillage
Gray leaf spot (fungus)
Symptom/Sign

- Rectangular lesions with sharp parallel edges, restricted by veins with yellow margin
- Window pane look, and old lesions are opaque.
- Early lesions are small necrotic spots with chlorotic halos.
- Often symptoms are worse along the edges of fields
Gray Leaf Spot (fungus)
Gray leaf spot (fungus)
Conditions favoring development

- High humidity
- Near water ways
- Overwinters in residue
- Reduced tillage or no-till
Gray leaf spot (fungus)
Control Methods

- Resistant hybrids
- Tillage is recommended but is questionable where the disease is well established.
- Rotation
Common Rust (fungus)
Symptom/Sign

- Golden brown to cinnamon brown pustules on both sides of the leaf.
Common Rust (fungus)
Rust

Conditions favoring development

- Spores are wind blown from the south.
- Moderate temperatures (61-80) and high humidity
- Infections often occur in the whorl where moisture and humidity are high
Rust
Control Methods

- Resistant hybrids
Fusarium stalk rot (fungus)
Symptom/Sign

- Cottony white mat of fungus at base of plant or at internodes
- Soft rotted stalk
- Red discoloration inside of stalk
- Lodging
- Yield loss
Fusarium Stalk Rot
Fusarium stalk rot (fungus)

Conditions favoring development

- Reduced tillage or no-till
- Fungus overwinters in crop residue
- Warm, wet conditions
- Can enter through wounds or directly (corn borer interaction)
- Same organism causing scab in cereals
Fusarium stalk rot (fungus)
Control Methods

- Hybrid selection
- Tillage
- Proper fertility
- Rotation
- Early harvest
Fusarium ear rot (fungus)
Symptom/Sign

- White fungus growing on kernels
- Pink discoloration
- “Starburst” symptom on infected kernels
Diplodia  Fusarium  Giberella

‘Starburst pattern’  Fusarium

Fusarium Ear Rot
Fusarium ear rot (fungus)
Conditions favoring development

- Reduced or no-till
- Fungus overwinters in crop residue
- Warm, wet conditions
- Insect damage to ear
- Can produce mycotoxin “fumonison”
Fusarium ear rot (fungus)

Control Methods

- Tillage
- Proper fertility
- Rotation
- Early harvest
SOYBEAN DISEASES
Damping Off
Symptom/Sign

- Seedlings fail to emerge or emerge then die
- Seed or root is brown and decayed
Damping Off
Conditions favoring development

- Cool, damp conditions
Pythium

Rhizoctonia

Damping Off
Damping Off
Control Methods

- Seed treatment fungicides
- Later planting date
- Rotation
Phytophthora root rot (fungus)

Symptom/Sign

- Poor growth
- Wilting
- Brown discoloration on stem
- Rotted roots
Phytophthora root rot (fungus)
Conditions favoring development

- Poorly drained areas
- Heavy soils
- Flooding
Phytophthora root rot (fungus)
Control Methods

- Resistant variety
- Seed treatments using Apron, Apron XL, or Allegiance control the damping-off stage.
Rhizoctonia root rot (fungus)
Symptom/Sign

- Seedlings emerge and die
- Brown, red-brown, or red sunken lesion on roots or base of the seedling stem.
Rhizoctonia root rot (fungus)
Conditions favoring development

- Cool, damp conditions
- Fertility, soil conditions and the amount of fungus in the soil can all influence the degree of infection.
Rhizoctonia root rot (fungus)
Control Methods

- Fungicide seed treatments
- Later planting date
Septoria leaf spot
(Brown spot)

Symptom/Sign

- Irregular dark brown spots on unifoliate leaves progressing to trifoliate later in the season.
- Infected unifoliate leaves turn brown and drop.
- Black fruiting bodies (pycnidia) of the fungus form in old spots.
Septoria leaf spot
Conditions favoring development

- Fungus overwinters on old infected plant debris
- Unifoliate infection provides inoculum for later infection
- Warm, wet weather conditions especially later in the season influences brown spot in the canopy.
Septoria leaf spot

Control Methods

- Rotation
- Plant less susceptible varieties
- Plow under crop residues
Charcoal rot
Symptom/Sign

- Usually after midseason, plants appear stunted in irregular areas of the field.
- Leaves may turn yellow and wilt
- Lower stem and taproot develop a gray to silvery discoloration
- Microsclerotia develop in epidermis on root and lower stem and inside pith resembling charcoal dust
Charcoal Rot
Charcoal rot

Conditions favoring development

- Low soil fertility
- Continuous cropping of soybeans.
- Low soil moisture and hot temperatures increase disease severity.
Charcoal rot
Control Methods

- Plant later maturing varieties late group IV’s and group V’s.
- Rotate with small grains, corn and sorghum for at least 3 years in severely infected fields.
- Do not overplant, causes seedling stress
- Good fertility practices
Sclerotinia white mold (fungus)
Symptom/Sign

- Wilting and death of the upper leaves of the plants during early pod development
- Often occurs in patches in low areas
- White mat of fungus on stem at nodes often seen
- Stem lesions often girldle the stem and the upper portions die and produce no pods.
- Large sclerotia on stem and sometimes in pith
Sclerotinia White Mold
Sclerotinia white mold (fungus)
Conditions favoring development

- Cool, wet conditions that favor germination of sclerotia within the upper 2 inches of soil.
- Narrow row spacing
- Dense canopy structure
- Fields with history of white mold on crops of peas, beans, and soybean
Sclerotinia white mold (fungus)

Control Methods

- Avoid planting soybeans after other susceptible crops such as peas, snap and lima beans, and sunflowers.
- Choose varieties that are shorter, more open
Pod and stem blight (fungus)
Symptom/Sign

- Rows of black fruiting bodies (pycnidia) on stems, petioles and pods late in season
- Infected seeds are decayed which leads to direct yield loss
Pod and stem blight (fungus)
Conditions favoring development

- Disease of senescing soybeans
- Seed infection favored by delayed harvest
- Warm, rainy weather during pod development through maturity.
- Low potash levels favor more seed infection.
Pod and stem blight (fungus)
Control Methods

- Rotation
- Tillage
- Resistant variety
- Maintain high level of potash fertility
Anthracnose
Symptom/Sign

- Often appears in early reproductive stages on stems, petioles and pods as an irregularly shaped brown areas. Often resembles pod and stem blight.

- Fruiting bodies of the fungus are randomly scattered on infected plants tissues and produce black spines called setae that can be seen.

- Can produce cankers on petioles and stems causing severe defoliation.
Anthracnose
Anthracnose
Conditions favoring development

- Overwinters on debris and can infect seed.
- Moist, warm weather during reproductive stages.
- Plants are most susceptible from bloom to pod fill
- Need wet periods of 12 hours or more for infection to occur.
Anthracnose
Control Methods

- Plant disease free seed
- Plow down old soybean residues
- Rotation
Soybean cyst nematode
Symptom/Sign

- Stunted yellow plants in patches or large areas
- Poorly developed roots
- Suppressed nodulation
- Lemon shaped cysts (females) on roots.
Soybean cyst nematode
Control Methods

- Resistant varieties
- Rotation
Root knot nematode

Symptom/Sign

- Stunted yellow plants
- Knots (galls) on roots
Root Knot Nematode
Root knot nematode
Control Methods

- Resistant variety
- Rotation
Soybean mosaic (virus)
Symptom/Sign

- Puckered leaves
- Mosaic pattern of yellow and green on leaves
- Bleeding hilum on infected seed
Soybean Mosaic (virus)
Soybean mosaic (virus)
Conditions favoring development

- Seed borne disease
- Aphid transmitted
Soybean mosaic (virus)
Control Methods

- Certified seed
- Resistant variety
Tobacco Ringspot Virus
Symptom/Sign

- Primarily seedborne at a low level in the field
- This results in scattered infected plants.
- Maturity is delayed so they remain green until killed by frost
- Pods are underdeveloped, tops of plants have shortened internodes, and leaves are distorted
Tobacco Ringspot
Conditions favoring development

- Nearby crops that may harbor the virus
- Insect vectors are possible and disease is often found near the edges of fields.
- Dagger nematode (Xiphinema) may cause a low level of transmission.
Tobacco Ringspot
Control Methods

- Planting virus free seed.
Wheat Diseases
Powdery Mildew (fungus)
Symptom/Sign

- Irregular shaped yellow areas on leaf initially
- White powdery mass of fungus on upper surface of lower leaves
- Older PM colonies will have small brown to black sexual fruiting structures present late in the spring
Powdery Mildew (fungus)
Conditions favoring development

- Optimal powdery mildew development occurs between 60-72 F basically cool, wet conditions
- High nitrogen fertility
- Dense stands of susceptible varieties
- High humidity
Resistant varieties
Rotation is of some value but limited
Balanced fertility
Fungicides (seed and/or foliar treatments)
Leaf rust (fungus)
Symptom/Sign

- Orange-red pustules mostly on upper leaf surfaces
- Randomly scattered within the canopy
- Usually appears after heading
Leaf Rust
Leaf rust (fungus)
Conditions favoring development

- Overwinters far south
- Spores carried by wind
Leaf rust (fungus)
Control Methods

- Resistance
- Fungicides
Septoria leaf and glume blotch (fungus) 

*Septoria nodorum*

Symptom/Sign

- Elongate lens-shaped lesions with yellow margins
- Black fruiting bodies in center of lesion help distinguish from tan spot. Often found in orderly rows.
- On the heads a brown to gray-brown discoloration occurs and pycnidia are found on the infected glumes
Septoria Leaf and Glume Blotch
Septoria leaf and glume blotch (fungus)
Conditions favoring development

- Optimal development is between 68-82 F wet, windy conditions.
- Minimal wet periods of 6 hours, but mostly needs 16 hours of wetness.
Septoria leaf and glume blotch (fungus)
Control Methods

- Fungicides
- Tillage
Scab (fungus)
Symptom/Sign

- Bleached spikelets on part or all of wheat head
- Pink or orange spore masses may be seen at the base of infected spikelets during periods of high humidity
- Infected heads are sterile or contain white shriveled grain
- Same as Fusarium on corn (mycotoxins)
Scab (fungus)
Conditions favoring development

- Spores from corn, wheat and grass residue spread to flowering wheat under warm, wet conditions.

- Temperatures between 77-86 F and continuous moisture at flowering are most favorable for epidemics.
Scab (fungus)
Control Methods

- Tillage prior to planting
- Rotation (limited value in areas with intense no-till or reduced tillage corn production)
- No resistance
Take-all (fungus)
Symptom/Sign

- Infected plants are stunted and ripen prematurely
- Best identified at heading by stunted growth in patches and heads are bleached white and often sterile
- Black lesions at base of crown under the lowest leaf sheath
- Plants pull easily from the soil from extensive rot rot.
Take-all
Take-all (fungus)
Conditions favoring development

- Continuous wheat production
- High pH, poorly drained soils or wet years
Take-all (fungus)
Control Methods

- Rotation
- Maintain good fertility levels
- No good resistant varieties
- Control grassy weeds before cropping to wheat
Barley yellow dwarf (virus)  
Symptom/Sign

- Ambiguous often look like nutritional disorders
- Fall infection results in patches of yellow, stunted plants. Spring infections usually result in plants of varying heights and yellow or purple colored flag leaves after head emergence
- Occurs in patches of field where aphid vectors feed
Barley yellow dwarf (virus)
Conditions favoring development

- Transmitted by aphids
- Cool, moist conditions (50-65 F)
- Early planted fields attractive to aphids
- Mild winter with aphids
Barley yellow dwarf (virus)
Control Methods

- Tolerance
- Later planting date
- Control aphids
Wheat spindle streak mosaic (virus)
Symptom/Sign

- Non-distinct yellow streaks can be confused with early stage powdery mildew
- Often produces yellow-green mottling, dashes and streaks. The streaks often have tapered ends forming spindles.
- Entire field affected--not patchy. Low spots in field can have more severe symptoms.
Wheat spindle streak mosaic (virus)
Conditions favoring development

- Soil borne virus
- Transmitted by fungus, in the fall.
- Cool weather (46-53 F) produces the most symptoms
- “Disappears” as temperatures increase
Wheat spindle streak (virus)
Control Methods

- Resistant variety
- Rotation of some value
- Later planting
- Poultry manure may decrease disease incidence
Loose Smut (fungus)
Symptom/Sign

- Black smutted heads on wheat
Loose Smut (fungus)
Control Methods

- Fungicide seed treatment
- Plant certified seed
Alfalfa Diseases
Phytophthora root rot (fungus)

Symptom/Sign

- Poor growth
- Wilting
- Brown discoloration on stem
- Rotted roots
Phytophthora Root Rot
Phytophthora Root Rot
Phytophthora root rot (fungus)
Conditions favoring development

- Cool, wet conditions
- Poorly drained soils
Phytophthora root rot (fungus)
Control Methods

- Select well drained sites
- Break up compacted soils to enhance drainage
- Plant resistance varieties
- Use Apron seed treatments to avoid seedling damping-off
Anthracnose (fungus)
Symptom/Sign

- Wilted stems
- Diamond shaped lesions on lower stem
- Lesion gray with red margin
- Scattered in the field
- Infected stems with characteristic diamond shaped lesion will also produce a typical shepherd’s crook
Anthracnose (fungus)
Conditions favoring development

- Warm, humid conditions
- Late summer/early fall weather can be very favorable for infection
Anthracnose (fungus)
Control Methods

- Resistant variety
- Clean harvesting equipment before first cutting and when going from a known infected fields to a healthy field.
<table>
<thead>
<tr>
<th>Symptom/Sign</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fall</td>
<td>Fall-planted alfalfa dies in spring during cool, wet conditions.</td>
</tr>
<tr>
<td>Cottony web-like</td>
<td>Cottony web-like growth on stems and crowns.</td>
</tr>
<tr>
<td>Stems turn brown,</td>
<td>Stems turn brown, then soft and mushy then disintegrate.</td>
</tr>
<tr>
<td>Black fruiting bodies</td>
<td>Black fruiting bodies (Sclerotia) on stem.</td>
</tr>
</tbody>
</table>
Sclerotinia Crown Rot
Sclerotinia Crown Rot
Sclerotinia crown rot (fungus)

Conditions favoring development

- Infection occurs in fall
- Plants die in cool, wet spring
- Favored by late summer early fall planting
- Planting into clovers
Sclerotinia crown rot (fungus)

Control Methods

- Spring planting date
- Deep plowing to bury sclerotia
- No resistance
Leaf spots (fungus) - Common Lepto

Symptom/Sign

- Spots on leaves
- New growth most affected
Leaf Spots

Leaf Spots
Leaf spots (fungus)-Common Lepto
Conditions favoring development

- Cool, moist season
Leaf spots (fungus)-Common Lepto
Control Methods

- Early harvest
Spring blackstem (fungus)
Symptom/Sign

- Black spots on lower leaves, petioles, stems
- Entire stem black--first cutting problem
Spring blackstem (fungus)
Conditions favoring development

- Cool, moist early season and again in fall
- Heavy dew or rain
Spring blackstem (fungus)
Control Methods

- Early cutting
- Plant moderately resistant cultivars
Verticillium wilt (fungus)
Symptom/Sign

- Scattered infected stems
- Early symptoms include V-shaped chlorosis at leaflet tips
- Not all stems on the same plant infected initially
- Internal root tissue is often brown, but it is not a dependable diagnostic feature.
Verticillium Wilt
Verticillium wilt (fungus)

Conditions favoring development

- Introduced on seed usually
- Could be disseminated in manure
- Insects can serve as vectors
- Can spread within the field during cutting
Verticillium wilt (fungus)

Control Methods

- Plant clean seed free of debris
- Plant resistant varieties
- Disinfestation of cutter bars and equipment
Most Common Symptoms of Nematode Injury

Field Symptoms
- Stunting and sometimes yellowing of plants in patches of varying size
- Not definitive, need to look at roots

Plant Symptoms and Signs
- Galls, cysts, lesions or dead areas on roots
FUNGICIDE CLASSIFICATION

■ PROTECTANT
  – Forms a protective barrier on the plant surface that prevents spore germination eg. Dithane, Bravo, thiram

■ SYSTEMIC
  – Moves in the plant from point of application across the leaf or into new growth. Can move from roots to above ground parts. Prevents spores from germinating or kills them soon after germination. Eg. Tilt, Baytan, Raxil, Quadris, Ridomil.

■ ERADICATIVE (Curative)– kills fungus already present. Some systemic fungicides have some curative activity
TREATMENT THRESHOLDS FOR FUNGICIDE APPLICATION

- Thresholds are available for making spray decisions for wheat in the mid-Atlantic region.

- Use stage of development and amount of disease present to determine need for an application.