PLANT DISEASES CCA TRAINING

BOB MULROONEY EXTENSION PLANT PATHOLOGIST UNIVERSITY OF DELAWARE

COMPETENCY AREA 2

Management of Plant Diseases

Disease Identification

SymptomsSigns

SYMPTOMS

External and internal reactions or alterations of a plant as a result of a disease



SIGNS

The pathogen (disease causing agent) or its parts or products seen on a host plant







CLASSIFY DISEASES BY PATHOGEN

FUNGUS
BACTERIA
VIRUS
NEMATODE



WHEAT TAKE-ALL caused by a FUNGUS BARLEY YELLOW DWARF caused by a VIRUS

KNOW CONDITIONS THAT FAVOR DISEASE DEVELOPMENT FOR EACH DISEASE

CLIMATIC CONDTIONSCROPPING PRACTICES

DETERMINE CONTROL MEASURES FOR EACH DISEASE

CULTURAL CHEMICAL

CULTURAL CONTROLS

ROTATION
VARIETY (HYBRID) SELECTION
PLANTING DATE
FERTILITY MANAGEMENT
TILLAGE
WEED CONTROL

DISEASE 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 varietyControl Johnsongrass

Maize chlorotic dwarf (virus) Symptom/Sign

Chlorosis (yellowing) severe on young leaves

Some reddeningSevere 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 varietyControl 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.



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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 Leaf Spot



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 (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



'Starburst pattern'

Fusarium



Diplodia

Fusarium

Giberella

isarium 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





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

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 trifoliates 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

C'harcoal 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 **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
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 uper portions die and produce no pods. Large sclerotia on stem and sometimes in pith



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 a 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

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 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 infecton 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

Soybean cyst nematode Control Methods

Resistant varietiesRotation

Root knot nematode Symptom/Sign

Stunted yellow plants
Knots (galls) on roots



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



whean Mosaic (virus)







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Soybean mosaic (virus) Conditions favoring development

Seed borne diseaseAphid transmitted

Soybean mosaic (virus) Control Methods

Certified seedResistant 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



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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 initailly
- 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

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

Powdery Mildew (fungus) Control Methods

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 (fungus) Conditions favoring development

Temperatures from 59-72 F and free-moisture. Needs adequate rainfall.
 Overwinters far south
 Spores carried by wind

Leaf rust (fungus) Control Methods

ResistanceFungicides
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 (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

FungicidesTillage

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





arley Yellow Dwarf

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 (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 shepard'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.

Symptom/Sign

Fall- planted alfalfa dies in spring during cool, wet conditions.

- Cottony web-like growth on stems and crowns
- Stems turn brown, then soft and mushy then disintegrate.
- Black fruiting bodies (Sclerotia) on stem



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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 (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



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Spring blackstern (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.

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Verticillium Wil

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Verticillium Wilt

Verticillium wilt (fungus) Conditions favoring development

Introduced on seed usually
Could be disseminated in manure
Insects can 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.