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PIONEER agronomy

Common Stalk Rots of Corn

Anthracnose

Disease Facts

- Caused by *Colletotrichum graminicola*, a fungal pathogen.
- Most common stalk disease of corn.
- Favored by plant stress following pollination.

Identification and Symptoms

- Shiny black coloration on outside of stalk late in the season (Figure 1).
- Internal stalk discoloration (Figure 2).
- Stalk may be easily crushed when squeezed at base.
- Stalk may lodge when pushed sideways.
- For a positive identification of the disease with a hand lens, look for the presence of setae, which are bristle like hair structures on the stalk surface. Setae are often found within a mucous-like droplet. (Figure 3).

Management

- Crop rotation - at least one year out of corn
- Tillage - encourages breakdown of crop residue, reducing disease inoculum
- Genetic resistance
    - Pioneer plant breeders select hybrids and parent lines for resistance, using induced and natural infection.
    - Hybrids differ significantly in resistance to anthracnose. Scores for Pioneer® brand hybrids generally range from 2 to 7 on a 1 to 9 scale (9=resistant).

Figure 1. External stalk discoloration caused by anthracnose.

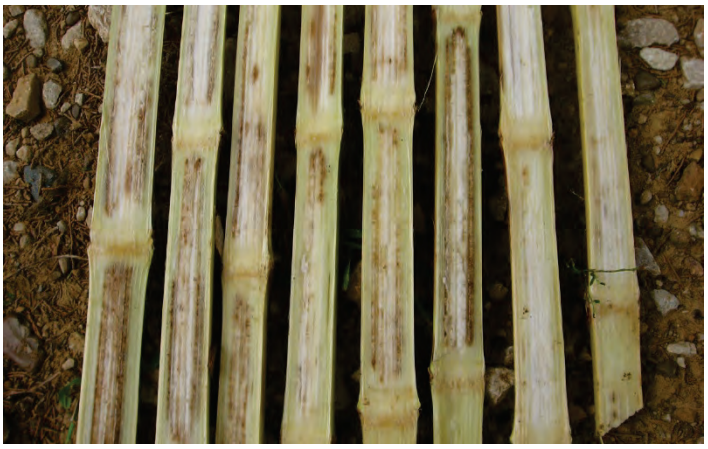

Figure 2. Internal stalk symptoms of anthracnose.

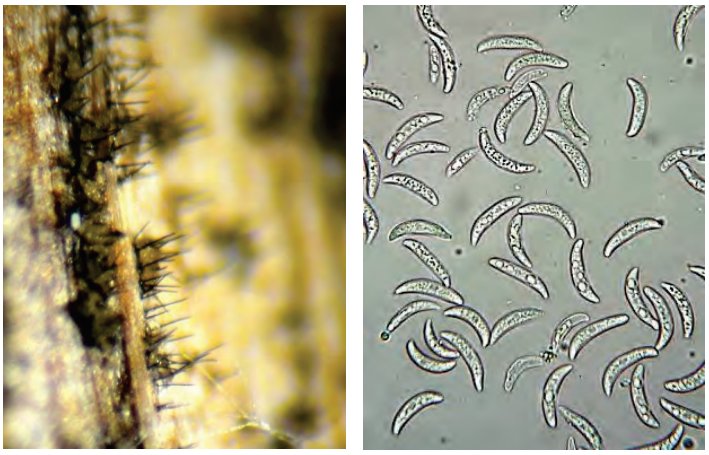

Figure 3. Left – Setae visible on the stalk surface using a hand lens; Right – Curved anthracnose spores as seen under a microscope.

Gibberella

Disease Facts

- Caused by the fungus *Gibberella zeae*.
- Ascospores produced in perithecia are disseminated to corn plants by wind and rain splash.
- Insect injury often allows pathogen to enter the plant.
- Can infect corn at the leaf sheaths, brace roots, or roots. Infection continues from roots into lower stem.
- Infection often occurs after pollination. Disease can progress rapidly with warm, wet weather during corn reproductive stages.
- Environmental and physiological stresses may weaken the plant and allow disease development.

Identification and Symptoms

- Rotting at roots, crown and lower internodes.
- Perithecia (small black fungal fruiting structures), may develop on the stalk surface near the node (can be scraped off with fingernail).
- Pink to reddish coloration of pith and vascular strands (Figure 4).
- Pith of the inner stalk may deteriorate leaving only the vascular bundles intact.
- Destruction of the nodal plate (Figure 4).
- Later stages – plant turns gray-green, internodes turn straw colored or dark brown and are easily pinched between fingers.
- Late season snapping of stalks at the node (Figure 5).

Management

- Select hybrids with good stalk strength and resistance to leaf diseases. Control leaf diseases with fungicides if necessary.
- Rotate crops. Corn following soybeans often has less stalk rot and higher yield than continuous corn.
- Use a tillage system that chops and incorporates residue to break it down.
- Soil test and follow fertilizer recommendations; maintain proper nitrogen:potassium balance.

Figure 4. Pink to reddish discoloration characteristic of Gibberella.

Figure 5. Stalk breakage at the node caused by Gibberella.

Fusarium

Disease Facts

- Caused by *Fusarium verticilioides* fungus (formerly called *Fusarium moniliforme*), found everywhere corn is grown.
- Overwinters as mycelia in infected crop debris, spread by wind and rain splash.
- Can infect the plant directly through the roots, causing root and lower stalk rot. Can also infect at the nodes when dispersed to leaves and washed down into the sheath.
- Favored by warm, relatively dry weather; plant stress following pollination; and other diseases.
- Disease generally progresses during reproductive stages of corn development.
- Typically occurs in a complex with other root/stalk rots including Gibberella, Diplodia, and anthracnose
- European corn borer adults have been shown to vector the disease from plant to plant. Corn borer larvae create wounds that allow the fungus to enter the plant.

Identification and Symptoms

- Rotting at roots, crown and lower internodes.
- When split, inner stalk shows a light pink to tan discoloration, but no black specks (fungal fruiting bodies) in or on the stalk.
- Pith disintegrates, vascular bundles remain intact (Figure 6).
- Stalks feel spongy when squeezed and may be easily crushed or crimped at lower internodes.
- Plants may lodge when pushed sideways or impacted by wind.
- Fusarium may look similar to Gibberella stalk rot and is distinguished by inner stalk color – Fusarium: white/pink/salmon; Gibberella: red/pink (Figure 7).

Management

- Select hybrids with good stalk strength and resistance to leaf diseases. Control leaf diseases with fungicides if necessary.
- Rotate crops.
- Use a tillage system that chops and incorporates residue to break it down.
- Reduce stresses when possible -- stalk rots are favored by plant stress following pollination.

Figure 6. Disintegrated stalk pith caused by Fusarium.

Figure 7. External and internal fusarium stalk rot symptoms.

Diplodia

Disease Facts

- Caused by *Stenocarpella maydis* fungus (formerly called *Diplodia maydis*). Corn is the only host of this pathogen.
- Survives on corn stalk residues; spores are spread by wind or splashing rain.
- Favored by warm, wet weather two to three weeks after pollination.

Identification and Symptoms

- Diplodia stalk rot may first be evident when affected plants die suddenly during mid to late ear fill.
- Upon examination, dark brown lesions can be found extending in either direction from the node.
- Small black spots (pycnidia) may develop just beneath the stalk epidermis near the nodes (Figure 9). The black dots are not easily removed, which distinguishes Diplodia from Gibberella.
- Diplodia results in rotted stalks that are disintegrated and discolored (brown), allowing the stalk to be crushed or easily broken (Figure 10).
- Although the pith disintegrates, vascular bundles remain intact.

Management

- Genetic resistance – choose hybrids with high scores for stalk strength.
- Crop rotation - at least one year out of corn.
- Tillage to help break down crop residue.
- Use moderate plant population if field has a history of stalk rot.
- Control stalk-boring insects to prevent wounds stalk rot organisms can enter.

Figure 8. Diplodia stalk rot.

Figure 9. Corn stalk showing Diplodia stalk rot symptoms. Note pycnidia on corn stalk node.

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Figure 10. Broken corn stalks due to Diplodia stalk rot infection.

Charcoal Rot

Disease Facts

- Caused by the soil fungus, *Macrophomia phaseolina*.
- Charcoal rot begins as a root infection, which spreads into the lower stalk internodes and causes early ripening, shredding and breaking at the crown of the corn stalk.
- Corn is infected during dry periods where the temperature hits 80-85 °F (27-29 °C). The sclerotia germinates on the root surface and penetrates the host epidermal cells of the corn.
- The very tiny black fungal bodies, known as sclerotia, on the vascular strands of the interior of the stalks, contained on the shredded pith give them a charred appearance.
- This "charring" of the interior of the stalk contributes to its namesake, as it is a distinguishing characteristic of the disease.
- The pathogen overwinters on host crop residue and survives in the soil.

Identification and Symptoms

- Charcoal rot first becomes noticeable when corn is in the tassel stage or later. Upper leaves of the corn will dry out.
- Infected corn plants have shredded stalks, and the pith will have completely rotted, leaving only stringy vascular strands intact.

- The sclerotia of the fungus are small, black and spherical, and are found on and inside the vascular strands, numerous enough to give the internal stalk tissue a grey coloring.
- Translocation of water and nutrients are disrupted due to hyphae of the fungi growing intercellularly through the xylem and into the surrounding vascular tissue.
- The fungus can grow into the lower internode of the stalk as the plant matures, causing plants to ripen prematurely and weaken their stalks, causing breakage.

Management

- Hybrid selection: Use hybrids resistant to Diplodia and Gibberella stalk rot, as these tend to offer genetic resistance to charcoal stalk rot as well.
- Crop rotation: Rotation to a non-host crop, such as small grains can help reduce the disease potential. Many crops are host to this disease besides corn, including soybean, grain sorghum, sunflowers and other weed hosts.
- Insect management: Controlling insect damage and wounding to the crop will help minimize potential points of infection.

Figure 11. The very tiny black sclerotia on the vascular strands of the shredded pith are a characteristic sign of charcoal rot.

Figure 12. Charcoal rot begins as a root infection, which spreads into the lower stalk internodes and causes early ripening, shredding and breaking at the crown of the corn stalk. Charcoal rot is favored by heat and drought stress.

Physoderma

Disease Facts

- Physoderma stalk rot and the more commonly observed foliar symptoms known as Physoderma brown spot are both caused by the fungal pathogen *Physoderma maydis*.
- This pathogen was first documented in India in 1910 and in the United States in 1911.
- Historically, Physoderma stalk rot has generally been of little economic importance in the US, although instances of severe localized outbreaks have been reported.
- However, prevalence has increased in the U.S. Corn Belt within the last few years, possibly due to wetter conditions early in the growing season.

Identification and Symptoms

- Symptoms of Physoderma stalk rot includes blackening of lower stalk nodes and potentially some stalk rot of the pith, which can result in breakage at the node.
- Physoderma stalk rot can occur in fields in which foliar symptoms (Physoderma brown spot) are not present.
- Plants in which Physoderma stalk rot symptoms are observed are often otherwise healthy with large ears.

Management

- Tillage and crop rotation may be helpful in reducing disease inoculum, as the fungus survives in infected crop residue.
- Specific management for this disease is not typically required, as the occurrence is sporadic and the effect on yield should be minimal.
- Field observations suggest some variability among hybrid susceptibility to Physoderma stalk rot; however, Pioneer® brand corn products are not currently rated for genetic resistance to this disease.

Figure 13. Stalk breakage and dark lesions on lower nodes of plants affected by Physoderma stalk rot.

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