Stalk Rot Diseases of Corn

Each year at grain harvest, stalk rots are present in corn fields. The pathogens that cause stalk rots are the same organisms that help breakdown the corn plant following physiological maturity, which is a natural and necessary process. The challenge for corn producers is to prevent stalk rots from getting started early enough in the growing season to interfere with grainfill and standability of their crop. If the corn crop can mature before the infection becomes severe, the stalk rot organisms simply help decompose crop residue; if the infection becomes severe during early and mid-reproductive stages (tassel through early dent), yield reduction and harvest complications are likely.

Disease Cycle
While specific stalk rot pathogens thrive in different environmental conditions, stalk rots generally follow a similar annual cycle. The pathogens enter corn plants through the root system or through above-ground wounds caused by mechanical injury, insects, or hail. After gaining entry, they either remain latent until the crop starts to mature or immediately begin to colonize and damage the plant. Which scenario happens depends on timing of the infection, the overall health of the crop (i.e. absence of a major stress), the environmental conditions following infection, and hybrid susceptibility. The greatest losses are associated with early infection of a susceptible hybrid that is under stress, followed by environmental conditions that favor the pathogen. Fertility levels also play a role in severity of a stalk rot infection (see management section). Stalk rot pathogens overwinter in the soil and on crop residue. If a host crop is planted and environmental conditions are favorable the cycle will repeat.

Disease Management

Hybrid Selection
Hybrids vary in their susceptibility to certain stalk rots. Additionally, hybrids with strong stalks and/or roots will maintain standability longer into the harvest season, regardless of the presence of stalk rots. Consider hybrids with above average stalk and root strength, combined with above average resistance to stalk rots, if available, for fields that are at risk for stalk rot and/or will be harvested later in the season. Stalk and root strength scores can be found in the Rob-See-Co product guide characteristics chart and/or Hybrid Tech Sheets. Hybrid ratings for tolerance to Fusarium crown rot and Anthracnose stalk rot, if available, can be found in the Disease Tolerance section of the Tech Sheets.

Crop Stress
Stalk rot is most damaging when the infection coincides with a crop that is under stress, especially during early- and mid-reproductive stages. Plant stress is caused by any factor that reduces the plants ability to conduct photosynthesis or access water and nutrients. Excess or too little soil moisture increases plant stress during reproductive stages by reducing the ability of the root system to deliver water and nutrients to the plant. Excess soil moisture further contributes to crop stress by weakening the overall health of the root system and by favoring the stalk rot pathogen more than the crop. Damage by foliar diseases and/or leaf-feeding insects cause plant stress by reducing the amount of healthy leaf material available to conduct photosynthesis, and cloudy weather stresses the crop by reducing the amount of photosynthesis occurring over time. When the plant is stressed and
photosynthesis is reduced, there are fewer carbohydrates to fill the developing ear. Plants respond to this carbohydrate deficiency by reallocating carbohydrates from the stalks and roots to developing kernels. This reallocation of carbohydrates places the roots and stalks in a negative carbohydrate balance and makes them more susceptible to accelerated decay by stalk rot organisms.

**Soil Fertility**

Inadequate or imbalanced soil fertility increases crop susceptibility to stalk rots. Excess levels of nitrogen can lead to very rapid and unbalanced vegetative growth, and low levels of potassium can decrease stalk strength. Both can lead to increased risk for stalk rot development and lodging. Ensure fertility programs are based on soil testing and are balanced to meet the specific farm’s yield goal.

**Crop Rotation**

Rotation to a non-grass crop is encouraged to reduce the amount of inoculum in the soil. Rotation is not a silver bullet, and should only be used in combination with other good stalk rot management practices. Many stalk rot pathogens are associated with multiple crop types and have demonstrated persistence in the soil for multiple years following a host crop.

**Tillage**

Because it accelerates the decomposition of stalk residue, which eliminates their food source, survival of stalk rot pathogens is generally reduced by tillage. However this reduction in survival rate has not consistently corresponded to a reduction in incidence of stalk rots in the following host crop. It is more important for the tillage program to meet the needs of the farm (i.e. ensure good stand establishment, aid in nutrient and weed management, and provide erosion prevention), than to be relied on to eliminate risk of losses to stalk rot.

**Plant Population**

Planting populations that are too high for the yield conditions in the field, or too high for the hybrid planted in the field, cause additional plant stress by increasing competition for light, nutrients, and water, as well as by increasing plant height (a mechanism individual plants use to compensate for the surrounding competition). Ensure plant populations are based on both the yield goal of the field, and the specific hybrid’s response to population.

**Harvest Schedule**

Stalk health should be evaluated during later reproductive stages and again as the grain dries to a moisture content in the mid- to upper 20% range. Walk the field and pinch the lower internodes of a representative number of plants. If 10% or more of the evaluated stalks are weak (pinch or give easily), the field should be scheduled for early harvest. Be sure to evaluate areas of the field that vary in soil moisture or soil type to give a full assessment of stalk health throughout the field. In cases of severe stalk rot, it will likely be more economical to harvest the field early and pay additional drying costs than to risk lost yield and time from lodged corn.
Common Stalk Rot Diseases

Fusarium Root, Crown, Stalk and Ear Rot

Fusarium root, crown, stalk, and ear rot can be caused by three different species of Fusarium: *Fusarium verticillioides*, *F. proliferatum*, and *F. subglutinans*.

**Timing:** Infection of the roots, crown, and stalk may occur at any time during vegetative growth. Fusarium ear rot infections occur during or after flowering.

**Environment:** The stalk rot phase is favored by dry weather prior to silking, followed by warm wet weather during reproductive stages. Fusarium ear rot is favored by hot dry conditions after flowering.

**Identification:** The roots, crown and lower internodes will all express symptoms in plants with Fusarium stalk rot. White mycelium (a network of fine, white filaments) may be found outside the lower nodes of affected plants. Pith tissue (the spongy white tissue inside the stalk) disintegrates and may become whitish pink to salmon in color. Unlike most other stalk rots, fusarium infections do not produce visible fungal fruiting bodies inside the affected stalk.

Fusarium ear rot is characterized by diseased kernels that are whitish pink to grey in color. It often occurs in patches on the infected ear. White streaks on infected kernels, commonly referred to as “starbursts,” develop where the fungus is growing beneath the seed coat. Two of the three Fusarium species (*F. verticillioides* and *F. proliferatum*) can produce Fumonisins in infected ears. Fumonisins are a type of mycotoxin and can be toxic when fed to livestock. Horses and swine are most sensitive. Laboratory analysis is required to identify which species is causing the ear rot and the level of Fumonisin present, if any.

Charcoal Rot

Charcoal rot is caused by the fungus *Macrophomina phaseolina*.

**Timing:** A Charcoal rot infection can occur anytime during reproductive stages through senescence.

**Environment:** Temperatures over 85°F and dry field conditions during reproductive stages or senescence encourage development of charcoal rot.

**Identification:** *M. phaseolina* produces distinct sclerotia inside and outside an infected stalk. The distribution of sclerotia gives the appearance of charcoal dust. Pith tissue will disintegrate but vascular bundles remain intact.
**Anthracnose Stalk Rot**

Anthracnose stalk rot is caused by the fungus *Colletotrichum graminicola*. This same fungus also causes Anthracnose leaf blight, although the presence of one does not necessarily indicate presence of the other.

**Timing:** Anthracnose stalk rot infection can occur anytime throughout the growing season, although symptoms generally appear during corn reproductive stages.

**Environment:** High temperatures during corn reproductive stages favors development of Anthracnose stalk rot.

**Identification:** Shiny black discoloration on the outer rind is characteristic of Anthracnose stalk rot. Pith and vascular bundles may develop a light to dark brown discoloration, particularly at the nodes of infected stalks. When the upper stalk is infected, Anthracnose stalk rot may cause top die-back (early death of the upper canopy).

**Note:** Anthracnose leaf blight may occur at seedling stage or after R6, but generally not during mid-vegetative growth stages. Development of the leaf blight phase is favored by high temperature in combination with wet conditions. Anthracnose leaf blight is identified by oval shaped water soaked lesions with reddish brown margins and tan interiors. Early season infections occur on lower leaves, while infections at crop maturity occur in the upper canopy. A single lesion may grow to 6” in length.

**Diplodia Stalk and Ear Rot**

The fungus responsible for Diplodia stalk rot (*Stenocarpella maydis*) survives only on corn residue, placing continuous cornfields at the highest risk for infection. This same fungus also may infect the developing ear, causing Diplodia ear rot.

**Timing:** Stalk infections most often occur through the roots or crown, but occasionally the fungus enters through wounds in the stalk or leaves. If the fungus is present and conditions favor development, infected plants will exhibit stalk rot symptoms during grainfill. Ear infections occur through the husks, near the base of the ear, or through the silks. Ears are the most susceptible to development of ear rot symptoms during the first three weeks after flowering.
**Environment:** Dry conditions prior to reproductive stages followed by warm, wet conditions during reproductive stages encourage development of the infection.

**Identification:** Diplodia stalk rot causes the pith to turn brown and disintegrate, leaving the vascular bundles intact. The fungus forms reproductive structures called *pycnidia*. These structures will appear as tiny dots the size of a pinhead inside the stalk and on the lower outer rind. The pycnidia are partially embedded in the plant tissue, giving the stalk a rough, sandpaper texture. Diplodia ear rot symptoms include a premature browning of the outer husk accompanied by a white or grayish fungal mycelium, generally beginning at the base of the ear and covering the kernels. As the infection develops, pycnidia may also be found on the affected kernels and husk.

**Gibberella Stalk and Ear Rot**

Gibberella stalk rot is caused by *Fusarium graminearum*. This same fungus causes Gibberella ear rot in corn, as well as Fusarium head blight in barley, wheat, oats and rye. *F graminearum* overwinters in crop residue and is dispersed to new fields by wind.

**Timing:** Gibberella stalk rot infections generally occur around pollination. Infection may occur through corn roots, leaf sheaths, or wounds in the leaves or stalk. Gibberella ear rot develops in the first three weeks following silking.

**Environment:** Warm and wet conditions favor the development of Gibberella stalk rot. Conversely to the stalk rot form, Gibberella ear rot is most prevalent when cool, wet conditions occur after silking.

**Identification:** Reproductive structures called *perithecia* can be found near nodes on the exterior of the stalk of infected plants. They appear as black specks, and are easily scraped off. The interior of the stalk will develop a pinkish-red discoloration as the pith disintegrates; vascular bundles are left intact. Reproductive structures are also found in the stalk interior. Gibberella ear rot can be identified by a distinct pink-white mold that begins at the tip of the ear and progresses toward the butt of the ear. Gibberella ear rot can produce mycotoxins that are toxic to livestock.