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PIONEER®

Common Corn Ear Rots

Diplodia Ear Rot (no mycotoxins)

- Wet weather during grain fill and upright ears with tight husks promote Diplodia
- Diplodia may cause ear rot, stalk rot or seedling blight
- Corn is only known host
- Wet weather plus moderate temperatures allow infection to occur if spores are present during early silking to two to three weeks after silking
- Diplodia is highly dependent on quantity of infected, unburied corn residue (stalks, cobs and kernels)

Fusarium Ear Rot (produces mycotoxins)

- Most common fungal disease on corn ears
- Fungi survive on residue of corn and other plants
- Most severe when weather is warm and dry
- Disease enters ear primarily through wounds from hail or insect feeding
- Scattered or groups of kernels are typically affected
- Mold may be white, pink or salmon-colored
- Infected kernels may turn tan or brown
- "Starburst" pattern often associated with the disease

Gibberella Ear Rot (mycotoxins may occur)

- Infects other cereals – causes head scab of wheat
- Overwinters in infected crop residue
- Spores are spread from crop residue to corn ears by wind and rain splash
- Infection of corn ears occurs through young silks
- Infection favored by cool, wet weather during and after pollination (optimum temps 65 to 70° F)

Aspergillus Ear Rot (mycotoxins may occur)

- Most common under drought conditions, high temperatures (80-100° F) and high relative humidity (85%) during pollination and grain fill
- Gray-green, olive, yellow-green or yellow-brown powdery mold growth on and between kernels
- Surface mold can develop anywhere on the ear
- Symptoms are often found at damaged areas of ear

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Diplodia Ear Rot

Disease Facts

- Caused by the fungus *Stenocarpella maydis*, previously known as *Diplodia maydis*.
- Wet weather during grain fill and upright ears with tight husks promote Diplodia.
- Pathogen can cause ear rot, stalk rot and seedling blight.

- Corn is the only known host.
- Wet weather plus moderate temperatures allow infection to occur if spores are present from early silking until two to three weeks after silking.
- Diplodia is highly dependent on quantity of infected, unburied corn residue (stalks, cobs and kernels).

Disease Symptoms

- Early infected plants have tan spots on husks or bleached husks that are obvious from a distance.
  - Husks on severely infected plants dry down well before the rest of the plant.
- White mycelial infection progresses from base of ear to tip.
- Extensive mycelial growth causes ears to remain erect and husks to bind tightly to ear.
- Rotted seed may germinate prematurely (vivipary).
- Later-infected plants are less damaged and may show no obvious symptoms on husks.

Impact on Crop

- Infection can reduce grain quality and yield due to lower kernel size and test weight.
- If infection occurs early, some ears may not produce harvestable grain. Less damage results if ear is more developed when infection occurs.
- Fungal growth is most common during milk, dough and dent stages.
- Mycotoxins are not associated with this disease but some animals may reject infected feed.

Management

- Hybrids differ in their susceptibility to Diplodia ear rots, but all will show some damage under severe conditions
- Harvest seriously infected fields early and dry grain to below 15% moisture (below 13% for storage through the following summer).
- Cool infected grain below 50 ºF as quickly after harvest as possible and store at 30 ºF.
- Clean grain after drying and before storing to remove lighter, damaged kernels, cobs and fines.
- Diplodia development on ears in field can worsen in the bin if grain is not dried properly.
- Screen grain and store the most infected grain separately to help avoid putting the whole bin at risk.

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Fusarium Ear Rot

Disease Facts

- Fusarium rot is the most common fungal disease on corn ears.
- Caused by *Fusarium verticillioides* (previously known as *Fusarium moniliforme*) and several other Fusarium species.
- The causal organism survives on residue of corn and other plants, especially grasses.
- Infection can occur under a wide range of environmental conditions, but is more severe when weather is warm and dry.
- Disease enters ear primarily through wounds from hail or insect feeding.
- Airborne spores can germinate and grow down the silk channel to infect kernels.

Disease Symptoms

- Scattered or groups of kernels are typically affected
- Mold may be white, pink or salmon-colored
- Infected kernels may turn tan or brown
- "Starburst" pattern often associated with the disease (light-colored streaks radiating from top of kernels where silks were attached)
- In severe infections, ears may be completely consumed by the fungus, leaving lightweight husks cemented to the kernels by mycelia.

Mycotoxins

- *Fusarium verticillioides* and *Fusarium proliferatium* produce fumonisins, the most commonly occurring mycotoxins in the Corn Belt.
- Fumonisins can be fatal to horses and pigs.
- Fumonisins can damage organs in other mammals and are carcinogenic.

Left: Bt ears – no insect feeding or disease symptoms

Right: Non-Bt ears – insect feeding allowed entry of Fusarium fungus with resulting symptoms

Management

- Since the disease enters the ear primarily through injury and insect feeding, hybrids with one or more aboveground insect protection traits can have a lower risk of Fusarium ear rot
- Hybrids differ in their susceptibility to fusarium ear rot. If Fusarium ear rot has caused significant damage in the past, growers should consider planting only hybrids with a Fusarium ear rot rating of 5 or higher.

Harvest and Storage

- Clean bins before storage.
- Harvest at 25% moisture and dry to 15% moisture or lower if storing grain into the following summer.
- Cool infected grain below 50°F as quickly after harvest as possible and store at 30°F.
- Clean grain before storing to remove infected kernels, cobs and fines.
- Store infected grain separately, if possible.

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Vol. 12 No. 31 September 2020

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Gibberella Ear Rot

Disease Facts

- Caused by the fungus *Gibberella zeae*.
- Overwinters in infected crop residue.
- Spores are spread from residue to corn ears by wind and rain.
- Infection of corn ears occurs through young silks.
- Infection favored by cool, wet weather during and after pollination (optimum temperature 65 to 70 °F).
- Often a problem in the northern and eastern Corn Belt (both US and Canada).
- Most common in continuous corn or corn following wheat that was infected with Fusarium head blight.

Disease Symptoms

- Most readily identified by the red or pink color of the mold starting at ear tip.
- Mold may be very pale in some cases, causing it to be confused with other ear rots.
  - Gibberella almost always begins at the ear tip and progresses from there.
  - Fusarium is usually scattered throughout the ear or localized on injured kernels.
  - Diplodia usually starts at the base of the ear, is gray rather than pink, and husks may be "bleached."
- Early, severely infected ears may rot completely, with husks adhering tightly to the ear and the mold growing between the husks and ear.
- Perithecia, or black fungal fruiting structures, may be lightly attached to kernel surface.

Mycotoxins

- *Gibberella zeae* can produce two mycotoxins in the infected kernels: deoxynivalenol and zearalenone.
- These mycotoxins can be harmful to many monogastric animals, especially swine.
- Mycotoxin contamination of grain may or may not accompany ear mold symptoms.

Management

- Scout fields before harvest in order to make informed decisions about harvest timing, postharvest grain handling, storage and utilization.
- Fields with significant infestations of Gibberella ear rot should be harvested as early as possible and handled separately.
- Set combine to reduce kernel damage and remove fines and shriveled or broken kernels.
- Dry infected grain at high temperature to a moisture of 15% or less and monitor grain in storage to maintain its condition.
- Test grain for presence of mycotoxins and manage accordingly.

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Vol. 12 No. 32 September 2020

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Aspergillus Ear Rot

Disease Facts

- Aspergillus ear rot is a fungal disease most commonly caused by *Aspergillus flavus* although it can be associated with other *Aspergillus* species.
- Aspergillus ear rot is most common under drought conditions, high temperatures (80-100°F) and high relative humidity (85%) during pollination and grain fill.
- Disease and associated aflatoxins are a common problem in the southeastern United States and Texas but less common and detrimental in the Corn Belt.
- Corn ears damaged by insects or weather such as hail, high winds or early frost that cracks the kernels may predispose grain to infection (Figure 1).
- Aspergillus fungal spores are produced on crop residue in fields and on discarded kernels and fines around grain bins.
- Infection most commonly occurs via kernel wounds or insect damage but fungal spores can also infect kernels by growing down the silk channel when silks are yellow-brown and still moist.
- Aspergillus can occur on many types of organic material, including forages, cereal grains, food and feed products and decaying vegetation.

Figure 1. Aspergillus infection following hail injury.

Symptoms

- Gray-green, olive, yellow-green or yellow-brown powdery mold growth on and between kernels (Figure 2).
- Infection often occurs at the tips of ears but can develop anywhere on the ear, particularly if the ear has experienced physical injury or insect damage.
- Fungal spores are powdery and may disperse when the husk is pulled back from the ear.

Mycotoxins

- Aflatoxins, produced by *A. flavus* and *A. parasiticus*, are the only mycotoxins for which the U.S. FDA has established formal action levels (Table 1).
- Corn grain with aflatoxins above 20 parts per billion (ppb) may not be sold for transport across state lines.
- Mycotoxin levels can vary among infected ears and do not necessarily correlate to the severity of visible infection.
- If Aspergillus ear rot is present in a field, the harvested grain should be tested for aflatoxin.

Figure 2. Corn ear with aspergillus ear mold. A laboratory test for aflatoxin is recommended where Aspergillus ear rot is suspected.

Management

- When Aspergillus occurs, crop yield has likely already been reduced by drought stress. Fungal infection may further reduce weight of infected kernels.
- Production of aflatoxin by fungus is variable, but more likely under heat and drought stress.
- If Aspergillus is confirmed, the corn must be tested to determine if aflatoxin is present and to determine the proper marketing channel.
- Blending corn lots to reduce the level of aflatoxins is prohibited for interstate trade.
- There is no method to “detoxify” infected corn.
- Aflatoxins are not destroyed by fermentation and will be concentrated in dry distillers grain.

- Since the disease enters the ear primarily through injury and insect feeding, hybrids with one or more aboveground insect protection traits can have a lower risk of Aspergillus ear rot.
- Little native hybrid resistance exists and seed companies do not rate hybrids for Aspergillus.
- Hybrids that perform well in drought conditions can have lower risk for Aspergillus infection than less drought-tolerant hybrids.

Harvest and Storage

- Clean bins, areas around bins and all grain handling equipment before putting grain in storage.
- Infected fields or areas should be harvested as early as possible since the fungus will continue to develop and produce aflatoxin as the corn dries down. Begin harvest when grain is at 25% moisture and dry to 15% or lower within 24 to 48 hours.
- Corn going into long-term storage should be dried to below 13% moisture and cooled to 30°F.
- Adjust combine to minimize trash and broken kernels.
- Harvest and store grain from Aspergillus-contaminated fields separately.
- Clean grain going into storage by screening or gravity separator to remove lightweight and broken kernels, foreign material and fines.
- High concentrations of aflatoxin may be found in corn screenings so they should be disposed of properly.

Table 1. U.S. FDA action levels for aflatoxin contaminated corn.

Grain Intended Use	Action Level (ppb)
Finishing beef cattle	300
Finishing swine (100 lbs or greater)	200
Breeding beef cattle, swine, mature poultry	100
Immature animals	20
Dairy animals	20
Human consumption	20

Source: Guidance for Industry: Action Levels for Poisonous or Deleterious Substances in Human Food and Animal Feed
https://www.fda.gov/regulatory-information/search-fda-guidance-documents/guidance-industry-action-levels-poisonous-or-deleterious-substances-human-food-and-animal-feed

Figure 3. Corn ear with aspergillus ear mold.

Figure 4. Corn ear with aspergillus ear mold.

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Less Common Corn Ear Rots

Penicillium Ear Rot (mycotoxins may occur)

- Blue-green fungal growth on and between kernels usually near the ear tip is characteristic of this disease
- Fungal disease of ears often associated with damage from insects or other physical injury
- Infected kernels may become bleached or streaked
- Common and damaging fungus of stored grain, and can grow on kernels with moisture greater than 18%

Cladosporium Ear Rot (no mycotoxins)

- Kernels have a gray to black or greenish-black appearance, and sometimes a powdery mold growth is present
  - Also causes black streaks on kernels
- This fungal disease is often seen on ears damaged from frost, insects or other mechanical injury
- Wet weather during ear maturation and delayed harvest may favor this fungal growth

Nigrospora Ear Rot (no mycotoxins)

- Kernels have a dark gray or black discoloration from fungal mycelium and spores, mostly at the base of kernels
- Infection may first be noticed when cobs shred from the butt end during mechanical harvest
- Usually more severe at the base of ears, and ears are often chaffy and lightweight
- Affected ears are often from plants that have been weakened from frost, drought, root injury, leaf blights, stalk rots or poor nutrition

Trichoderma Ear Rot (no mycotoxins)

- Typical symptoms include a dark green fungal growth on and between husks and kernels, often involving the entire ear
- Fungal disease of ears usually associated with injury to the developing ear, including damage from bird or insect feeding or other mechanical injury
  - For this reason, damage is not found on every ear, but rather, is usually more scattered within a field