

Integrated Pest & Crop Management

Late Season Soybean Diseases

By *Laura Sweets*

This year has been a challenging one for soybean production in Missouri. Late planting and extremes in weather conditions have had an impact on the crop. However, there are still some biotic diseases showing up in fields across the state. Plants may still be showing symptoms of late season Phytophthora root rot, sudden death syndrome (SDS) and Cercospora leaf spot/blight as well as of the soybean vein necrosis virus that was been so prevalent last season. Charcoal rot may be a problem in the northern portion of the state. This is also the time of year when anthracnose and pod and stem blight may show up on maturing soybean plants. Losses from soybean cyst nematode continue to be a problem. This would be a good year to sample fields for SCN. Also, downy mildew seems to be more prevalent than usual although not at levels that would impact yield.

Yield losses from these various late season diseases will vary depending on when symptoms began to occur, number of plants infected, severity of disease in infected plants and weather conditions from now to harvest. In some cases although yellowing of the upper nodes may be quite widespread and spectacular in a field, damage is limited to the uppermost leaves and pods so yield loss should be minimal. In other cases, especially with sudden death syndrome, the entire plant may have been killed prematurely. If large areas of a field are thus affected, yield losses will be greater. Although it is too late in the season to do much to control these diseases this year, management strategies to prevent or minimize these diseases next season are also given below.

Late Season Phytophthora Root Rot

Wet conditions after planting regardless of planting date increase the likelihood of Phytophthora root rot. Phytophthora may cause seed decay and seedling blight but it can also cause symptoms later in the season as plants move into reproductive stages

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of growth. Infected older plants show reduced vigor through the growing season or die gradually over the season. Lower leaves may show a yellowing between the veins and along the margins. Upper leaves may yellow. The stems show a characteristic brown discoloration that extends from below the soil line upward and even out the side branches. Eventually the entire plant may wilt and die. Withered leaves remain attached even after the plant dies. Preventive measures are the main means for



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Phytophthora Root Rot (top) & Phytophthora Root Rot Stem Discoloration (bottom)

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managing *Phytophthora* root rot. Select varieties with race-specific resistance, tolerance or a combination of the two, plant in good seedbed conditions, tile to improve drainage, take steps to reduce compaction, rotate crops and use an appropriate fungicide seed treatment.

Sudden Death Syndrome

Symptoms of sudden death syndrome (SDS), caused by a strain of *Fusarium virguliforme*, may appear several weeks before flowering but are more pronounced after flowering. Foliage symptoms begin as scattered yellow blotches in the interveinal leaf tissue. These yellow blotches may



Early Symptoms of Sudden Death Syndrome (top) & Sudden Death Syndrome of Soybean (bottom)

increase in size and merger to affect larger areas of leaf tissue. Yellow areas may turn brown but veins remain green giving the leaves a striking appearance. Infected plants may wilt and die prematurely. Severely affected leaflets may drop off the plant leaving the petiole attached or may curl upward and

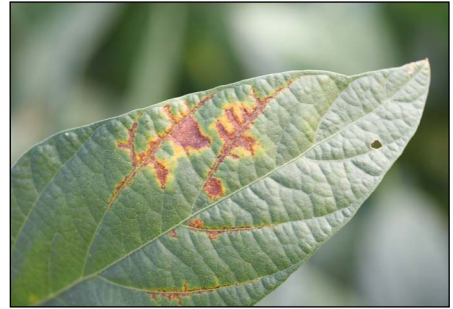
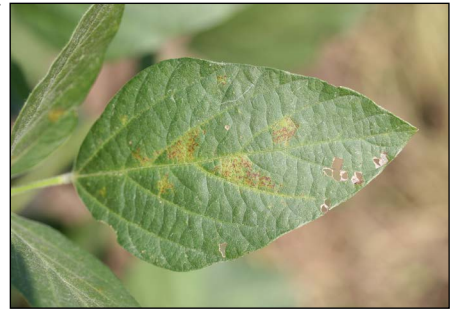
remain attached to the plant. Root systems may show deterioration and discoloration of lateral roots and taproot. When split open, internal tissues of the taproot and stem may show a light gray to light brown discoloration.

Management options for SDS are somewhat limited but should include planting varieties which have performed well where SDS has been a problem, improving drainage in poorly drained fields, avoiding compaction, staggering planting dates, delaying planting until soils are warm and dry, avoiding continuous crop soybean, maintaining good crop vigor, avoiding crop stress including stress from soybean cyst nematode and harvesting fields with SDS in a timely fashion.

Soybean Vein Necrosis

Last year a relatively new virus disease of soybean, soybean vein necrosis, showed up in many soybean fields in August 30, 2013

various regions of the state. Initially, small light-green to yellow patches develop near main leaf veins. These patches then develop a mottled light green-yellow-brown pattern. The veins in these areas of the leaflet may become clear to almost translucent which is referred to as vein clearing. As the disease progresses these areas turn reddish-brown with a



Initial Symptoms of Soybean Vein Necrosis (top) & Soybean Vein Necrosis (bottom)

browning of the veins. The reddish-brown areas may have a scaly or scabby appearance. On more susceptible varieties the brown areas may expand killing larger areas of leaf tissue and giving a scorched appearance to the leaves.

The virus which causes soybean vein necrosis belongs to a group of viruses called tospoviruses which are spread by thrips. At this point the disease is still a relatively new disease and there are more questions about it than answers. It appears that the virus is spread from soybean to soybean by thrips but which species(s) of thrips is unknown. Other hosts, especially weed hosts, have not been confirmed. And there are many questions related to the disease cycle, possible yield losses and appropriate management strategies. Varieties seem to vary in their susceptibility to this virus disease and symptoms may vary with varieties.

At this time there isn't enough known about the virus and disease to make effective management recommendations. As more information becomes available on this disease, management strategies can be formulated and recommendations made. Overall, disease symptoms of soybean vein necrosis have been low to moderate across fields in all states in which the disease has been reported this season. So for this season no control measures are recommended

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Downy Mildew



Downy Mildew on Upper Leaflet Surface (top) & Downy Mildew on Lower Leaflet Surface (bottom)

Downy mildew, caused by the fungus *Peronospora manshurica*, is reported wherever soybeans are grown. The downy mildew fungus survives as oospores in infected leaf residues and on seeds. Spores produced in diseased areas on lower leaf surfaces are wind-blown and serve to infect additional leaves on that plant or other plants. Initial symptoms of downy mildew are pale green to light yellow spots or blotches on the upper leaf surface of young leaves. These areas enlarge into pale to bright yellow blotches of indefinite size and shape. Eventually lesions turn grayish brown to dark brown with a yellow margin. During periods of heavy dew or wet weather, a gray to purple fuzz that is visible growth of the downy mildew fungus develops on the lower leaf surface beneath the diseased areas on the upper leaf surface. Severely infected leaves turn yellow and then brown. Downy mildew is favored by high humidity and temperatures of 68-72 degrees F.

Management options for downy mildew include planting disease-free seed and rotating crops with at least one year between soybean crops.

Septoria Brown Spot

Septoria brown spot causes small brown spots on the unifoliate and lower trifoliate leaves. The individual spots may run together forming irregularly shaped brown blotches on the leaves. Infected leaves may yellow and drop prematurely. Brown spot usually starts on the lower portion of the plant. Under favorable weather conditions (warm, wet weather), the disease may move up through the plant. Brown spot was evident in many Missouri soybean fields earlier this season. But late season rains can

trigger a reoccurrence of Septoria brown spot. Symptoms move up through the canopy of soybean plants. Lower leaves may show heavy spotting, yellowing and dropping prematurely. Upper leaves may also show spotting and yellowing. Some fields which have a yellow cast from the road may be showing symptoms of Septoria brown spot rather than SDS.

The fungus which causes this disease, *Septoria glycines*, survives in infested residues left on the soil surface. Fields with continuous soybean production are more likely to show damage. Planting disease-free, good quality seed of resistant varieties, rotating crops with at least one year between soybean crops and maintaining good plant vigor should reduce losses from Septoria brown spot.

Cercospora Leaf Spot and Purple Seed Stain

Cercospora kikuchii can infect soybean seeds, pods, stems and leaves but is most commonly found on the seed. However, this year we are seeing some cases of leaf spot or leaf blight caused by this fungus. Infection is primarily occurring on the uppermost leaves and begins as reddish purple to reddish brown, angular to somewhat circular lesions on the soybean leaves. These lesions may coalesce to kill larger areas of leaf tissue. The uppermost trifoliate leaf and petiole may be blighted and brown. One striking symptom of this disease may be the premature yellowing and then blighting of the youngest, upper leaves over large areas of affected fields. In most fields, the symptoms have not progressed down the plants more than one to two nodes. Pods at the uppermost node may develop round, reddish purple to reddish brown lesions. This pathogen may also infect seed causing purple seed stain. Infected seed show a conspicuous discoloration ranging in color from pink to pale purple to dark purple. The discoloration may range from small specks to large blotches which cover the entire surface of the seed coat. Temperatures of 82-86°F with extended periods of high humidity favor disease development.

At this point in the season control of Cercospora leaf spot and purple seed stain is not feasible. It is important to remember that since this fungus can infect the seed, seed from heavily infected fields should not be used for seed. If infected seed must be planted, seed lots should be thoroughly cleaned and an appropriate seed treatment fungicide used. Rotating soybean with crops other than legumes will also help reduce Cercospora leaf spot and blight in future soybean crops.

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Colletotrichum species

Colletotrichum truncatum and several other *Colletotrichum* species cause anthracnose of soybean. Typically, anthracnose is a late season stem and pod disease of soybean. Symptoms occur on stems, pods and petioles as irregularly shaped, light to dark brown spots, streaks or lesions. Eventually black fungal structures may be evident in these lesions. Anthracnose may also cause tip blight. The tip blight phase of anthracnose causes a yellowing or browning of the uppermost leaves and pods. The blighted tips may dry up and die prematurely. Anthracnose is favored by warm, wet weather, and the tip blight phase of anthracnose is most likely to occur after a rainy period.

Again, at this point in the season control of anthracnose is not feasible. This fungus may also infect seed so seed from heavily infected fields should not be used for seed. If infected seed must be planted, seed lots should be thoroughly cleaned and an appropriate seed treatment fungicide used. Rotating crops with at least one year out of soybean will also help reduce anthracnose.

Pod and Stem Blight

Phomopsis longicolla and the other *Diaporthe* and *Phomopsis* species that cause pod and stem blight and *Phomopsis* seed decay can survive in infested crop residues, in the soil and in seed. Symptoms usually develop on stems of plants during later reproductive stages of growth.

Pod and stem blight infected plants may be stunted and their stems discolored. Black pycnidia or fruiting bodies of the cause fungi develop on the lower portion of the main stem, branches and pods as plants reach maturity. The pycnidia may be limited to small patches near the nodes or may cover dead stems and pods. On stems, pycnidia are usually arranged in linear rows while on pods they are scattered across the pods. The fungi may grow through the pod walls and infect the seed causing *Phomopsis* seed decay. Infected seed is usually oblong in shape, somewhat shrunken or shriveled and covered with a white mold growth.

Although prolonged periods of wet weather during flowering and pod fill favor the development of pod and stem blight, the rains since Labor Day have been enough to trigger low levels of this disease this year. If wet weather continues through harvest, levels of *Phomopsis* seed decay may increase.

At this point in the season control of pod and stem blight is not feasible. Management options include rotating crops with at least one year between soybean crops and planting disease-free seed.

Soybean Cyst Nematode

Symptoms of soybean cyst nematode (SCN) range from no obvious symptoms to subtle differences in plant height and vigor or unexpected decreases in yield to severe stunting and discoloration of plants or dead plants. Foliage symptoms may include a yellowing of leaves from the margin inward or a general yellowing of leaves. But such foliage symptoms are also caused by a number of other factors including root rot diseases, nutrient deficiencies, herbicide injury and compaction, so foliage symptoms should not be used to diagnose SCN. Plants with SCN may have poorly developed root systems, if plants are carefully dug up, females may be evident on the roots. The females appear as tiny (smaller than nitrogen-fixing nodules), whitish to yellow to brownish, lemon-shaped structures on the roots. Symptom expression may be more severe if plants are subjected to other stresses such as moisture stress, nutrient deficiencies, herbicide injury, insect damage or other diseases.

Charcoal Rot

Symptoms typically begin to develop as plants move into reproductive stages of growth. Infected plants are less vigorous and have smaller leaves. Leaves may turn yellow and wilt. Leaves eventually turn brown and have a dry appearance. The taproot and lower stem develop a silvery gray to light-gray discoloration of the epidermis (outer layer of the soybean stem). The epidermis may flake or shred away from the stem, giving the stems a tattered appearance. Fine black specks or microsclerotia may be evident in tissues below the epidermis and eventually in epidermal tissues. Symptoms may develop on scattered plants, in circular to oval patches in a field, in drier areas of a field or across much of a field. Charcoal rot is favored by drought conditions so may be more prevalent than usual in much of Missouri this season. Management options for charcoal rot include rotating crops, maintaining good crop vigor to help reduce losses from charcoal rot and irrigating properly from just before bloom to pod fill.

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Update on Soybean Rust

By *Laura Sweets*

It has been several years since soybean rust has been confirmed in Missouri. But it would be a mistake to forget about this disease or think that it will never be a problem in the state. This is year when growers in the southern part of the state, especially southeast Missouri should be scouting for the disease and paying attention to reports from southern states as well as to the weather. There are factors which could lead to the occurrence of the disease in Missouri this year as well as factors which make it unlikely that even if the disease did occur it would cause yield losses.

Factors increasing the potential for soybean rust include the earlier than normal development of soybean rust on soybeans in the southern United States. Thus far in 2013, soybean rust has been reported in 24 counties in Alabama, 18 counties in Georgia, 18 counties in Florida, 12 counties in Mississippi, 10 parishes in Louisiana, 7 counties in South Carolina and 2 counties in Arkansas. In many of these areas, soybean rust occurred 2-3 weeks earlier than normal. The IPM PIPE web site can still be accessed through <https://sbr.ipmpipe.org> for current information on the distribution of soybean rust in the United States.

A second concern is that fact that late planting because of wet conditions last spring means that the soybean crop in Missouri is behind normal. If weather patterns occurred that would carry rust spores from the south to Missouri, there might be more fields in susceptible stages of growth.

However, for soybean rust to develop here inoculum from the south must reach fields in the state and weather conditions here need to be favorable for the disease to develop. Although the hurricane season is just reaching

its height there are not currently any active systems in the Atlantic Ocean. The prevailing weather patterns for much of the state are not conducive for wind-blown spread of spores from the southern United States to Missouri. And most of the locations where soybean rust has been found in 2013 are too far east to provide inoculum to most of the state (the exception being the southeast corner of Missouri).

Then the current environmental conditions are not very favorable for disease development even if spores were to reach the state. Favorable conditions would be frequent rain, overcast days and moderate temperatures. After a very cool start to August, the temperatures have climbed and the forecast seems to be for a continuation of hot, dry weather.

Once soybean plants reach the R6 stage of growth, yield loss from soybean rust is less likely to occur. Although it is possible that soybean rust may reach Missouri this season (especially southeast Missouri), it may not arrive in time to cause significant yield losses and/or weather conditions here may not be conducive to the buildup and spread of the disease even if spores do reach the state. Bottom line it would be wise to be alert for soybean rust, to scout fields and to watch the IPM PIPE website for further information on the distribution of soybean rust.

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Field Crop Diseases - What Is Showing Up and What Is Not

By *Laura Sweets*

This is another challenging year for field crops in Missouri. Most of the state was unusually wet early in the season so planting was delayed and crops are not quite as far along in growth stages as is normal. Since mid-season, fluctuations in weather conditions have further challenged crops. The southern portion of the state has seen near record to record precipitation with extensive flooding. The northern portion of the state has been quite dry and is, again, in the initial stages of drought. These variations in environmental conditions have influenced which diseases are showing up in both corn and soybean fields.

The most widespread problem on corn this season appears to be rust. Both common rust and southern rust have been found in varying levels in fields across the state. Most field corn hybrids are fairly resistant to common rust so it typically doesn't have a major impact on yield. Many field corn hybrids do not have good resistance to southern rust so that disease can impact yield. Once corn plants are past the R3 growth stage, yield losses are less likely. Gray leaf spot has not been particularly widespread although there have been a few scattered reports of this disease on corn.

It is a little early to know how severe corn stalk rots and corn ear and kernel rots will be. However, there have already been cases of ear rots on corn- especially *Diplodia* ear rot, *Penicillium* ear rot and *Fusarium* or Gibb ear rot. The recent stretch of hot, dry weather may slow the development of these ear rots but might also lead to *Aspergillus flavus* ear rot. See accompanying articles on corn ear and kernel rots and on corn stalk rots.

So far, the most common disease complaint on soybean has been sudden death syndrome. Symptoms of this disease are quite evident in some regions of the state and surprisingly absent in other regions. Wet soil conditions when plants are in the seedling stages of growth favor infection by the soil-borne pathogen and cool, wet conditions as the crop moves from vegetative to reproductive stages of growth favor foliage symptom development of SDS.

The soybean vein necrosis virus which was so widespread during the 2012 season doesn't appear to be as prevalent this season. Very early symptoms of this virus disease were found in fields in central Missouri but there have been few questions related to this disease from other areas of the state.

Downy mildew and bacterial blight are evident in the upper canopy of many fields. Downy mildew symptoms on the upper leaf surface might be mistaken for the early symptoms of sudden death syndrome. However, turning the leaves over will aid in distinguishing between these two diseases. With downy mildew a grayish purple mold growth develops on the lower leaf surface beneath the yellow lesions. This year the mold growth is quite obvious. *Septoria* brown spot lesions may be evident on lower leaves but doesn't appear to be moving up in the canopy in most fields. There have been a few reports of frogeye leaf spot but that disease has not been as prevalent as normal thus far this season. See accompanying article on late season soybean diseases.

Soybean rust has NOT been reported from Missouri this season. The recent reports of positive finds in Drew and Desha counties in southeast Arkansas raised concern that soybean rust might move into Missouri for the first time in several years. See separate article on soybean rust in this issue of the newsletter.

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Ear and Kernel Rots of Corn

By Laura Sweets

Corn harvest is beginning or rapidly approaching in many parts of the state. So far we have received only a few samples with ear and kernel rots. Usually *Diplodia* ear rot, Gibb ear rot, *Penicillium* ear rot and *Aspergillus* species other than *Aspergillus flavus* are associated with wet conditions, especially wet falls and harvests that are delayed by wet conditions. Although much of the state has been unusually dry recently, there have already been fields in which these ear and kernel rots are present. In some cases the ears showing molds had been damaged by insects or hail and the molds had come in around the damaged areas. But in other cases *Penicillium* and *Fusarium* are showing up on the tips of the ears. And then in fields in which hot, dry conditions occurred at or just after pollination, *Aspergillus flavus* and aflatoxin could be problems.



Diplodia-Ear-Rot

Diplodia ear rot, *Penicillium* ear rot and Gibb ear rot are common problems year in and year out but the severity varies with weather conditions at pollination or close to harvest. The *Penicillium* ear rot and Gibb ear rot are particularly evident on the exposed tips of ears, around insect tunnels and on ears that have remained upright. If there are periods of wet weather before corn is harvested, some of the corn plants that died prematurely may show the black discoloration caused by secondary fungi coming in on the senescing plant tissues. Because of the wet conditions early in the season, there was a wide range of planting dates for corn. Unfortunately, there were some fields which were silking and pollinating during the stretch of hot, dry weather about mid-season. These fields might be at risk for the occurrence of *Aspergillus flavus* and aflatoxin.

Both *Diplodia maydis* and *Diplodia macrospora* can cause **Diplodia ear rot** of corn. The ear leaf and husks on the ear may appear prematurely bleached or straw-colored. When the husk is peeled back, dense white to grayish-

white mold growth will be matted between the kernels and between the ear and the husks. Small, black fungal fruiting bodies may be scattered on husks or embedded in cob tissues and kernels. The entire ear may be grayish-brown, shrunken, very lightweight and completely rotted. *Diplodia* ear rot is favored by wet weather just after silking and is more severe when corn is planted following corn.

Penicillium rot is usually evident as discrete tufts or clumps of a blue-green or gray-green mold erupting through the pericarp of individual



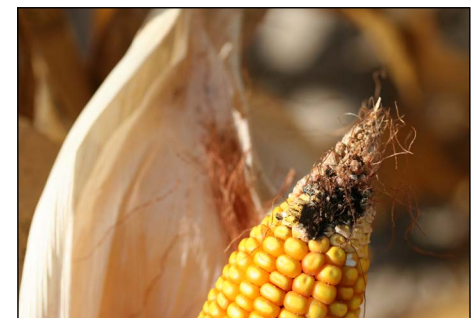
Penicillium and Aspergillus niger ear rots

kernels or on broken kernels. *Penicillium* appears as small, discrete colonies of mold growth with a dusty or powdery appearance. The fungus may actually invade the kernel giving the embryo a blue discoloration. Blue-eye is the term used for this blue discoloration of the embryo.

Gibb ear rot (caused by *Gibberella zeae*) usually begins as a reddish mold at the tip of the ear. Early infected ears may rot completely with husks adhering tightly to the ear and a pinkish to reddish mold growing between husks and ears. Although mold growth usually has a pinkish to reddish color, it can appear yellow to yellow-orange or yellow-red. Gibb ear rot typically begins at the tip of the ear but under favorable conditions it can move down the ear causing extensive damage. It may also develop around injuries from hail, birds or insects.

Aspergillus niger is also common on exposed ear tips. This fungus will be evident as black, powdery masses of spores on the tip of the ear or around insect tunnels.

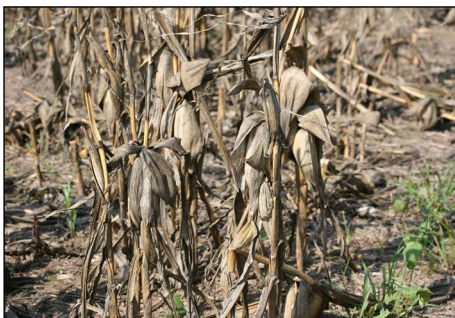
Black corn occurs when any of a number of saprophytic or weakly parasitic fungi grow on corn plants in the



Aspergillus niger

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Black Corn

Since the affected plants may have a sooty appearance these fungi are sometimes called sooty molds. These sooty molds or secondary fungi tend to develop on plants when wet or humid weather occurs as the crop is maturing or if harvest is delayed because of wet weather. Typically these fungi come in on plants that are shaded, undersized, weakened or prematurely ripened and on senescing foliage. Plants that are lodged or that have been stressed by nutrient deficiencies, plant diseases or environmental conditions may be more severely affected. Although many of these fungi produce dark or black mold growth, the color of the mold growth can range for dark or black to olive green or even pink to white.

These secondary fungi tend to develop on senescing plant tissues, primarily leaf, stalk and husk tissue, but under favorable conditions can cause infection of the kernels. Infected kernels might show a black discoloration.

It is possible that these sooty molds or secondary fungi could contribute to stalk deterioration or stalk rot. Lodging could become a problem in these fields, especially if there are high winds or strong storms before harvest.

Grain from fields with high levels of sooty molds should be treated with care if it is stored. Grain should be thoroughly cleaned to remove lightweight, damaged or broken and moldy kernels. Grain should be stored at the proper moisture content and temperature and checked on a regular basis during storage.



Aspergillus flavus

field. *Alternaria*, *Cladosporium*, *Aureobasidium* and other species are frequently found on these discolored or black plants. Since the affected plants may have a sooty

appearance these fungi are sometimes called sooty molds. These sooty molds or secondary fungi tend to develop on plants when wet or humid weather occurs as the crop is maturing or if harvest is delayed because of wet weather. Typically these fungi come in on plants that are shaded, undersized, weakened or prematurely ripened and on senescing foliage. Plants that are lodged or that have been stressed by nutrient deficiencies, plant diseases or environmental conditions may be more severely affected. Although many of these fungi produce dark or black mold growth, the color of the mold growth can range for dark or black to olive green or even pink to white.

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Aspergillus flavus is evident as greenish-yellow to mustard yellow, felt-like growth on or between kernels, especially adjacent to or in

insect damaged kernels. *Aspergillus flavus* is favored by high temperatures and dry conditions, so *Aspergillus* ear rot is typically associated with drought stress. The fungus survives in plant residues and in the soil and spores are spread by wind or insects to corn silks where the spores initiate infection.

An additional concern with ear and kernel rots of corn is the possibility of mycotoxin production. Mycotoxins are naturally produced chemicals that in small amounts may be deleterious to animal or human health. *Aspergillus* and *Gibberella* are most frequently involved in cases of mycotoxin contamination in Missouri corn. The presence of molds or their spores does not necessarily mean that mycotoxins will be produced. Circumstances that favor mold growth may allow production of mycotoxins in some situations, but frequently mold growth occurs with little or no mycotoxin production. Once formed, mycotoxins are stable and may remain in grain long after the fungus has died. In general, swine and poultry are more susceptible than ruminants to mycotoxin-induced health problems. In cases where mycotoxin problems are suspected, a sample should be submitted to a qualified laboratory for mycotoxin analysis. Table 1 below gives the acceptable levels of aflatoxin in corn intended for various uses as established by the United States Food and Drug Administration.

Table 1. Present acceptable levels of aflatoxin in corn used for food and feed as established by the United States Food and Drug Administration (FDA) are as follows:

1. Corn containing no more than 20 ppb of aflatoxin when destined for food use by humans, for feed use by immature animals (including immature poultry) and by dairy animals, or when the intended use is unknown.
2. Corn containing no more than 100 ppb aflatoxin when destined for breeding beef cattle, breeding swine or mature poultry (e.g. laying hens).
3. Corn containing no more than 200 ppb aflatoxin when destined for finishing swine (e.g. 100 lbs. or greater).
4. Corn containing no more than 300 ppb aflatoxin when destined for finishing (i.e. feedlot) beef cattle.

Little can be done to prevent or reduce the invasion of corn by fungi in the field. These ear and kernel rots tend to be more severe on ears with insect, bird, hail or other physical damage. Ears well covered by husks and

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maturing in a downward position usually have less rot than ears with open husks or ears maturing in an upright position. However, if ear and kernel rots developed in the field, it is important to harvest the field in a timely manner and to store the grain under the best possible conditions. Both *Penicillium* and *Aspergillus* can continue to develop on corn in storage if the grain is not stored at proper moisture content and temperatures. These two fungi can cause serious storage mold problems.

Adjust harvest equipment for minimum kernel damage and maximum cleaning. Before storing grain, clean bins thoroughly to remove dirt, dust and any grain left in or

around bins. Thoroughly clean grain going into storage to remove chaff, other foreign material and cracked or broken kernels. Dry grain to 15% moisture as quickly as possible and monitor grain on a regular basis throughout storage life to insure moisture and temperature are maintained at correct levels. Protect grain from insects.

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Corn Stalk Rots

By Laura Sweets

Any factors which stress corn during the growing season may contribute to an increase in stalk rots that season. And this has certainly been a season of stresses for corn in Missouri with late planting due to wet soil conditions, flooding, cool temperatures, high temperatures, high night temperatures, cool night temperatures, overcast days, moisture stress, heavy rains, hail, some foliage diseases, etc. Therefore, it would be wise to scout fields for corn stalk rots and to harvest fields with stalk rot problems as quickly as possible.

A number of different fungi and bacteria cause stalk rots of corn. Although many of these pathogens cause distinctive symptoms, there are also general symptoms which are common to all stalk rot diseases. Early symptoms, which occur a few weeks after pollination, usually start with premature dying of bottom leaves. Eventually, the entire plant may die and appear light green to gray. Diseased stalks usually begin losing firmness during August. The cells in the interior of the stalk are dissolved, resulting in a loss of stalk firmness and strength. Stalks may then lodge, particularly if harvest is delayed or wind storms occur.

Fusarium stalk rot and Gibberella stalk rot can be difficult to distinguish in the field. Both can cause a pink to reddish discoloration of diseased stalk tissue. Tufts of white mycelium may be evident at the nodes of diseased stalks. When stalks are split open the pith is usually shredded and discolored.

Anthrax stalk rot, caused by the fungus *Colletotrichum graminicola*, may be most evident at the nodes. Initially lesions are tan to reddish-brown but they

become shiny black later in the season. These shiny black lesions may begin at a node and extend out from that node. The lesions may merge to discolor much of the lower stalk tissue. Internal pith tissues may also be discolored and may disintegrate as disease progresses.

Diplodia stalk rot may begin as a brown to tan discoloration of the lower internodes. Stalks become spongy. The pith disintegrates leaving only the vascular bundles. Mats of white fungal growth of *Diplodia maydis* may be evident on affected tissues. *Diplodia* also produces fruiting bodies which may be seen as small black specks embedded in the white fungal mat. *Diplodia* also causes an ear rot of corn. *Diplodia* ear rot has been found in scattered fields across the state so *Diplodia* stalk rot could also occur this season.

Charcoal rot may begin as a root rot and move into the lower internodes of the stalks. Pith tissues will be shredded and plants may break at the crown. The charcoal rot fungus, *Macrophomina phaseolina*, produces very small survival structures called microsclerotia which may be visible as very small, black flecks just beneath the stalk surface or on the vascular strands remaining in the interior of the shredded stalks. Charcoal rot is usually more severe under hot, dry conditions, so this corn stalk rot could be a serious problem in areas of the state which suffered from drought conditions the latter part of the growing season.

Stalk rots are caused by several different fungi and bacteria which are part of the complex of microorganisms that decompose dead plant material in the soil. They survive from one growing season to the next in soil, in

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Corn Stalk Rots

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infested corn residues or on seed. Stalk rot pathogens enter the corn plant in a variety of ways. The spores may be blown into the base of the leaf sheath where they may germinate and grow into the stalk. Spores may enter directly into a plant through wounds made by corn borers, hail or mechanical injury. When fungi are present in soil or infested residue as either spores or mycelium, they may infect the root system causing root rot early in the growing season and later grow up into the stalk causing stalk rot.

Stalk rot becomes a problem when plants are stressed during the grain filling stage of development. Water shortage, extended periods of cloudy weather, hail damage, corn borer infestation, low potassium in relation to nitrogen, leaf diseases and other stresses that occur in August and September may be associated with an increase in stalk rot.

Losses from stalk rots vary from season to season and from region to region. Yield losses of 10 to 20% may occur on susceptible hybrids. Losses greater than 50% have been reported in localized areas. Losses may be direct losses due to poor filling of the ears or lightweight and poorly finished ears or indirect through harvest losses because of stalk breakage or lodging. Harvest losses may be reduced if fields are scouted 40-60 days after pollination to check for symptoms of stalk rot. Stalk rot can be detected by either pinching stalks or pushing on stalks. If more than 10-15 percent of the stalks are rotted, the field should be harvested as soon as possible.

Management of stalk rots of corn should include the following:

- Select hybrids with good stalk strength and lodging characteristics.
- Plant at recommended plant populations for that hybrid.
- Follow proper fertility practices.
- Avoid or minimize stress to corn (especially during pollination and grain fill).
- Harvest in a timely manner.

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Weather Data for the Week Ending August 29, 2013

By Pat Guinan

Station	County	Weekly Temperature (°F)						Monthly Precipitation (in.)		Growing Degree Days‡	
		Avg. Max.	Avg. Min.	Extreme High	Extreme Low	Mean	Departure from long term avg.	August 1-29	Departure from long term avg.	Accumulated Since Apr.1	Departure from long term avg.
Corning	Atchison	92	72	94	68	82	+7	1.96	-1.68	2831	+66
St. Joseph	Buchanan	93	72	94	69	82	+7	1.53	-2.43	2728	-20
Brunswick	Carroll	92	68	94	65	81	+6	0.80	-3.32	2884	+95
Albany	Gentry	96	67	97	64	81	+6	0.10	-3.41	2679	-30
Auxvasse	Audrain	95	68	98	65	80	+5	2.14	-1.22	2703	-120
Vandalia	Audrain	*	*	*	*	*	*	*	*	*	*
Columbia-Bradford Research and Extension Center	Boone	94	66	97	63	79	+4	1.76	-2.26	2645	-249
Columbia-Capen Park	Boone	95	65	97	62	78	+2	1.95	-2.03	2657	-337
Columbia-Jefferson Farm and Gardens	Boone	94	68	96	66	80	+5	1.85	-2.17	2749	-152
Columbia-Sanborn Field	Boone	93	70	95	68	82	+6	2.23	-1.80	2912	-86
Columbia-South Farms	Boone	93	69	95	66	80	+5	1.87	-2.19	2730	-167
Williamsburg	Callaway	97	66	100	61	80	+5	0.78	-2.97	2718	-52
Novelty	Knox	94	68	97	64	80	+5	0.00	-3.28	2567	-160
Linneus	Linn	95	69	96	67	81	+7	0.05	-3.61	2666	-24
Monroe City	Monroe	94	68	97	66	80	+5	1.36	-2.17	2657	-130
Versailles	Morgan	94	71	97	69	82	+6	4.39	+0.83	3118	+153
Green Ridge	Pettis	92	69	95	67	80	+7	3.01	-0.19	2762	-28
Lamar	Barton	91	69	94	68	79	+1	3.65	+0.69	2919	-166
Cook Station	Crawford	91	64	93	59	77	+1	7.86	+4.50	2655	-314
Round Spring	Shannon	91	65	92	61	76	+1	6.56	+3.40	2617	-227
Mountain Grove	Wright	89	67	93	64	77	+1	9.47	+6.84	2584	-227
Delta	Cape Girardeau	9	65	95	62	77	0	3.42	+0.60	2939	-329
Cardwell	Dunklin	91	69	94	67	79	0	4.79	+2.74	3201	-335
Clarkton	Dunklin	90	68	94	67	78	0	6.72	+4.68	3136	-346
Glennonville	Dunklin	92	69	95	68	80	+2	4.17	+2.09	3194	-273
Charleston	Mississippi	91	69	95	68	79	+2	2.62	+0.31	3111	-184
Portageville-Delta Center	Pemiscot	91	71	95	70	80	+1	5.69	+3.64	3326	-184
Portageville-Lee Farm	Pemiscot	91	71	94	69	80	+2	5.79	+3.65	3304	-179
Steele	Pemiscot	91	70	95	68	79	+1	4.45	+2.18	3361	-152

‡Growing degree days are calculated by subtracting a 50 degree (Fahrenheit) base temperature from the average daily temperature. Thus, if the average temperature for the day is 75 degrees, then 25 growing degree days will have been accumulated.

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