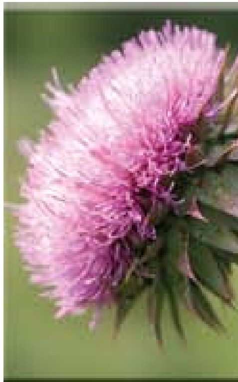
Plant Protection Programs University of Missouri

Integrated Pest & Crop Management



Field Crop Disease Update for September 7, 2010

By Laura Sweets

Soybean:

Over the last two weeks most of the questions related to soybean diseases have been on either sudden death syndrome or frogeye leaf spot.

Although symptoms of **sudden death syndrome** (SDS) started appearing the first of August, they have been slower to develop than last season. Because of the wet conditions after planting throughout the state, SDS should be expected to occur anywhere in the state.

Symptoms of SDS 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 increase in size and merge to affect larger areas of leaf tissue. Veins typically stay green. The bright yellow blotches between the green veins give affected leaves a striking appearance. The yellow areas may turn brown. As the interveinal leaf tissue turns brown, it also dries out. Upper trifoliolates become brown and dry out. Severely affected leaflets may drop from the plant, leaving the petiole attached or they may curl upward and remain attached to the plant. Infected plants may wilt and die prematurely. Pod development may be poor or pods may be aborted. Root systems may show deterioration and discoloration of lateral roots and taproot. When split open, internal tissues of the taproot and lower stem may show a light-gray to light- brown discoloration. A bluish-gray mold growth may be evident on the taproot and lateral roots of infected plants.

Currently symptoms in fields through the state range from slight yellow flecking between the veins of leaflets to leaflets in which the interveinal tissue has turned brown, dried out and curled up. Infected plants may be scattered through a field, concentrated in low areas of a field or along drainage patterns in a field or widespread throughout the field. Potential yield losses from SDS are difficult to estimate. Because the symptoms are so striking there is a tendency to overestimate the losses which will occur. Weather conditions during the remainder of the season will also influence losses due to SDS. Mild temperatures with adequate moisture or conditions which do not stress soybean plants should reduce losses from SDS. Periods of hot, dry weather that further stress plants might lead to more defoliation and even pod abortion on infected plants.

Some of the calls coming in describe areas on soybean plants were pods are flat and brown or pods have aborted. Areas above and below this band of affected pods may have normal pods. If none of the other symptoms of SDS are present, i.e. foliage symptoms, discoloration of cortex tissues in lower stem and taproot or mold growth present on taproot and lateral roots, it may be that the band of poor pod development is related to environmental conditions(ex. high temperatures, high night temperatures, etc.) rather than SDS.

Field observations suggest that SDS is more likely to occur and to be more severe with high soil moisture. High soil moisture during vegetative stages of growth seems to be the most conducive for disease development. This year much of the state had unusually high rain fall through July. So even later planted soybean fields were likely to have received rain when plants were in the vegetative stages of growth. The onset of SDS symptoms frequently is associated with wet conditions and below normal temperatures at or near bloom. The weather this season has been favorable for the development of SDS and for expression of SDS symptoms.

Continued on page 124

Table of Contents

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, moisture stress, heavy rains, 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.

Anthracnose 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 already been found in fields across the state and Diplodia stalk rot could also be more widespread than normal 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 is not likely to be widespread this 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 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. Tolls 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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Ear and Kernel Rots of Corn

By Laura Sweets

Corn harvest is underway or rapidly approaching in many parts of the state. So far we have received very few samples with ear and kernel rots. But preliminary surveys suggest that ear and kernel rots of corn could be problems this season. Diplodia ear rot, Gibb ear rot, Penicillium ear rot and *Aspergillus* species other than *Aspergillus flavus* have all been found on ears in the early dent stage of growth in fields in central and northern Missouri. Although most of the state did not experience drought conditions areas of southeastern Missouri did. In areas in which hot, dry conditions occurred at or just after pollination, *Aspergillus flavus* and aflatoxin could be problems. See article by Dr. Allen Wrather in the August 4, 2010 issue of the Integrated Pest and Crop Management Newsletter for more information on aflatoxin.

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 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. Most corn fields in the state did get through silking and pollination in relatively good condition and have not been exposed to extended periods of hot, dry weather either during or after pollination. Therefore, the potential for *Aspergillus flavus* and aflatoxin should not be high in most of Missouri.

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 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 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.

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.

Little can be done to prevent or reduce the invasion of corn by fungi in the field. 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. 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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Field Crop Disease Update for September 7, 2010 *continued from page 121*

There are no rescue treatments for SDS. Management options for SDS include selecting varieties that have performed well where SDS has been a problem, improving drainage in poorly drained fields, avoiding compaction, staggering planting dates and delaying planting until soils are warm and dry, rotating crops and maintaining good crop vigor.

Frogeye leaf spot has been slow to develop but has picked up in both incidence and severity over the last few weeks. In some fields lesions of frogeye leaf spot are apparent on upper leaves of scattered plants through the field. In other cases, frogeye has increased in severity and leaves in the upper canopy are heavily infected.

Frogeye leaf spot, caused by the fungus *Cercospora sojina*, occurs worldwide. However, the disease is most serious in warm regions or during periods of warm, humid weather. The fungus that causes frogeye leaf spot survives in infested soybean residue and infected seed. Spores produced on infested residues or infected plant tissues are spread by splashing rain or winds.

Symptoms of frogeye leaf spot occur primarily on leaves, although the causal fungus may also infect stems, pods and seed. Lesions are small, circular to somewhat irregular spots that develop on the upper leaf surfaces. Initially the spots are dark and water soaked in appearance. As the lesions age, the center becomes light brown to light gray in color. Older lesions have a light center with a darker red to purple-brown border. Lesions may merge to kill larger areas of the leaf surface. Heavily spotted leaves usually wither and drop prematurely.

Disease development is favored by warm, humid weather. Leaves that expand and develop during periods of warm, wet weather are more likely to be infected than leaves that expand during dry periods. Dry weather severely limits disease development.

The principle means of reducing frogeye leaf spot are to plant disease-free seed, to select resistant varieties and to rotate crops with at least one year between soybean crops. The use of foliar fungicides from bloom to early pod development may be warranted in high value fields (ex. seed production fields) or in years when weather is especially favorable for disease development. See the *2009 Missouri Pest Management Guide: Corn, Grain Sorghum, Soybean and Winter Wheat M171* for information on fungicides labeled for use on soybeans. Most of the fungicides labeled for use on soybeans which have frogeye leaf spot of the label say to apply prior to disease development or at the onset of disease. If symptoms are obvious in the upper canopy it is probably too late for fungicides to be effective.

The labels vary in the time of last application or PHI. At least one product states do not apply after R5 and the others do not apply within 30 days of harvest or 21 days of harvest. At this point in the season it is probably too late for foliar fungicides to be of much benefit.

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Corn Earworm (Soybean Podworm) in Soybean

By Wayne Bailey

Many soybean fields in Missouri have elevated numbers of corn earworm moths and larvae. Corn earworm larvae are major pests of soybean in many southern and eastern states and traditionally have been a pest of soybean in counties bordering Arkansas, although in the past few years this pest has been found in higher numbers throughout the state of Missouri. Corn earworm larvae may feed on host plant foliage, but most often feed directly on the fruit of its cultivated hosts such as the tips of corn ears, grain sorghum seed heads, cotton squares and bolls, and soybean pods, seeds and occasionally flowers.

Although corn earworms overwinter as pupae in the soil in Missouri, additional moths migrate into Missouri each spring from more southern states. Moths are variable in color but tend to be tan with a yellow to light green tint. Moths are relatively large with approximately ½-inch wing spans. They may lay eggs throughout fields at sites where crop canopy has not yet closed. Eggs are laid singularly on a variety of field crops, although silks of late planted field corn and sweet corn are excellent hosts. Traditionally a pest during periods of hot, dry conditions when beneficial insect numbers are reduced, this pest may also flourish whenever field conditions and/or farming practices reduce beneficial insect numbers. There are typically 3 generations of this insect produced in Missouri annually with the second and third generations being most damaging to soybean. Each female may lay an average of 1000 (500 to 3000) white to cream colored, dome shaped eggs which are laid singularly. Eggs display brown bands just prior to hatch with larvae emerging in 2-10 days depending on field temperatures. Once corn earworm eggs hatch in soybean, larvae initially feed on foliage, but prefer to feed on pod walls and consume seeds as larvae approach maturity (1-1/2-inch in length). Larvae grow through 5 or 6 worm stages and change in color with age. Newly hatched larvae are yellowish-white in color with second and third instar larvae changing to yellowish-green. Later instars found on feeding on soybean pods can range in color from green to yellow to tan or reddish brown. Regardless of color, they will generally display several dark longitudinal stripes running the length of their bodies and numerous black bumps with protruding hairs will be present on the top and sides of their bodies. In addition, this insect has 4 pairs of abdominal prolegs and 1 pair of anal prolegs. When disturbed, larvae often roll into a tight ball until the threat passes.

Continued on page 125

Corn Earworm (Soybean Podworm) in Soybean *continued from page 124*

Late-planted or double-crop soybean are most vulnerable to attack from corn earworm. The preferred method of scouting for this pest is through the use of a shake cloth (drop cloth). Typically the cloth is laid between rows where 1-2 linear feet of each adjacent soybean row is vigorously shaken over the cloth. If an average of 1 or more corn earworm larvae are found per linear foot of row sampled, then the economic threshold has be reached. A less effective method of sampling for this pest is through the use of a 15-inch diameter sweepnet. If this method is used, be sure to angle the net opening upward as you sweep the upper 2/3 of the soybean plants in an upward motion. Each pass is considered a sweep with 25 sweeps per location at several locations in a field recommended. If you capture an average of 15 or more corn earworm larvae per 25 sweep sample, the economic threshold has been reached. Note that sweepnet samples tend to under estimate the number of larvae present. In soybean where neither sampling method can be used, treatment of the pest population is recommended if 5-10% or more of the soybean pods exhibit feeding damage from corn earworm larvae.

Several insecticides are labeled for corn earworm control in soybean and are listed below. Additionally, several beneficial insect species feed on corn earworm larvae and can help prevent the buildup of corn earworm larval populations in most years. Insecticide applications through the growing season should be used as a last resort as most insecticides substantially reduce both beneficial insect numbers. Pest alerts (http://ppp.missouri.edu/pestmonitoring/pestalert.html) issued by the University of Missouri IPM Plant Protection Program use statewide pheromone traps to provide early warning of elevated corn earworm moth numbers by region. Additional information is available in University of Missouri Extension Guide Sheet G7110 "Corn Earworm in Missouri".

Excellent images of corn earworm are available in guide G7110 or at the Iowa State University entomology photo gallery (www.ent.iastate.edu/imagegal)

Treatment of corn earworm infestations in soybean are justified when 20% or more defoliation occurs during pod fill or 1 or more larvae are present per linear foot of row or if 5 to 10% or more of soybean pods are damaged.

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Table 1. Insecticides Labeled for the Control of Corn Earworm in Soybean

Chemical Name	*Insecticide*	*Rate of Formulated Material per acre*
Esfenvalerate	***Asana XL**	1.92 to 3.2 fl oz
Beta-cyfluthrin	***Baythroid XL**	1.6 to 2.8 fl oz
Chlorpyrifos plus gamma-cyhalothrin	***Cobalt**	19 to 38 fl oz
Deltamethrin	***Delta Gold**	1.0 to 1.5 fl oz
Lambda-cyhalothrin plus thiamethoxam	***Endigo ZC**	2.5 to 3.5 fl oz
Zeta-cypermethrin plus bifenthrin	***Hero**	4.0 to 10.3 fl oz
Methomyl	***Lannate LV**	0.4 to 0.75 pt
Imidacloprid plus cyfluthrin	***Leverage**	3.8 fl oz
Chlorpyrifos	***Lorsban Advanced**	1 to 2 pts
Zeta-cypermethrin	***Mustang Max EC**	2.8 to 4.0 fl oz
Chlorpyrifos	***Nufos 4E**	1 to 2 pts
Permethrin	***numerous products**	see labels
Gamma-cyfluthrin	***Proaxis**	1.92 to 3.2 fl oz
Carbaryl	***Sevin XLR Plus**	1 to 2 pts
Indoxacarb	***Seward 1.5 SC**	5.6 to 11.3 fl oz
Spinosad	***Tracer 4SC**	1.5 to 2 fl oz
Lambda-cyhalothrin	***Warrior**	1.92 to 3.2 fl oz
Lambda-cyhalothrin	***numerous products**	see labels

**** designates a restricted use pesticide. Be sure to read and follow all label directions, precautions and restrictions.***
Most labeled insecticide will provide good control of corn earworm if the spray penetrates the soybean canopy. For ground application, 15 to 20 gallons of water per acre are recommended.

Weather Data for the Week Ending September 13, 2010

By Pat Guinan

Station	County	Weekly Temperature (ºF)						Monthly Precipitation (in.)		Growing Degree Days‡	
		Avg. Max.	Avg. Min.	Extreme High	Extreme Low	Mean	Departure from long term avg.	Sept 1-Sept 13	Departure from long term avg.	Accumulated Since Apr. 1	Departure from long term avg.
Corning	Atchison	82	59	89	53	69	0	1.40	-0.06	3534	+485
St. Joseph	Buchanan	79	60	85	56	69	-1	2.35	+0.58	3426	+372
Brunswick	Carroll	80	58	87	52	69	-1	2.70	+1.55	3548	+452
Albany	Gentry	80	54	87	47	67	-2	2.17	+0.77	3382	+354
Auxvasse	Audrain	79	58	87	53	68	-2	3.08	+1.61	3496	+370
Vandalia	Audrain	78	56	87	50	67	-3	5.09	+3.67	3478	+374
Columbia-Bradford Research and Extension Center	Boone	79	57	86	52	67	-4	2.14	+0.71	3446	+221
Columbia-Sanborn Field	Boone	80	60	86	55	70	-2	2.56	+1.10	3746	+426
Williamsburg	Callaway	79	56	87	52	67	-3	1.82	+0.37	3523	+447
Novelty	Knox	76	56	85	49	66	-4	4.73	+3.44	3282	+249
Linneus	Linn	78	55	86	49	67	-2	2.86	+1.36	3330	+360
Monroe City	Monroe	77	56	86	49	67	-3	2.41	+0.90	3428	+342
Versailles	Morgan	82	59	89	53	69	-2	6.17	+4.57	3761	+478
Green Ridge	Pettis	80	59	87	57	69	-2	6.15	+4.56	3588	+548
Lamar	Barton	81	63	91	56	72	0	5.61	+3.74	3793	+367
Cook Station	Crawford	80	58	86	50	68	-3	5.09	+3.60	3523	+229
Round Spring	Shannon	80	58	85	51	68	-2	5.50	+4.08	3519	+364
Mountain Grove	Wright	80	59	86	51	69	-2	7.45	+6.02	3625	+491
Delta	Cape Girardeau	82	60	91	54	70	-3	4.55	+3.36	3955	+340
Cardwell	Dunklin	84	64	92	56	73	-2	2.01	+0.95	4299	+396
Clarkton	Dunklin	85	63	93	56	73	-1	1.23	+0.39	4239	+392
Glennonville	Dunklin	84	63	89	55	72	-2	0.73	-0.04	4269	+442
Charleston	Mississippi	84	63	93	57	72	-1	3.51	+2.67	4186	+568
Portageville-Delta Center	Pemiscot	84	65	89	59	73	-1	1.70	+0.54	4396	+542
Portageville-Lee Farm	Pemiscot	84	65	90	57	73	-1	0.65	-0.58	4413	+586
Steele	Pemiscot	86	65	93	57	74	-1	0.87	-0.25	4487	+632

* Complete data not available for report

‡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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