Plant Protection Programs University of Missouri

Integrated Pest & Crop Management

Evaluate Winter Wheat Seed Quality Prior to Planting

By Laura Sweets

This season wheat diseases were widespread and, in some fields, severe. Barley yellow dwarf and wheat streak mosaic are not seed-borne diseases but when these virus diseases are severe there may be more lightweight, poor quality kernels. Fusarium head blight or scab was widespread this season. The fungus which causes this disease may infect kernels and can affect stands if infected seed is planted. Loose smut was again an obvious problem in some fields. If wheat is going to be saved for seed, this is certainly a year to pay careful attention to the quality of seed being saved.

The first step is to clean the wheat seed. It is important that wheat seed be cleaned to remove small and damaged seed and to eliminate weed seeds. Removing small and damaged seed will not only aid in crop establishment it will also provide a more uniform wheat seedling stand. Removing small and damaged seed will also increase the thousand-kernel weight (TKW), which serves as a measure of seed quality. Wheat seed lots with TKW values greater than 30 grams tend to have increased fall tiller number and seedling vigor.

The next step is to perform a germination test. Germination tests can either be completed at home or by sending a sample to the Missouri Seed Improvement Association. A home test can be performed by counting out 100 seeds and placing them in a damp paper towel. Place the paper towel into a plastic bag to conserve moisture and store in a warm location out of direct sunlight. After five days count the number of germinated seeds that have both an intact root and shoot. This will give the grower an estimate of % germination. It is important to choose random seeds throughout the entire seed lot and conduct at least five 100 seed counts. The Missouri Seed Improvement Association also performs a germination test. The test requires one pound of seed and costs $13.75. For details e-mail MOSEED@AOL.com or check the Missouri Seed Improvement Association web site at http://www.moseed.org/. If germination is below 85% it is important to increase the seeding rate to compensate; however seeding any wheat with a germination test below 80% would not be recommended.

The next step is to decide whether a fungicide seed treatment is necessary. A number of fungicides are labeled for use as seed treatment fungicides on winter wheat. These seed treatment fungicides protect germinating seed and young seedlings from seedborne and soilborne pathogens. Seed treatment fungicides will not improve germination of seed that has been injured by environmental factors and will not resurrect dead seed. A correct assessment of the cause of poor seed quality or poor germination rates is the first step in deciding if a seed treatment fungicide is necessary.

As mentioned before loose smut was more common than usual in Missouri wheat fields during the 2008 season. Loose smut is obvious as heads emerge from the boot. All portions of the head except the rachis are converted to masses of dusty black spores. Spores produced on smutted heads are wind carried to adjacent plants in the field and infect those plants through the flowers. Later in the season loose smut is not as obvious as most of the spores on the smutted heads have been dislodged by wind and rain leaving only the bare rachis of the plant.

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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, 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.

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

With the extreme range in planting dates because of wet conditions at planting in much of the state, there is a wide range in corn maturity now. There is also a wide range in condition of the corn crop. There are fields in which the ears are still upright, the husks are not closed over the tip of the ear and ear and kernel rots are already visible on the exposed ear tips. Other fields have large ears with husks completely covering the ears and no signs of ear and kernel rots. If wet, overcast conditions continue the likelihood of ear and kernel rots will increase. 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 from nitrogen deficiency and other stresses may show the black discoloration caused by secondary fungi coming in on the senescing plant tissues.

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.

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.

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.

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 maturing in a downward position usually have less rot than ears with open husks or ears maturing in an upright position. 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.

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

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Ear and Kernel Rots of Corn *continued from page 101*

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.

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.

Soybean Disease Update

By Laura Sweets

This has been an unusual year for soybean diseases. Sudden death syndrome has been widespread this season. Premature defoliation from SDS is evident in some fields or portions of fields. Septoria brown spot was not been particularly widespread early in the season but it has come on since August and is now quite obvious in the lower canopy of many fields. *Cercospora kikuchii* and *Colletotrichum* spp. have been causing leaf spot, yellowing and shoot dieback. Downy mildew has become quite common on the uppermost leaves in many fields. And soybean cyst nematode continues to be a problem in most areas of the state.

Yield losses from these various 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.

Sudden Death Syndrome

Symptoms of sudden death syndrome (SDS), caused by *Fusarium virguliforme* (formerly called *Fusarium solani* f. sp. *glycines*), 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 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.

Septoria Brown Spot

Septoria brown spot causes small brown spots on the unifoliolate and lower trifoliolate 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. Hot, drier weather during July slowed down disease development. 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 trifoliolate 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.

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.

Missouri Cotton Producers Should Prepare Now for the 2009 Crop

By Allen Wrather, University of Missouri-Delta Center

I realize that harvest of the 2008 Missouri cotton crop has just started and few are concerned about anything but getting this crop out of the field. However, producers should now start preparations for the 2009 cotton crop. The following is a check list of items to consider.

- Dig cotton roots after harvest this fall in areas of the field where nematode problems are suspected and examine them for root-knot nematode (RKN) galls. University of Missouri research shows that root gall severity due to RKN is a reliable indicator of the presence of this nematode and the severity of RKN damage to cotton. Producers should do this soon after harvest because the roots begin to rot by December. Contact me for more information about this method. If RKN is a problem, producers should make decisions this winter about how to manage it in 2009.
- Select the fields you intend to plant to cotton in 2009 and test a sample of the soil from each field for pH and nutrients if this has not been done since 2005.
- Apply needed lime, phosphorus, and potassium fertilizer this fall or early next spring.
- Break hardpans by subsoiling this fall or early next spring.
- Improve drainage of the fields this fall or next spring to reduce wet soil problems for the 2009 crop.
- Select varieties for planting in 2009 based on University of Missouri cotton variety yield trials and the yields of varieties in your own and your neighbor's fields. The University of Missouri cotton variety yield trial results for 2008 will be available by late-October to early November on the web at http://aes.missouri.edu/delta/cotton/index.stm.
- Hire a cotton scout or consultant to weekly inspect your 2009 crop for pests.

Following these suggested procedures will give Missouri cotton producers a better chance of producing higher yields and greater profits in 2009. For more information contact Allen Wrather at the University of Missouri Delta Center (Phone: 573-379-5431, E-mail: wratherj@missouri.edu) or check the Delta Center Web Page (aes.missouri.edu/delta).

Evaluate Winter Wheat Seed Quality Prior to Planting *continued from page 99*

The fungus which causes loose smut survives within the embryo of the wheat seed. The fungus survives as dormant vegetative strands within the embryo. This infection is not visible to the naked eye and will not be picked up in the standard germination test. If infected seed is planted and germinates, the fungus also begins to grow within the plant, and at heading, the fungus is at the growing tip and produces smut spores where the grain kernels should be. If seed from a field that has a "small" amount of smut in one season is used for seed, the field planted with that seed may have a substantially higher level of smut.

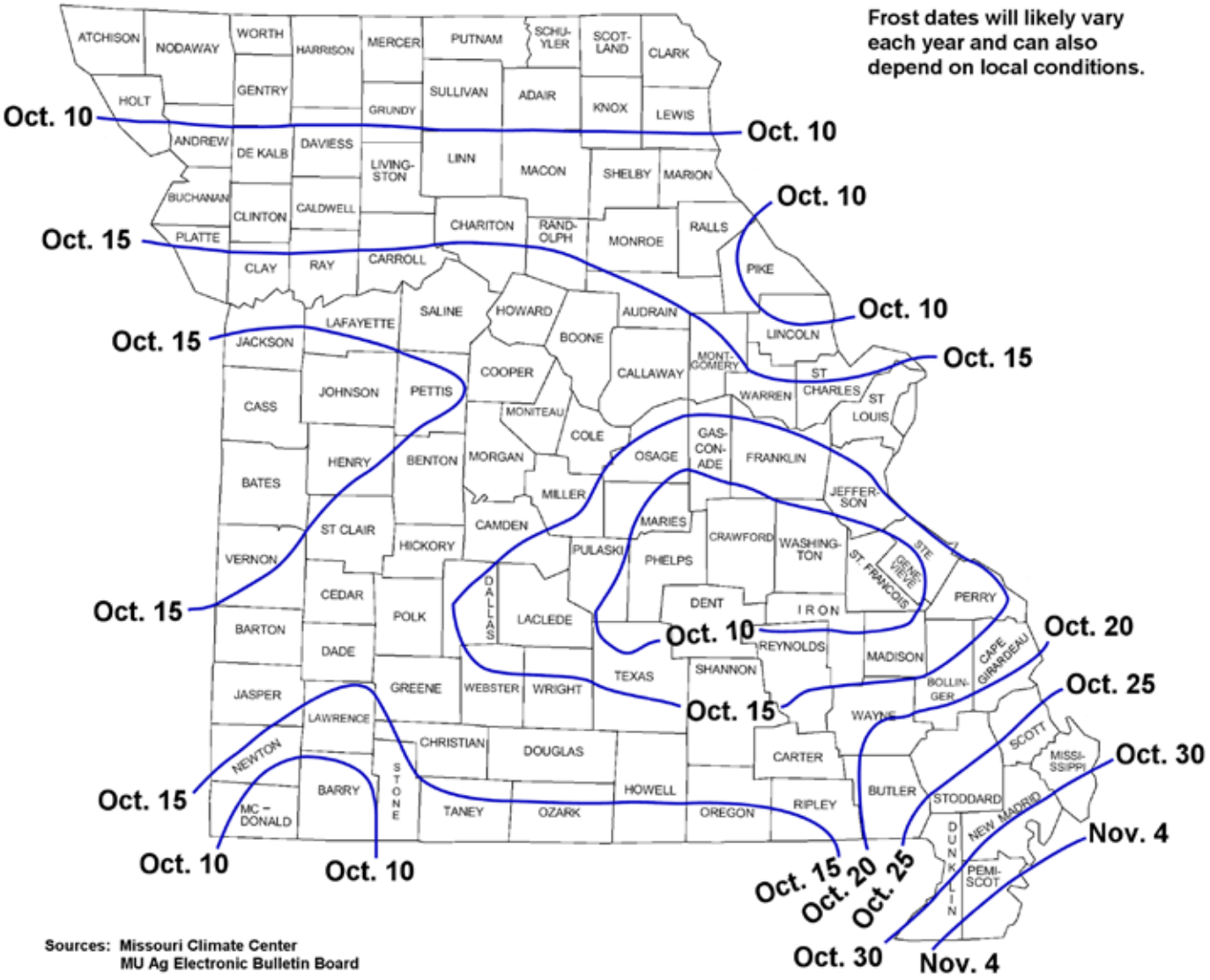
Management of loose smut is through the planting of disease-free seed or the use of a systemic fungicide seed treatment (see accompanying table of wheat seed treatment fungicides). Growers with considerable loose smut should consider seed treatment on this grain next year, if grain must be used for seed. In wheat, infection levels of 2% or greater would indicate that seed treatment would be economic.

Fusarium head blight or scab infection may result in shriveled and shrunken kernels, lightweight bleached or tombstone kernels or kernels that have a pinkish cast or discoloration. Lots with high levels of scab may have lower germination rates. The fungus that causes scab can also cause a seedling blight of wheat. If scab infected seed is used for planting, seedling blights and stand establishment problems may occur. Management of Fusarium seedling blight is through the planting of disease-free seed or the use of a fungicide seed treatment effective against seed-borne Fusarium or scab (see accompanying table of wheat seed treatment fungicides. Because scab can decrease germination, a germination test may be especially useful in determining if a particular lot should be used for seed.

Fungicide seed treatments for winter wheat are included in the 2008 Pest Management Guide: Corn, Grain Sorghum, Soybean and Winter Wheat, Extension Publication M171. Printed copies of this bulletin are available from the Extension Publications Distribution Center, 2800 Maguire Blvd., Columbia, MO, 573-882-7216. The information may also be accessed on the World Wide Web at http://ppp.missouri.edu/pestguide/disease.cfm.

Average Date of First Fall Frost (≤ 32°F)

1971-2000



Sources: Missouri Climate Center
MU Ag Electronic Bulletin Board

Weather Data for the Week Ending September 22, 2008

By Pat Guinan

		Weekly Temperature (oF)						Monthly Precipitation (in.)		Growing Degree Days‡	
Station	County	Avg. Max.	Avg. Min.	Extreme High	Extreme Low	Mean	Departure from long term avg.	Sep 1-22-Sep	Departure from long term avg.	Accumulated Since Apr. 1	Departure from long term avg.
Corning	Atchison	82	56	84	51	69	+5	3.45	+0.78	3168	+3
St. Joseph	Buchanan	78	56	80	51	67	+3	7.17	+3.84	3020	-180
Brunswick	Carroll	82	54	84	46	67	+2	6.81	+4.66	3075	-169
Albany	Gentry	79	52	82	44	65	+1	6.39	+3.69	2964	-214
Auxvasse	Audrain	79	55	82	46	66	+1	11.52	+9.17	3039	-230
Columbia-Sanborn Field	Boone	79	57	82	47	67	0	10.47	+8.13	3279	-203
Columbia-South Farms	Boone	78	56	82	46	66	0	11.36	+9.03	3119	-276
Williamsburg	Callaway	79	54	82	45	65	-1	9.22	+6.41	3063	-163
Novelty	Knox	78	54	80	47	65	0	7.44	+5.04	2825	-364
Linneus	Linn	79	54	81	46	66	+2	12.15	+9.72	2907	-200
Monroe City	Monroe	78	53	83	44	65	0	10.05	+7.82	2950	-298
Versailles	Morgan	80	55	84	48	66	0	9.04	+6.67	3279	-164
Green Ridge	Pettis	79	55	82	46	66	0	10.95	+8.15	3174	-6
Lamar	Barton	78	54	80	45	66	-2	9.24	+6.13	3387	-215
Cook Station	Crawford	79	51	84	44	63	-3	7.79	+5.22	3114	-351
Alley Spring	Shannon	78	52	81	44	63	-3	5.54	+3.29	3154	-148
Round Spring	Shannon	78	53	81	47	63	-3	7.24	+5.02	3138	-169
Mountain Grove	Wright	76	54	80	44	64	-2	9.20	+6.39	3093	-212
Delta	Cape Girardeau	79	56	84	49	66	-2	2.99	+0.81	3496	-305
Cardwell	Dunklin	81	57	87	51	67	-3	2.87	+0.66	3919	-173
Clarkton	Dunklin	81	56	86	49	67	-3	2.80	+0.67	3787	-263
Glennonville	Dunklin	80	57	85	49	67	-3	4.63	+2.52	3821	-205
Charleston	Mississippi	81	57	86	51	67	-1	0.66	-1.44	3718	-61
Portageville-Delta Center	Pemiscot	81	59	87	53	68	-2	2.97	+0.53	3987	-46
Portageville-Lee Farm	Pemiscot	81	58	87	50	68	-2	2.98	+0.47	3982	-24
Steele	Pemiscot	81	57	86	51	68	-2	2.22	-0.17	4052	+19

* 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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