

## Grain sorghum diseases and their management

Grain sorghum diseases can and do occur each year in Missouri. Problems with germination and stand establishment that are related to seed decay, damping-off and seedling blights are often encountered in the field. These losses can be costly, especially if replanting is necessary. Diseases may cause leaf spots or leaf blights, wilts or premature death of plants. Sorghum diseases also can cause harvest losses, affect the quality of the harvested crop and cause storage losses. The extent of the damage due to sorghum diseases in a given season depends on a number of factors including the susceptibility of the sorghum cultivar to the specific disease, the level of pathogen inoculum present and the environmental conditions during that season.

To minimize losses due to sorghum diseases, it is important to correctly identify the disease or diseases present so that appropriate management steps can be taken. The principal diseases of sorghum in Missouri can be divided into seed and seedling diseases, foliage diseases, root and stalk rot diseases, head blights and molds and a few miscellaneous diseases. Descriptions and management strategies for each of these categories of sorghum diseases are given below. For additional information see MU publication G4356, *Management of Grain Sorghum Diseases in Missouri*.

### Seed and seedling diseases

There are a number of pathogens that live in the soil or can be carried on or in seed that can cause seed and seedling diseases of sorghum. The symptoms may include discolored and/or rotted seed, seedlings may show a general rotting, they may have discolored embryos, leaves and roots or they may die. Stands may be thin and uneven.

Seed and seedling diseases tend to be more severe in poorly drained soils. They may be more severe if prolonged periods of wet, cool weather follow planting or if hot weather occurs when seedlings are emerging and secondary roots are developing.

#### Management options for sorghum seed and seedling diseases

- Plant high-quality seed that is free of undersized, cracked or discolored kernels.

- Plant in good seedbed conditions, especially in warm (above 70 degrees F), well-drained soils.
- Plant into fertile soils that have a pH of 6.0 to 6.5. Plants growing in low pH soil (e.g., pH 5.0) are more likely to be infected by *Fusarium* sp.
- Avoid excessively high plant populations.
- Use fungicide seed treatments. Almost all commercial grain sorghum seed comes with a fungicide treatment already applied to the seed. Seed bags should have labels that list the products applied to the seed and the rate of each material applied. Occasionally there may be a need to apply additional fungicide treatment or a combination of insecticide plus fungicide treatment for added protection. See accompanying table of seed treatment fungicides labeled for use on grain sorghum.

### Seed treatment fungicides for grain sorghum

Although seed treatment fungicides can be an effective means of preventing or reducing losses from various seed- and soilborne microorganisms, there are several important laws or guidelines concerning fungicide-treated seed. Always read the pesticide label and follow all directions and restrictions on the label; for seed treatment fungicides in particular, remember the following points.

1. Do not use treated seed for food, feed or oil purposes.
2. All treated seed must be colored with an EPA-approved dye that imparts an unnatural color to the seed.
3. Federal law requires that bags containing treated seed shall be labeled with the following information: "This seed has been treated with (common chemical name of active ingredients) fungicide(s). Do not use treated seed for feed, food or oil purposes. Store away from feeds and food stuffs."

The following table was prepared using current company product label books and Web sites. However, label registrations can change at any time. Before using any agricultural pesticide, read and follow directions accompanying that product. Product names have been used for clarity. Reference to specific trade names does not imply endorsement by the University of Missouri; discrimination is not intended against similar products not listed.

## Seed treatment fungicides and nematicides labeled for use on grain sorghum

Trade name Company	Common chemical name	% active ingredient	Rate	Additional label information
<b>Acquire</b> BASF	metalaxyl		0.375 to 1.5 fl oz per 100 lb of seed	For control of <i>Pythium</i> . Commercial supplied only.
<b>Allegiance FL</b> Bayer	metalaxyl	28.35%	0.375 to 0.75 fl oz per 100 lb of seed	For control of <i>Pythium</i> damping-off.
<b>Apron XL</b> Syngenta	mefenoxam	33.30%	0.32 to 0.64 fl oz per 100 lb of seed	For <i>Pythium</i> damping-off protection on all sorghum cultivars use 0.32 to 0.64 fl oz per 100 lb of seed.
<b>Dynasty</b> Syngenta	azoxystrobin	9.6 %	0.3 to 3.1 fl oz per 100 lb of seed	For management of seedling diseases caused by <i>Rhizoctonia</i> .
<b>Maxim 4FS</b> Syngenta	fludioxonil	40.30%	0.08 to 0.16 fl oz per 100 lb of seed	For protection against seedborne and soilborne fungi that cause seed decay, damping-off and seedling blight. Maxim 4FS is active against <i>Fusarium</i> , <i>Rhizoctonia</i> , <i>Helminthosporium</i> and weakly pathogenic fungi such as <i>Aspergillus</i> and <i>Penicillium</i> . When rate ranges are given, use higher rate when disease pressure is expected to be severe.  Apply Apron XL seed treatment in combination with Maxim 4FS for protection against <i>Pythium</i> spp. See label for additional information of the addition of Apron XL to control downy mildew of sorghum.
<b>Poncho/VOTIVO</b> Bayer CropScience	clothianidin <i>Bacillus firmus</i>	40.3% 8.1%	6.13 fl oz per 100 lb of seed	Commercial application. For management of early-season nematodes and insects.
<b>Stamina</b> BASF	pyraclostrobin	18.4%	commercial application only	For management of seedling diseases caused by <i>Rhizoctonia</i> .
<b>Trilex</b> Bayer CropScience	trifloxystrobin	22%	0.32 to 0.64 fl oz per 100 lb of seed	Commercial application.

This information was current as of October 1, 2012. It applies only to Missouri and may not be appropriate for other states. The listing of any product in this publication does not imply endorsement of that product or discrimination against any other product.

### Foliage diseases

Sorghum is susceptible to a large number of both fungal and bacterial foliage diseases. Symptoms range from small, insignificant spots and stripes on leaves to extensive damage of large areas of leaf tissue that may result in premature death of leaves and even entire plants. Diagnosing specific leaf diseases on sorghum can be difficult because cultivars respond differently to the same pathogen, symptoms may vary with environmental conditions and several foliage diseases may occur on the same leaf at the same time. Severity of these foliage diseases depends on the specific disease, the susceptibility of the cultivar and the weather conditions during the growing season. Foliage diseases are usually favored by warm temperatures and wet weather or high humidity.

Fungal foliage diseases of sorghum in Missouri include anthracnose, leaf blight, gray leaf spot, zonate leaf spot, rough spot and sooty stripe. Symptoms range from small, circular to elliptical spots to large elongated spots that may extend several inches in length. Symptoms usually develop on lower, older leaves first.

Zonate leaf spot, caused by the fungus *Gloeocercospora sorghi*, forms circular lesions that have concentric bands of reddish brown and light tan. These lesions have irregular borders and usually develop along the leaf margins. Both leaf blades and leaf sheaths may be infected. Zonate leaf spot is favored by wet conditions. When it develops early in the season on young plants, defoliation and even death of plants may occur. If disease is severe late in the season loss of leaf tissue can lead to poorly filled seed. The fungus that causes zonate leaf spot of sorghum can also affect corn, millet and numerous other grasses. The pathogen forms survival struc-

tures called sclerotia in infected leaf tissue of sorghum, millet and other grass hosts.

The initial symptoms of rough leaf spot of sorghum are small, somewhat circular to oblong, reddish lesions with well-defined margins. As the lesions mature fruiting bodies of the causal fungus, *Ascochyta sorghina*, develop in the lesions. These pycnidia are evident as small black bumps or specks within the infected tissue. As the disease progresses, lesions may merge killing larger areas of leaf tissue. Rough leaf spot is favored by wet weather. The fungus that causes this leaf spot on sorghum has also been found on sudangrass, johnsongrass and other wild sorghum species. It survives in infested crop residues of sorghum and perennial weed hosts.

Bacterial foliage diseases of sorghum include bacterial spot, bacterial streak and bacterial stripe. Bacterial spot tends to produce water-soaked elliptical spots on leaves. Bacterial streak and bacterial stripe both result in long, narrow stripes on leaves. Lesions from all three bacterial foliage diseases tend to have a reddish color or reddish margin.

#### Management options for foliage diseases of sorghum

- Plant disease-free seed of locally adapted, resistant cultivars.
- Rotate crops with at least one year out of susceptible crops.
- Manage crop residues.
- Eliminate alternate or weed hosts of these diseases, especially weed grasses such as johnsongrass.
- Use a foliar fungicide if needed (see table).

## Foliar fungicides labeled for use on grain sorghum

Trade name Company	Common chemical name	% active ingredient	Rate	Additional label information
<b>Quadris</b> Syngenta	azoxystrobin	22.9%	6.0 to 15.5 fl oz per acre	For management of anthracnose and gray leaf spot.
<b>Quilt</b> Syngenta	azoxystrobin propiconazole	7% 11.7%	14 oz per acre	For management of anthracnose and gray leaf spot.
<b>Quilt Xcel</b> Syngenta	azoxystrobin propiconazole	13.5% 1.7%	10.5 to 14 fl oz per acre	For management of zonate leaf spot, leaf blight, anthracnose and gray leaf spot.

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### Root and stalk rot diseases

Several root and stalk rot diseases occur on sorghum. These diseases are usually most evident late in the season as plants are maturing. Stalk rots likely to occur on sorghum in Missouri include charcoal rot, Fusarium stalk rot, anthracnose or Colletotrichum stalk rot and Rhizoctonia stalk rot. Stalks tend to be soft, discolored and deteriorated. Plants may die prematurely. Lodging may be a problem in fields with high levels of stalk rot. Stress to plants at flowering and grain-filling stages may increase the incidence and severity of stalk rots.

The charcoal rot fungus, *Macrophomina phaseolina*, can cause seedling blight, damping-off and dry rot early in the season. Later in the season symptoms include root rot with infected roots turning brown or black and stalk rot with stalks becoming soft and spongy. Plants tend to lodge. If infected plants are split open, the pith usually shows signs of deterioration and small, dark sclerotia (survival structures of the fungus) are evident in the disintegrating tissues. Charcoal rot is favored by high soil temperatures (95 to 98 degrees F) and low soil moisture. The fungus that causes charcoal rot of sorghum can also infect corn and soybean.

Fusarium root and stalk rot may begin as small, circular to elongate, light red to dark purple lesions on roots, seed, stalks and peduncles. Plants with insect damage or other injuries may show more severe symptoms of Fusarium root and stalk rot. Leaves may turn off color or gray-green and plants may die prematurely. When stalks are split open, the lowest internodes may have large areas of pith that is reddish in color and the upper internodes may show a red to reddish brown discoloration of the vascular bundles. Lodging may occur.

#### Management options for root and stalk rots of sorghum

- Select cultivars with good stalk strength and tolerance to stalk rots.
- Plant at proper plant populations.
- Provide adequate moisture at planting and adequate irrigation through season.
- Maintain balanced soil fertility.
- Control weeds.
- Harvest in timely fashion to minimize lodging and harvest losses.

### Miscellaneous diseases of sorghum

**Crazy top**, caused by the fungus *Sclerophthora macrospora*, is another disease likely to occur in sorghum in wet seasons. This disease develops on young seedlings growing in saturated soils. The first symptom of crazy top is a mottled yellowing of the leaves. Leaves become thickened and puckered, and plants may tiller excessively. Infected plants may be stunted and have a bunched appearance. Diseased plants typically either do not produce heads or produce barren heads.

#### Management options for crazy top of sorghum

- Plant cultivars tolerant to crazy top if available.
- Land prone to flooding should not be planted to sorghum unless adequate drainage is provided.

**Maize dwarf mosaic virus (MDMV)** is the most common virus disease of sorghum in Missouri. MDMV produces a distinct mottling of the leaf tissue. Infected leaves have a light green to yellow mottled pattern. Symptoms are most evident on young leaves. Red leaf, a red discoloration that may appear on leaves, sheaths and peduncles, may develop in infected plants if night temperatures fall below 55 degrees F. Infected plants may be stunted, tillering may be reduced and yield may be reduced.

Many annual and perennial grasses, including corn and johnsongrass, are susceptible to maize dwarf mosaic virus. The virus that causes this disease is transmitted mechanically and vectored by more than 20 species of aphids.

#### Management options for sorghum virus diseases

- Plant resistant or tolerant cultivars.
- Follow cultural practices that eliminate johnsongrass and other susceptible annual grasses in and around sorghum fields.

**Sorghum downy mildew**, caused by the fungus *Peronosclerospora sorghi*, is a serious problem in the southern United States but is not typically found on sorghum in Missouri. Sorghum downy mildew may occur as either a systemic or a localized infection within the plant. Systemic infections may occur early in the season and affected seedlings are yellow, stunted and may die prematurely. During periods of cool, humid weather the lower surfaces of infected yellow leaves may be covered with a white, cottony mold growth. Infected

leaves may also show striking patterns of long green and white stripes running the length of the leaves.

Localized infections of sorghum downy mildew begin as small brown spots on leaves. Under cool, humid conditions, the white, cottony mold growth may be evident on lower leaf surfaces and the disease may become systemic within the plants.

Sorghum downy mildew is caused by a soil fungus that invades the roots of sorghum seedlings. The pathogen survives in the soil and in perennial host plants.

#### Management options for sorghum downy mildew

- In areas where downy mildew is a serious problem, plant resistant cultivars.
- Rotate crops to help manage sorghum downy mildew.
- Apply appropriate fungicide seed treatments. See accompanying table of seed treatment fungicides labeled for use on grain sorghum.

**Plant parasitic nematodes** such as root-knot nematode, root lesion nematode and stunt nematode may occur on sorghum. With these nematodes, aboveground symptoms depend on the level of nematode infestation. At high levels, plants may be stunted, yellowed and have an unthrifty appearance. Yields may be reduced. These symptoms may be mistaken for herbicide injury, root rots, nutrient deficiencies and drought. Root growth may be limited and roots may be discolored or have small brown to black lesions. With root-knot nematode, galls and excessive branching may be evident on roots. When nematode injury is suspected, it is important to collect soil and root samples and send them to a nematology laboratory for identification of the nematode species involved.

#### Management options for sorghum nematodes

- Rotate crops. Effectiveness of crop rotation may vary depending on the nematode species present.
- Although there are several nematicides labeled for use for the control of nematodes in grain sorghum, environmental and economic concerns limit their use. Two products labeled for management of nematodes attacking grain sorghum are the seed treatment Poncho/VOTIVO and the soil fumigant Telone II by Dow.

#### Head smut, blights and molds

**Head smut** primarily affects the head although foliage symptoms may occur on occasion. Smut galls replace part or all of the sorghum panicle. Initially the galls are protected

by a thin, white covering. Eventually this covering ruptures, releasing masses of powdery black spores of the causal fungus, *Sporisorium reilianum*. Plants may be stunted and may produce excessive tillers. Smutted plants may also have more root and stalk rots. Smut spores can survive for long periods of time in the soil.

#### Management options for head smut of sorghum

- Plant the most resistant or least susceptible cultivars in areas where the disease occurs.
- Rotate crops to help reduce the level of smut in subsequent crops. Crop rotation will not eliminate the disease.

**Covered kernel smut** is found in every sorghum-growing region of the world. Before the use of fungicide seed treatments, covered kernel smut was a serious disease of sorghum. The fungus, *Sporisorium sorghi*, replaces individual sorghum kernels with smut balls of sori. These sori vary in size and shape but resemble elongated sorghum seeds. They range in color from white to gray to brown. The entire sorghum head may be affected or only portions of the head. The fungus that causes covered kernel smut is seedborne.

#### Management options for covered kernel smut of sorghum

- Use an appropriate fungicide seed treatment. See accompanying table of seed treatment fungicides labeled for use on grain sorghum.
- Cultivars vary in their susceptibility to covered kernel smut, so cultivar selection may also help reduce losses from covered kernel smut.

Several fungi cause **head blights and molds** on sorghum. Pink, gray, white or black mold growth on the heads or grain surface is the most obvious sign of a problem. The development of these head blights and molds is favored by wet weather and high relative humidity during flowering and grain fill. There is some variation in susceptibility among sorghum hybrids to head molds.

#### Management options for head blights and molds on sorghum

- Plant adapted, tolerant cultivars.
- Rotate crops.
- Manage residues.
- Harvest in a timely manner.