

AGRICULTURAL GUIDE

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Grain Diseases

Controlling diseases of grain sorghum

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Diseases damage the grain sorghum (milo) crop in Missouri each year. They limit production and reduce profits. Many of these diseases can be controlled by using resistant varieties or through cultural practices, but the disease must be identified first, and then the proper control technique must be used. This guide will help you identify and select control measures for the most common grain sorghum diseases in Missouri.

Seed and seedling diseases

Getting a sorghum stand may be a problem. Unfortunately, stands can be reduced or lost as a result of the seed and seedling diseases common to Missouri every year. Where severe, these diseases often reduce plant populations, and costly replanting may be necessary. These diseases occur when young plants or seeds and disease-causing organisms (pathogens) are combined in a stressful environment for plants.

Most grain sorghum stands are lost when hard, packing rains seal the soil surface, and soil temperatures are cold (below 70 degrees F). This slows emergence, and pathogens in the soil use the seed and seedlings as food. Low soil pH enhances the problem.

The pathogens most commonly involved in seed and seedling diseases are fungi living in the soil. *Fusarium* sp., *Pythium* sp., and *Penicillium* sp. are the most common ones.

Symptoms

Seed and seedling diseases are responsible for thin, uneven stands. Infected seedlings that emerge are

pale-green, stunted, and slower growing. The leaves may have withered tips, and the affected roots will have dark red to black rotten areas. Severely damaged plants will die. Plants that survive infection are often weak, unproductive, and more susceptible to other diseases and environmental stresses.

Control

Seedling diseases can best be controlled by preventing development. This can be accomplished by using these five techniques:

1. Plant high quality, fungicide-treated seed. Most commercially sold hybrids are high quality and are treated with a fungicide.
2. Maintain a soil pH of 6.0 to 6.5. This can be effective in suppressing certain pathogens and encouraging vigorous plant growth.
3. Plant after the soil temperature is 70 degrees F to favor rapid seed germination, seedling development, and to help reduce seedling diseases.
4. Provide adequate drainage of the field.
5. Avoid excessively high plant populations.

Diseases of the leaves

Leaf diseases are common on grain sorghum in Missouri. They are caused by several species of bacteria and fungi. Symptoms may range from small spots or stripes on the leaves to prematurely destroyed leaves. Disease severity varies with the weather, the pathogen involved, and the grain sorghum variety. Rainy weather can cause rapid spread of these diseases, and plant injury varies from year to year. Leaf damage before plant maturity can result in reduced yield.

Three diseases are caused by bacteria: bacterial stripe, bacterial streak, and bacterial spot. (See Figure 1.)

Bacterial stripe, caused by *Pseudomonas androgoni*, is the most important and abundant of the three diseases. It is characterized by long, narrow, red stripes, first seen on the lower leaves. The stripes range from ¼ to 9 inches or more in length and tend to be confined between the leaf veins.

The first symptoms of bacterial streak, caused by *Xanthomonas holcicola*, are narrow, yellow stripes about ⅛ inch wide and 1 to 6 inches long, apparent first on

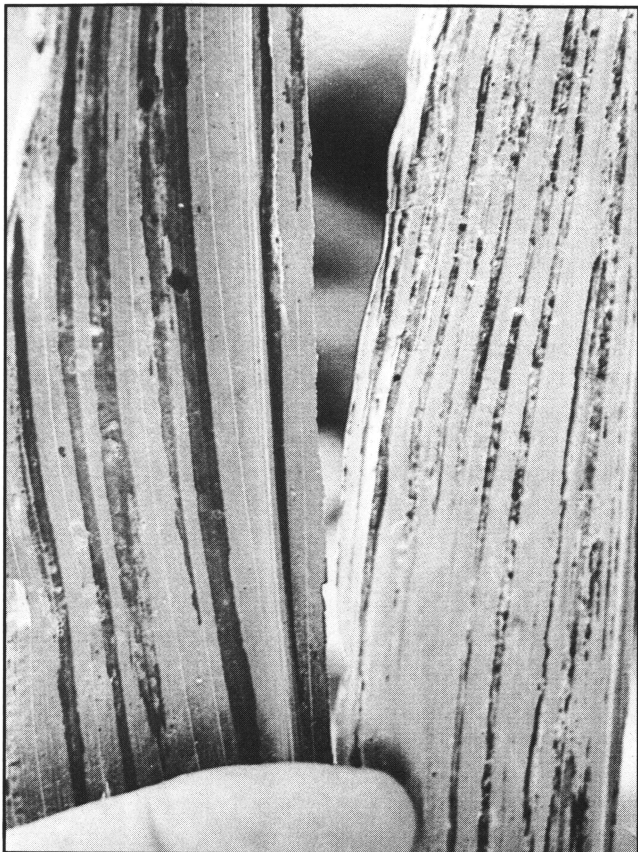


Figure 1. Bacterial stripe (left) and bacterial streak (right) are common diseases of sorghum.

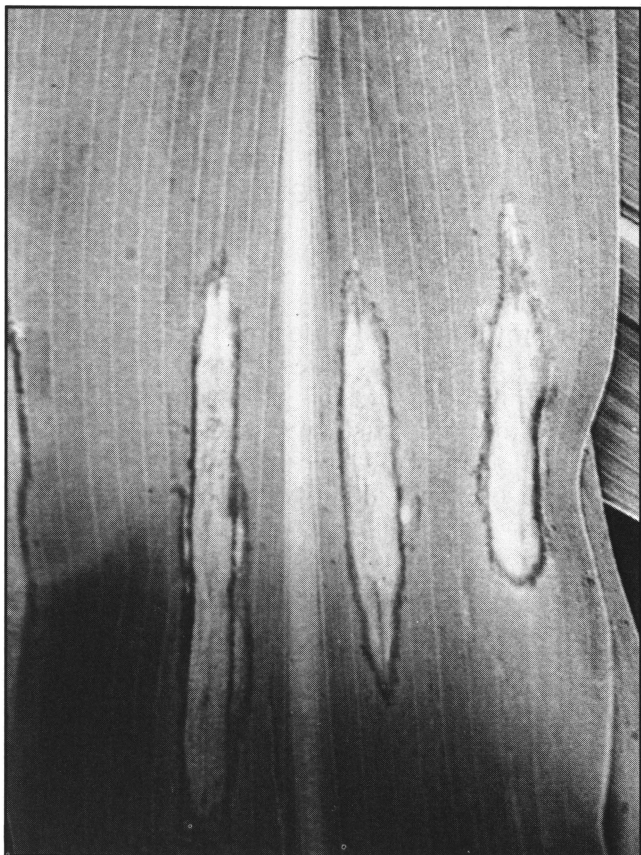


Figure 2. Leaf blight symptoms are large, elongated, gray spots with reddish borders.

lower leaves. These streaks may occur on plants anytime from seedling stage to near maturity. Eventually, red-brown blotches appear in the streaks, which may broaden into oval spots with tan centers and narrow, red margins.

Bacterial spot, caused by *Pseudomonas syringae*, has symptoms that begin as small, circular, yellow lesions on the leaves. Old lesions have light colored centers surrounded by red borders.

The bacteria causing these leaf diseases are believed to survive from one season to another on the seed and on infected plant residues. They spread from plant to plant by wind-blown splashing rain and by insects. These diseases favor warm (75-80 degrees F), moist weather.

Fungus leaf diseases common to milo are: Helminthosporium leaf blight (See Figure 2.) Target Spot, Grey Leaf Spot, Zonate Leaf Spot, Rough Spot, Sooty Stripe, and Rust. These diseases and the symptoms they cause are listed in Table 1. The symptoms you see in the field may vary due to the weather and the hybrid affected.

Control

Leaf diseases are controlled mainly by crop rotation, and by incorporating the crop residue into the soil to hasten decomposition. No highly resistant hybrids are available. However, some varieties are tolerant.

Anthracnose

Anthracnose, caused by *Colletotrichum graminicola*, can occur on both leaves and stems of susceptible plants and can be very damaging. This disease is a problem in the very humid Gulf Coast regions of the U.S. and can be a problem in Missouri.

Symptoms

Small circular spots ($\frac{1}{8}$ "- $\frac{1}{4}$ "), tan to red in color with a distinct margin (Figure 3) may appear on susceptible leaves in mid-summer. These lesions may enlarge slightly in humid weather.

This disease can affect the upper parts of mature stalks. Tan spots with red-purple margins develop on outer portions of affected stalks. The inside of these stalks are brick red interspersed with the normal, white color of the unaffected areas. (See Figure 9.) Diseased stalks may break at the point of injury. Diseased but unbroken stalks often produce small heads with small seeds.

Control

Planting resistant hybrids is the best control. Sanitation (destroying plant refuse by plowing it under) is effective. Elimination of other susceptible plants such as Johnson grass will also help in control.

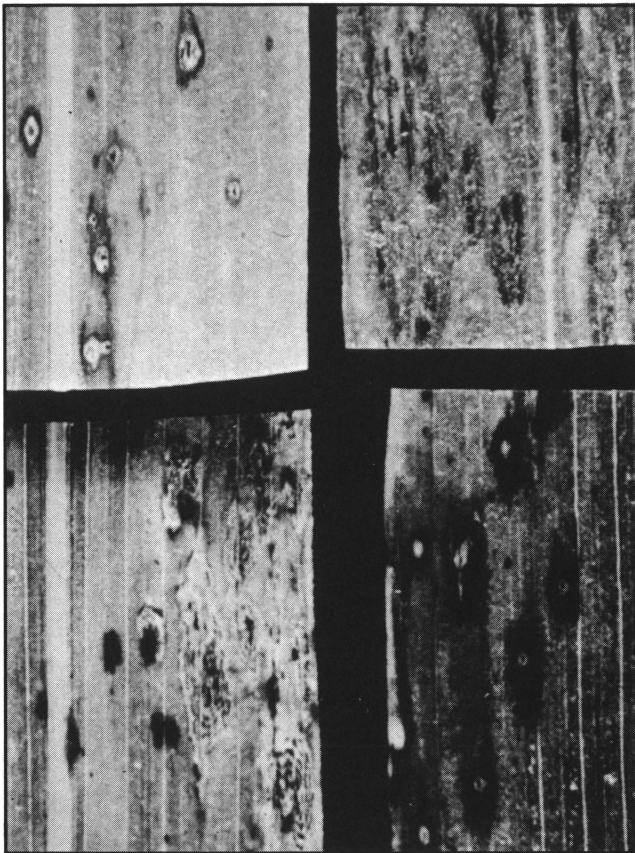


Figure 3. Anthracnose symptoms on leaves are small, elliptical leaves with distinct, reddish borders.



Figure 4. Leaf puckering and excessive tillering are symptoms of Crazy Top.

Sorghum downy mildew

Sorghum downy mildew, caused by a fungus named *Sclerospora sorghi*, was first observed in the U.S. in the early 1960s and in Missouri in the early 1970s. This disease has not become a serious problem in Missouri although it has occurred in some fields in southeast Missouri. It was a serious problem in several southern states and especially in the coastal regions until adequate controls were developed.

Symptoms

Infected plants have light, yellow-green, striped leaves and a cotton-like fungal growth visible on the underside of the leaf. Late in the season, infected leaves become shredded and appear as if damaged by hail. Plants may be partially or completely sterile.

Control

Plant resistant varieties for control of this disease. Most commercial sorghum seed companies sell resistant or highly tolerant varieties. Crop rotations of two or more years with cotton, wheat, soybeans, or a forage crop will reduce the threat of downy mildew.

Crazy top

Crazy top is caused by the fungus *Sclerophthora macrospora*. This fungus produces spores, which move through the soil by swimming in water. This way, they enter the roots of young seedlings, and infection occurs under flooded field conditions.

Symptoms

Infected plants have thickened, puckered leaves, and they tiller excessively. This gives plants a bunched appearance. The newest leaves may roll up and twist, resembling damage caused by the acetanilide herbicides such as Lasso and Dual. (See Figure 4.) Infected plants usually survive but do not produce grain.

Control

Providing adequate drainage is the most important control. Crop rotation is not useful because the fungus can infect many other grasses such as corn, wheat, rice, crabgrass, and foxtail. No available varieties are resistant, although some are tolerant.

Maize dwarf mosaic virus

Maize dwarf mosaic virus (MDMV) causes injury to grain sorghum in Missouri, especially in fields where Johnson grass is present. The virus infects Johnson grass and can survive the winter in the underground rhizomes. Shoots produced from these rhizomes will also be infected, and the virus can be moved by aphids (corn leaf aphid and greenbugs) from those shoots to other susceptible plants like sorghum and corn.

Symptoms

Maize dwarf mosaic virus infections produce distinctive mottling in leaf tissue. When compared to healthy leaves, infected ones are yellow with light green islands. These symptoms are more evident on young leaves. Generally, symptoms are less visible on plants which have reached the boot stage.

Mottling is the most common symptom, but other symptoms may occur. Red leaf occurs when plants become infected and temperatures fall below 55 degrees F. Then, elongated tan stripes with red margins develop on the leaves.

Severely infected plants with MDMV will die. Those that survive may be stunted and fail to produce a normal head.

Control

Losses due to MDMV can be prevented by growing tolerant varieties and by eliminating the Johnson grass in the field. Trying to reduce infections by killing the aphids which spread the disease is not worthwhile.

Root and stalk diseases

Root, crown, and stalk rots are the most serious sorghum diseases in Missouri. Plants affected by these diseases usually produce poorly and may lodge.

The most common and damaging stalk rot in Missouri is Charcoal Rot. However, stalk rots caused by other fungi such as *Fusarium* sp., *Pythium* sp., and *Periconia* sp. can become a problem.

Charcoal rot

Charcoal rot, caused by *Macrophomina phaseolina*, can cause sorghum seedling root rot and stalk rot. The stalk rot phase is more common.

Stalk rot is identified easily under field conditions by splitting the stalk lengthwise near the ground line and looking for shredded, dark grey tissue. (See Figure 5.)

The pith within the stalk is degraded by the fungus, leaving only the outer shell of the stalk and the vessels. In this advanced stage of the disease, the fungus forms reproductive structures (sclerotia) on the internal parts of the stalk. These structures give the tissues a dark grey color. The affected areas of the stalk are very weak, and the plant will usually lodge.

Damage from this disease is generally worse in areas of a field where the plants have been under stress due to high temperatures or lack of water. Drought does not cause the problem, but it weakens plants' defenses to infection. Charcoal rot is usually less severe if drought stress can be reduced by using lower plant populations or using irrigation. The disease may affect a few plants in some fields or all of the plants within a 5 to 10 acre area in other fields.

Charcoal rot of grain sorghum can be partially controlled by:

- Growing tolerant varieties. No resistant varieties are available.
- Reducing drought stress on the plants throughout

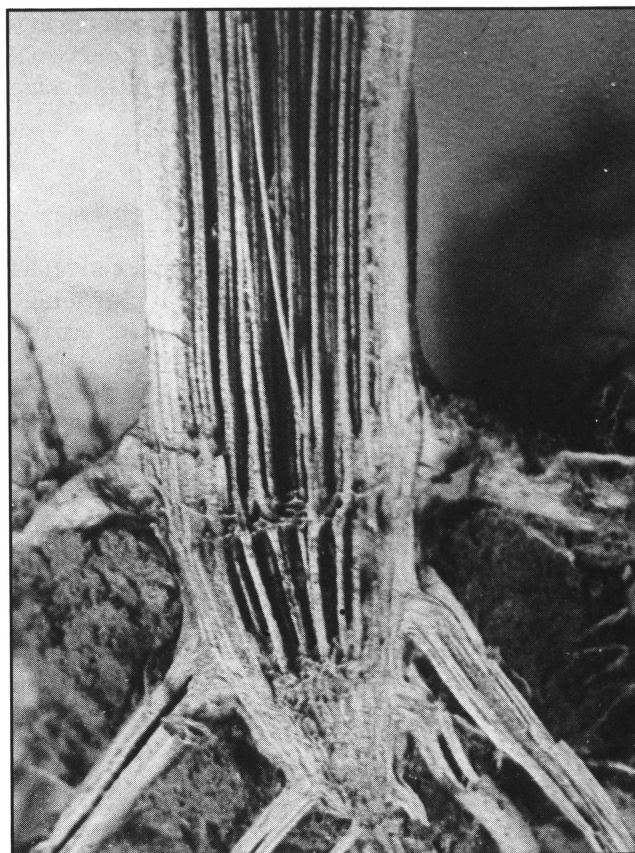


Figure 5. Charcoal rot results in degraded pith and dark gray lower stalk tissues.

the season and especially during the flowering and grain-filling stage of growth.

- Rotating with wheat and forages may reduce the disease severity. These crops should be kept on an affected area for at least two years before planting a susceptible crop again. This will not eliminate the problem, but it may reduce its severity. Rotation with row crops will not control this problem because this fungus can also attack cotton, corn, sorghum, soybeans, and peas.

Pythium root rot

Pythium root rot, caused by a certain *Pythium* species, occurs occasionally in wet springs, but very little is known about it. Infected roots appear grey to black, and the plants may lodge if the rot is severe.

Periconia root rot

Periconia root rot is caused by a fungus, *Periconia circinata*, which attacks the roots. The outer part of the affected roots will have a brown or red-brown discoloration. This fungus may be spread with soil carried in runoff water and by farm implements.

Resistance to this root rot has been incorporated into most available hybrids. Yet this disease remains potentially dangerous because future hybrids lacking resistance could be vulnerable.

Fusarium stalk rot

Fusarium stalk rot, caused by *Fusarium* sp., can affect many grasses including grain sorghum. It is generally found in the same areas where charcoal rot occurs. Like charcoal rot, Fusarium stalk rot can develop when the plants are under stress.

Fusarium stalk rot results in extensive root damage, internal rot of the stalk, small heads, and lodged plants. Discolored, disintegrating pith in the lower portion of the stalk is visible when it is split open.

Fusarium stalk rot is difficult to control. However, following good crop management and control practices will help reduce the problem.

Growers experiencing stalk rot problems should determine which rot is involved so that tolerant varieties can be selected if available.

Diseases of the heads

There are three smut diseases that affect sorghum heads: covered kernel smut (caused by *Spacelotheca sorghi*), loose kernel smut (caused by *Spacelotheca cruenta*), and head smut (caused by *Spacelotheca neiliana*). Fortunately, these diseases are not serious problems any more because controls are available. Covered and loose kernel smut are effectively controlled by properly treating the seed with fungicides. All commercially available hybrids are treated. Head smut is controlled mainly by growing resistant varieties.

Head molds are common in Missouri, especially when weather conditions are rainy after maturity. Several different fungi grow on glumes and grain surfaces, causing discolored heads and dark colored seeds. Head molds caused by *Alternaria* sp., *Curvularia* sp., and *Cladosporium* sp. usually do not cause serious yield losses under normal growing conditions but can provide inoculum for storage infections. Certain other fungi, such as *Fusarium moniliforme* (Fusarium head blight) and *Colletotrichum graminicola* (anthracnose) can cause considerable losses under adverse weather conditions. Prolonged wet conditions that delay harvesting allow invasion by the fungi and potential yield loss. Grain quality can be affected by head molds, and several storage fungi can develop unless moisture levels are reduced by prompt drying.

Bird damage is perhaps the most serious head problem in Missouri. Flocks of birds invade sorghum fields at various stages of maturity and cause damage to the grain. Often the developing kernels are snipped off. Secondary fungi develop on the exposed surfaces,

causing the heads to have a blackened appearance. This damage is often mistaken for smut infections.

Control of head molds involves harvesting when the grain is mature and as soon as the proper moisture level is reached. Proper drying of sorghum in storage is essential.

Nematodes

Several nematodes (Root-Knot, Lesion, Sting, Stubby-Root) can injure sorghum plants by feeding on their roots. No nematode problems on grain sorghum have been identified in Missouri yet. However, they do occur other places, especially in the South. Be aware of the symptoms which result from nematode infections, so you can use the proper controls.

Symptoms

Symptoms of nematode infections can be mistaken for those of other soil problems like nutrient deficiency, drought, and root rots. Affected plants may be stunted and have yellow-green leaves which may wilt in the midday summer sun more readily than those on healthy plants. Severely affected plants will not yield as well as healthy plants. These symptoms will be more apparent in sandy soils.

The only sure way to confirm a nematode problem is to take soil and root samples from the affected area and have them analyzed for nematodes. Two laboratories in Missouri (the State Extension Plant Diagnostic Laboratory, 108 Waters Hall, Columbia, Missouri 65211 and the Delta Plant Health Clinic, Delta Center, Portageville, Missouri 63873) can do the analysis. Contact the University of Missouri Extension Office in your area about sampling techniques. (There is a fee for testing.)

Control

Crop rotation and the use of nematicides are the most useful controls. No resistant varieties are available.

Non-parasitic disorders

Disease problems may be described as infectious or non-infectious. Infectious diseases are caused by living agents such as bacteria, viruses, fungi, and nematodes. Examples of these have already been described. Non-infectious disorders are caused by a wide variety of unfavorable environmental and nutritional conditions:

1. excess or deficiency of soil nutrients or water,
2. extremely high or low soil pH,
3. extremely high or low temperatures,
4. air pollutants,
5. injuries from pesticides, and
6. mechanical injury.

Certain environmental conditions or genetic factors sometimes produce symptoms on the leaves that can

Table 1. Symptoms of grain sorghum diseases caused by fungi.

Disease name	Lesion shape	Lesion size	Lesion color	Other characteristics
Leaf Blight (<i>Helminthosporium turcicum</i>)	Irregular & long	1" or more in length	grey with tan-red borders	—
Target Spot (<i>Helminthosporium sorghicola</i>)	Round, elliptical spots	1/8"-1"	tan with red borders	—
Grey leaf spot (<i>Cercospora sorghi</i>)	Elongate to rounded	1/4" or more	dark purple	Old lesions may be grey
Zonate Leaf Spot (<i>Gloeocercospora sorghi</i>)	Bull's eye appearance	1/4"-2"	alternating dark purple & tan bands	Lesions resemble a bulls eye target
Rough Spot (<i>Ascochyta sorghina</i>)	Broad elliptical	1/4"-1/2"	tan centers with purple border	The center of the lesion is rough to the touch (feels like fine sandpaper)
Sooty Stripe (<i>Ramulispora sorghi</i>)	Elongate-elliptical	3"-5" long 3/4 wide	tan center, purple margin	Centers of old lesions will appear sooty
Rust (<i>Puccinia purpurea</i>)	Round to elliptical raised pustules or blisters	1/16"-1/8"	light red-brown	Usually confined to older leaves

be confused with symptoms produced by bacteria and fungi. A very common condition in sorghum is the presence of intensely colored leaf spots or stripes without any other indications or sign of infection. The spots or stripes do not have bacterial exudates or scales; they do not consistently have dead areas in or around them; and they show no evidence of fungus mycelium or fruiting bodies when examined in the laboratory. Much of this non-parasitic spotting may be due to mechanical injuries from insect punctures, wind whipping, or wind-blown sand particles.

The remedy for genetic defects or for nutritional deficiencies that affect varieties differently is to choose varieties that do not have these responses.

Summary

Correct identification is the first step in preventing and controlling sorghum disease losses. Area extension specialists can assist in diagnosis, or they can send specimens to the State Extension Diagnostic Laboratories for further evaluation.