



Diagnosing
Sorghum
Production
Problems
in Kansas

Kansas State University Agricultural Experiment Station
and Cooperative Extension Service

Sorghum, like all crops, may suffer from a variety of insect, disease, nutritional, and environmentally related stresses. This publication focuses on diagnosing causes of slow growth, abnormalities, discolorations, injury, and death of sorghum plants from crop emergence through harvest.

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**Funding for the production of this
publication was provided by the Kansas
Grain Sorghum Commission.**



Emergence to Four-Leaf Stage

1

Daily to weekly field inspections are required during stand establishment. In most instances, it is much easier and more accurate to diagnose problems when the symptoms are readily visible. Delayed inspections usually result in fewer correct diagnoses, because fewer signs remain to assist with the identification of the crop issue.



Ciampitti

2



Ciampitti

Poor stand emergence is a common problem encountered after planting. Take time to examine the evidence. Look for patterns in the field. Is the stand uniformly poor? Are there skips? Are there stunted or dying plants? What are some of the causes that may lead to poor stands? Consider the overall pattern of injury along with the recent history of the field to understand the actual cause or causes of the problems. Close examination of each particular issue helps to precisely determine the potential causes of poor seedling emergence.

3

Once an overall pattern of injury is established, it is time for a closer inspection. Uniform patterns of skips suggest a **clogged, jammed, or broken planter**. Uneven seeding depth under dry soils could potentially promote poor stand emergence.



4



This seed has been hollowed out. Several insects feed on planted seed. This yellow, hard-bodied worm is a wireworm. **Wireworms** feed on seeds and small plants.

5



Seed corn beetles could have hollowed out this seed (photo 4) before it germinated. The beetle is small, about $\frac{1}{4}$ inch long, medium to dark brown, and has an area of lighter color around the outer margins of the wings. These beetles are often found crawling on the soil surface. Insecticide seed treatments work well to protect the seed and seedlings for 21 to 28 days after planting. Wireworms, white grubs, seed corn beetles, flea beetles, aphids, etc. are all controlled by using treated seed.

6



Notice the small hole where the seed was planted (seed is missing). Small plants have been dug up as well. Small **rodents** have been digging in the field, removing the seeds. Rodent damage is suspected when a soil pile is visible to one side of the hole. Look around field margins for rodent burrows.

7



Poor stands result when seedlings are unable to emerge because they cannot push through the soil surface crust. Seeds have germinated, but the seedlings are growing sideways and are unable to emerge. **Planting too deep** can cause this problem, which is complicated when there is soil surface **crusting**. Driving rains or planting in soil that is too wet also can cause crusting issues.

8



Ciampitti

Planting too shallow without soil moisture can produce delayed emergence until moisture conditions are restored. Instead, optimum planting depth (1.5 inches) or deeper planting depth (3 inches) shows much better growth compared to the shallow placement. Differences in development, expressed as number of leaves, also can be observed as the emergence is delayed in this case due to short moisture conditions when seed was placed too shallow in late planting dates.

9



When planting in wet soil, the seed slot opener of the planter can compact the soil, which causes roots to become stunted and knotted together. Plants growing in **compacted soil** also may show symptoms of **drought stress** and **nutrient deficiencies** in the leaves.

10



Seedlings are stunted and malformed. In this instance, **herbicide injury** (e.g. Dual herbicide) could have been avoided with the use of a seed safener, which is required when any labeled chloroacetamide herbicide is used in grain sorghum.

11



Application of **atrazine herbicide** can cause chlorosis or yellowing of leaves while the lower leaves may die. This is most common in high pH and low organic matter soils or in sandy soils.

12



Thompson

The bleached seedlings are caused by **Lumax herbicide injury**. Injury is most common when a significant rain occurs shortly after herbicide application and before sorghum emergence. High pH, low organic matter, and coarse-textured soils increase the risk of crop injury.

13



Thompson

Bleached sorghum seedlings are caused from a **misapplication of Balance Flexx** in February for kochia management. Sorghum should not be planted within 6 months following a Balance Flexx application.

14



Thompson

Misapplied Prowl H2O layby at the one-collar stage of sorghum. The pendimethalin caused clubbed roots and prevented root development. Note the plant tipped out of the ground.

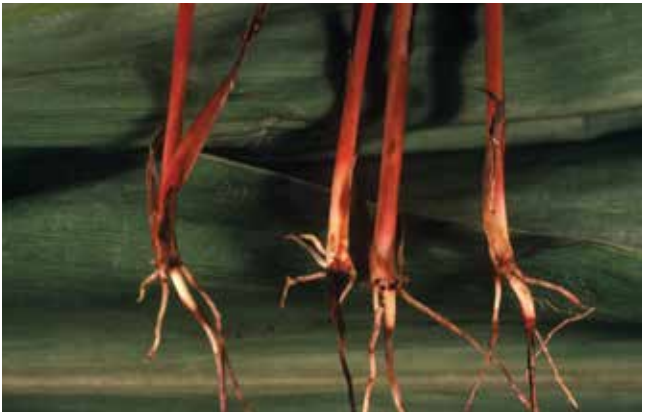
15

These seedlings have stunted growth and chlorosis, usually present in poorly drained or compacted soil areas, caused by **seedling blight**, which also can cause **wilting**.



Jardine

16



Clifton

Knowing the organism responsible for the **seedling blight** is important when selecting seed treatments. **Fusarium** is most often found in warmer, drier soils, especially where soil pH is low. If the subcrown internode is killed before the secondary roots become established, the plant usually dies.

17

Pythium is most frequently a problem in cooler, wetter soils. A constriction of the stem (**damping-off**) just below the soil line is a key symptom of **Pythium seedling blight**.



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18



During the first 2 to 3 weeks after planting, sorghum plants in nutsedge-infested areas may start to exhibit signs of aboveground feeding injury by **snout beetles**. Occasionally, patterns of oblong holes are present on leaves of damaged plants. In some cases, entire leaves and whole plants may be severed, often looking as if they have been run through a shredder.

19



The grayish to brownish **snout beetle** is slightly less than ½-inch long. Adults are usually on the soil surface hiding under trash or debris, or crawling on the exposed soil surface. They rarely fly. Feeding by the adults causes this ragged foliar injury on small sorghum plants. Yellow nutsedge is their natural host; later in the summer they lay their eggs and produce larvae in nutsedge plants.

20



Other problems can cause **thin plant stands**. The severity of damage may vary across the field. Close examination may reveal plants that are cut off near the soil surface. Cutworms cause this damage. Seed treatments do not provide protection against cutworms. If these symptoms are observed, scouting should be intensified.

21



Cutworms usually feed at night and hide underground during the day. Greasy looking grayish to dark colored worms are often found under the crust of the soil in the vicinity of injured plants.

22



A common insect, the **flea beetle** is tiny, shiny, and jumps when disturbed. Injured plants may have streaks or white stripes on upper leaf tissue. Damage can be more extreme when cool or dry weather slows sorghum development. Similar injury can be caused by **thrips**, tiny insects found in the whorl. Sorghum usually suffers less damage than corn. Flea beetles should not be a concern unless seedlings are infested with several beetles per plant.

23



Leaves on these plants have dead margins and are not fully expanded. A recent application of liquid nitrogen fertilizer left this pattern of damage often known as **fertilizer burn**.

24



These plants are small and the leaves have a purplish cast to them. The symptoms suggest a **phosphorus deficiency**. In this case, the problem was caused by low soil phosphorus availability enhanced by cool, wet growing conditions.

25



These plants are stunted and purple, while some also have a bleached appearance. These are the effects of **Classic carryover**, one of the components in several soybean herbicides. A soil test revealed a pH of 7.2, which was too high for the herbicide to rapidly break down in the soil. In this case, the high pH was due to poor lime incorporation.

26



Sometimes a plant can be found with one intensely **red leaf**. It is the result of feeding by **yellow sugarcane aphids** on the underside of the leaf. This red-leaf symptom may persist for a while after the insects are gone.

27



Whitworth

These tiny, soft-bodied, lemon-yellow insects found on the underside of the leaf are **yellow sugarcane aphids**. They are occasionally a problem in eastern Kansas. As they feed, they inject a toxin that produces the distinctive reddish reaction seen in photo 26.

28



Whitworth

In this picture, small areas within the leaf show pinpoint **reddish spots** that may gradually enlarge. The leaves may turn yellow and die. Feeding by **greenbugs** caused this damage. See photos 29 and 30.

29



Whitworth

Greenbugs, tiny, light-green insects are usually found on the underside of leaves.

30



Whitworth

This is a close-up of a **greenbug**. Note the uniform light-green color and the tendency to have a faint stripe down the middle of the back. They can be either winged or nonwinged. Winged forms are often wind-borne and are the first to appear.

31



Osweedy

The **white sugarcane aphid**, or sorghum aphid, was first detected in Kansas in 2014 in Sumner County. They apparently have the potential of developing large populations, which can stress plants due to sap feeding. They also may produce large quantities of honeydew, which can interfere with harvest due to its stickiness. Aphids are light colored, similar to greenbugs, but without the dark green stripe, and have dark-colored cornicles, or “tailpipes.”

Five-Leaf Stage to Heading

32



Ciampitti

During this stage of development, sorghum plants are developing and growing rapidly. Leaf area is being formed, the stalk is elongating, and the head is developing down in the whorl. Several issues may be encountered during this stage of sorghum development.

33



This sorghum field borders a recently cut wheat field. The plants along the edge of the wheat field are yellowing and showing signs of extreme stress caused by **chinch bug** feeding. See photos 34 through 36.

34



Whitworth

Looking closer, **chinch bugs** may be clustered at the base of the plants. These bugs migrate from mature or recently cut wheat. They remove plant juices, causing sorghum to wilt and die.

35



Whitworth

Chinch bug damage most frequently occurs in rows of sorghum adjacent to a field of ripening wheat. Affected plants are stunted and wilted. Often the entire length of the stem shows prominent reddish discoloration. Chinch bug damage also can cause plants to tiller excessively.

36



The injury is associated with the **chinch bug** and is a problem in some areas of eastern and central Kansas, especially in dry years. They feed mainly on the stem above and/or just below the soil surface.

37



These insects are commonly confused with chinch bugs. These bugs are **false chinch bugs**, which occasionally feed on sorghum. A reddish discoloration on the lower portion of the stalk and spotting on the leaf tissue are often visible.

38



Both the **true chinch bug** and the **false chinch bug** are similar in size. But, the false chinch bug, at the top of the picture, is a small gray-brown bug with transparent wings, while the true chinch bug is black with white wings. Immature chinch bugs are red with a white stripe across the body. Chinch bugs often lay an abundance of eggs in the soil around the base of sorghum plants.

39



In this field, the stand is thin, remaining plants are wilted, and no aboveground indication of what is causing the problem is present. **Wireworms** caused the damage (see photo 40).

40



Wireworms have tunneled into the base of the stalk on the plants, killing the growing point. Often, leaves in the whorl are the first to die and roots also may be pruned. Wireworms are a potential problem in fields that were previously in pasture or wheat and no-till planting system.

41



These leaves have holes and appear ragged. Look for frass in the vicinity of the feeding and for worms deeper in the whorl. If worms are not found in the injured plants, it is an indication they may have finished their feeding and dropped to the soil to pupate. This injury is evidence of the **fall armyworm**, although **corn earworm** and other **caterpillars** can cause similar injuries.

42



Schwartzing

The **fall armyworm** is the most common whorl feeder. This worm has a grayish, brown color and lighter colored stripes. Color patterns can vary greatly from one worm to the next, but all have four dark spots in a square pattern on the last abdominal segment.

43

The **fall armyworm** head capsule is usually dark, almost black, although some like this tend to be more of a dark brown shade of color, with a white-lined, upside-down Y structure in the middle of the face. This Y character is always present on fall armyworms.



44



If the shredded leaves and broken stems occur fieldwide without following a pattern, the damage could be caused by **hail**.

45



These plants are beginning to show signs of **stress**. There are red areas on the lower leaves. The upper surfaces of the lowest leaves may be sticky and shiny. These could be symptoms of a **greenbug** infestation during a later stage of growth (see photo 46).

46



Whitworth

Greenbug colonies may be found on the undersides of the lower leaves. Leaves may die where infestations are significant.

47



Whitworth

Here the leaves in the whorl are sticky and shiny. Look at the numerous white cast skins on the plant. This is not greenbug damage, but is caused by **corn leaf aphids**.

48



Schwarzting

Corn leaf aphids have prominent dark blue “tailpipes” compared to the greenbug’s less obvious green “tailpipes.” Greenbugs are entirely light green (see Photo 30).

49



Ciampitti

While sorghum is a drought-tolerant crop, it can show signs of stress when moisture is limited. The leaves show an upward and inward rolling of the upper leaves (more preponderant), plants are often smaller than normal, and more variation is expected to be found (different plant sizes) in the field. During severe **drought** conditions, the lower leaves may die.

50



Thompson

Slight leaf discoloration and leaf burn are caused by **Starane NXT application** on sorghum. The bromoxynil component in Starane NXT is causing the injury. This is most common with high humidity and temperatures. There is no effect on yield.

51



Thompson

Here **leaves are rolling and elongated** from herbicide injury. These symptoms are referred to as **onion leafing** and are associated with **2,4-D damage** and occasionally damage from **Aim herbicide** or **hail**. Sorghum hybrids vary in their response to 2,4-D.

52



Dicamba injury causes sprattling of sorghum. Sorghum generally recovers from the symptoms a few weeks following application.

53



Thompson

Misapplied 2,4-D also can cause brace roots to become malformed.

54



Thompson

Malformed brace roots caused by herbicide injury from 2,4-D LV ester applied to 15-inch sorghum. Lodging and stem breakage can occur. Yields can be affected. Hybrids vary in their response to 2,4-D.

55



Thompson

Injury from Facet L applied at 32 fluid ounces per acre appears much like injury from growth regulator herbicides. Quinclorac, the active ingredient, is also found in Paramount and can be used to control bindweed in sorghum. Facet L has some activity on small grasses.

56



Thompson

A bleached or chlorotic band across the leaf appears one to two days after an **application of Huskie herbicide** to grain sorghum. Huskie injury is common in grain sorghum. This damage does not affect grain yield.

57



Thompson

Huskie injury two weeks after application. New growth is unaffected and the chlorotic band on leaves has become more necrotic. There is no effect on grain yield.

58

The bleaching of the upper leaves and stem is the result of a late misapplication of **Huskie+atrazine** on susceptible forage sorghum. A second forage sorghum sprayed at the same time and growth stage showed no bleaching.



Thompson

59

Leaf burn caused by **injury from Aim herbicide**. Only the leaf tissue that was treated shows symptoms. New growth is unaffected.



Thompson

60

Stunting and chlorosis in the whorl can result from an **Ally + 2,4-D application** on 15 inch grain sorghum. Sorghum usually grows out of the injury but heading may be delayed.



Thompson

61

There are several diseases that can affect sorghum leaves. Symptoms of **northern corn leaf blight** include long, elliptical-shaped lesions with gray centers and tan to red borders.



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62



Jardine

There are two bacterial leaf diseases commonly found in Kansas — **bacterial stripe** and **bacterial streak**. It is often difficult to distinguish one from the other outside of the laboratory. In general, bacterial stripe, shown in this photo, has longer, broader lesions that may be purple or tan, depending on the hybrid.

63

Bacterial streak lesions are generally shorter and thinner than bacterial stripe. Both diseases may have shiny, crusty areas over the lesions on the underside of the leaves.



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64



Jardine

Sorghum rust frequently occurs late in the season in Kansas. On susceptible hybrids, dark, reddish brown, blister-like pustules form on the upper leaf. Eventually, the dried brown epidermis over the pustule ruptures, revealing the powdery mass of reddish brown spores underneath. These spores often rub onto hands or clothing.

65



APS Press

As tillage in Kansas has been reduced, **sooty stripe** has become the most important foliar disease of sorghum. The typical lesion is oval to elliptical in shape, and has a tan or gray center surrounded by a bright orangish-yellow to yellow halo. On the underside of older lesions, a mass of black or “soot-like” spores can be found.

66



Jardine

Zonate leaf spot has been increasing in Kansas as tillage has been reduced. This disease is easily recognized by concentric patterns, formed by alternating red and tan bands, resembling a bull's-eye.

67

Sorghum downy mildew infects plants shortly after emergence when soils are saturated. In the systemic phase of the disease, parallel green and white stripes running the entire length of the leaf can be seen. Sometimes only a single tiller on a plant may be infected. Sometimes mistaken for injury from Lumax EZ or Lexar EZ.



APS Press

68

As **sorghum downy mildew** progresses, the white areas will turn brown and fall out, giving the leaf a shredded appearance.



Jardine

69

Plants in areas of the field prone to water logging often develop **crazy top downy mildew**. Diseased plants are stunted, and the leaves are often thickened, yellow, and somewhat twisted.



Jardine

70



Ruiz Diaz

This field of sorghum has an unhealthy yellow color caused by **iron deficiency**. This situation is common in soils with a pH greater than 8.5.

71



Ruiz Diaz

The tissue between the veins on these leaves is pale yellow, while veins are green. In a severe case, leaves turn completely yellow or white. **Iron deficiency** is a problem on high pH, calcareous soils, and sorghum is generally a susceptible crop to iron deficiency.

72



Sharma & Kuma (IPNI Collection)

Plant stunting, with broad areas of chlorotic tissue that progress from the base of the leaf to the tip, may occur in sorghum. This stunting may be caused by **zinc deficiency**, which occurs in fields where erosion has removed the topsoil or leveling has occurred for irrigation.

73



This field has a pattern of stunted, spindly, pale-yellow plants growing next to healthy green plants. This growth difference is associated with **nitrogen deficiency**.

74



Ruiz Diaz

Nitrogen deficiency often causes the lower leaf to form a distinct V-shaped dead tissue pattern progressing from the tip to the midrib.

75



Ruiz Diaz

Potassium deficiencies make plants appear stunted and cause firing along leaf edges, with the oldest leaves showing the greatest amount of firing. Some leaves at the base also may die.

76



Sharma & Kuma (IPNI Collection)

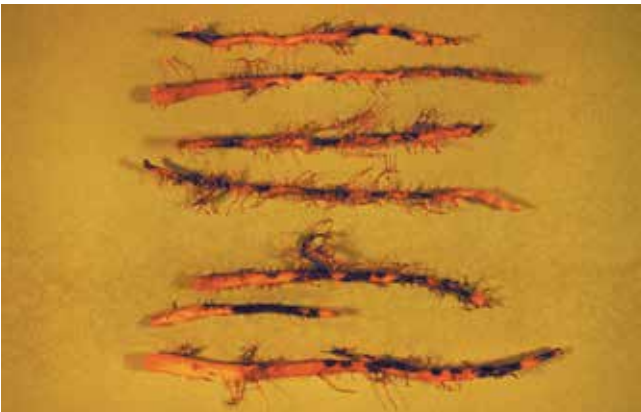
Sulfur deficiency symptoms are similar to nitrogen deficiency. The plant is stunted and has chlorosis in younger, rather than older leaves.

77



This picture shows a field with an elliptical patch of stunted and chlorotic plants. Often this is a symptom of **herbicide injury** or a **nutrient deficiency**, although the pattern of injury in this field does not support either diagnosis. To make a correct diagnosis, it is often necessary to dig up plants and examine the roots. In this case, damage was caused by **nematodes**.

78



If roots have noticeable lesions or wounds, they are often caused by **nematodes**, microscopic wormlike organisms that feed on root tissue. This possible diagnosis must be verified with a root tissue analysis. Nematodes are commonly found in soil samples from sorghum fields. A yearly soil test for these organisms, available through county extension offices, helps manage the populations.

Heading to Physiological Maturity

79

As the sorghum crop is progressing toward the end of the season, a number of issues can reduce yield potential. During the grain-filling period (immediately after heading), the grain is filling and nutrients that were stored in the stalk and leaves are translocated to the seed. Correct diagnosis through the use of best management strategies reduces yield-limiting production issues.



Cianpitti

80

If cold or very wet weather interferes with pollination, **sorghum ergot** may infect the florets. Flowering is the only time this infection occurs. Within 1 to 2 weeks after infection, a clear to amber colored, sticky “honeydew” begins forming on the heads.



Oldroyd

81

Honeydew can drip from the head onto the leaves and surrounding soil. Under moist conditions, secondary **sorghum ergot** spores develop in this honeydew, causing a **white scum** or **powdery growth** to develop on the leaves or soil.



Outvody

82



Caterpillar feeding in developing heads reduces grain quality as well as reducing yields about 5 percent per worm per head. Finding grain particles and insect droppings on the flag leaf and surrounding soil indicate a **sorghum headworm** has been feeding in the head.

83



This picture shows destruction of grain in the developing head caused by **corn earworm**.

84



Whitworth

Infestations of **corn earworm** or **fall armyworm** may occur between bloom and the soft dough stage. The corn earworm can be recognized by its green, pink, or blackish striped body.

85



Sorghum webworms can cause grain particles on the flag leaf and on the ground around the plants similar to corn earworm damage. These insects are more common in southern parts of the state.

86



This photo shows **sorghum webworms** feeding on the head.

87



The **sorghum webworm** is a small, yellow- and brown-striped worm. On a worm-for-worm basis, they often cause less damage than corn earworm; however, because sorghum webworm populations may be much higher, they can cause serious damage. Infestations are often more severe in late maturing fields.

88



Lack of grain fill can give heads a “blasted” appearance. This damage can have many causes, such as excessive heat or cold, or bird damage. In this photo, **sorghum midge** caused the damage.

89



Sorghum midge damage caused a lack of grain fill in part of this head. Occasionally small, white, pupal cases still attached to the ends of the empty spikelets may be seen.

90

These are signs of damage by **sorghum midge**. The adult midge is so small it is rarely seen. When seen, it looks similar to many other gnats that are commonly present in fields. The most distinctive characteristic of the adult midge is its orange-colored body.



91

These leaves have large chunks of tissue missing from the margins and damage in the head. **Grasshoppers** moving out of field borders infested with weeds have caused this injury. Damaged plants are usually confined to field margins.



Whitworth

92



Seeds are missing from damaged heads in this field, caused by flocks of **birds feeding** in the field. For other causes of this appearance, see photo 88.

93

A close examination shows the chalky endosperm exposed where there has been **bird feeding**.



Ciampiti

94

Head smut usually becomes evident at heading. All or part of the seed head is transformed to black powdery spores.



95



When the seed is mature and the weather is rainy with high humidity, **grain** may **sprout** in the head or germinate if the head is on the ground.

96



Fertilizer spread was uneven earlier in the season, causing this field to ripen unevenly, showing a noticeable striped pattern.

97



Unlike photo 96, **drought stress** caused this uneven ripening. Plants in the low areas of the field, which had more available moisture, developed mature heads.

98



Drought stress may result in **small heads** that have not fully emerged from the flag leaf; the leaf margins may also die.

Ciampiti

99

Plants recovering from **drought stress** can produce heads on late tillers, but the heads produced may be immature by the time the head on the main stem matures, resulting in delayed harvest and storage problems.



Ciampiti

100

Showing signs of **arrested sorghum ear**, the ovules on this head were not receptive for pollination and grains did not form. The main cause for this problem is associated with extreme heat conditions presented before or around flowering time for sorghum.



Ciampiti

101



Ciampiti

Partial or total **grain abortion** within the sorghum head can occur when **extreme heat** conditions occur near flowering time. The heads showed signs of grain abortion in different sections of this organ.

102



Look at the middle of one of the heads and the base of the other head. The branches of these two heads are **poorly developed**. Although the cause may not be known, the damage occurred during early head development.

103



These sorghum heads have sections without seed formation, sometimes referred to as banding, that can be caused by environmental stress when plants are flowering. A **misapplied herbicide**, such as 2,4-D or dicamba, could cause similar symptoms.

104



These leaves have a scorched appearance, similar to injury caused by **spider mites**, but in this case it is actually **frost injury**.

105



Hang

Frost injury can occur in different degrees of intensity as related to the air temperature, but severe conditions will interrupt seed grain filling, which affects the final grain weight.

106



High winds and **hail** have shredded the leaves on these plants and broken over some heads. Damage is fieldwide.

107



Stalk lodging can be a serious problem, making grain harvest difficult. **High winds** have broken the heads over on these plants as they are all lying in the same direction.

108



Frass on the leaf surface near the base of the leaf indicates **European corn borer** feeding inside the stem, which can weaken the stalk.

109



European corn borer larvae make extensive tunnels, which weaken the stalk. Insect damaged tissue is more susceptible to invasion by stalk rotting fungi, which can cause the plants to lodge.

110



Stalk rotting fungi can cause serious lodging problems in sorghum fields. When the lower stalk is split open, the vascular tissue has a shredded appearance (infected, left; healthy, right). The tissue may be tan, red, purple, or gray, depending on the organism causing the rot and the genotype of the hybrid.

Jardine

111

Fusarium stalk rot is most often identified by areas of red or purple tissue that is visible when the stalk is split open; however, many sorghum hybrids with *Fusarium* show only a tan discoloration.



112



Charcoal stalk rot develops under soil conditions that are hot and droughty for extended periods of time later in the season. Charcoal stalk rot shows the same symptoms of vascular shredding as **Fusarium**, but in this case, small, black fruiting structures form on the vascular bundles, giving the interior of the stalk a dark gray discoloration.

You may find additional information on these topics in these K-State publications:

Chemical Weed Control for Field Crops, Pastures, Rangeland, and Noncropland (for current year)

Grain Sorghum Production Handbook, C687

Kansas Sorghum Management, MF3046

Sorghum Insect Management (for current year), MF742

Stalk Rots of Corn Sorghum, L741

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Publications are reviewed or revised annually by appropriate faculty to reflect current research and practice. Date shown is that of last publication or revision.

**Kansas State University
Agricultural Experiment Station
and Cooperative Extension Service**

S125

December 2014

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