Kentucky Integrated Crop Management Manual for Field Crops

"Grain Sorghum"

UNIVERSITY OF KENTUCKY • COLLEGE OF AGRICULTURE • COOPERATIVE EXTENSION SERVICE
Agriculture • Home Economics • 4-H • Development

Kentucky Integrated Crop Management Manual

Authors:

Jim Herbek, Extension Grain Crops Specialist, Research and Education Center, Princeton, KY
Douglas W. Johnson, Extension Entomology Specialist, Research and Education Center, Princeton, KY
James R. Martin, Extension Weed Control Specialist, Research and Education Center, Princeton, KY
J. D. Green, Extension Weed Control Specialist, College of Agriculture, Lexington, KY
Lloyd Murdock, Extension Soils Specialist, Research and Education Center, Princeton, KY
Paul Vincelli, Extension Plant Pathology Specialist, College of Agriculture, Lexington, KY

Editor: *Patty Lucas,* Extension Integrated Pest Management Specialist
IPM-Coordinator: *Douglas W. Johnson,* Extension Entomology Specialist

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The following individuals have provided information, expertise and/or revised portions of this manual:

Paul R. Bachi, University of Ky., Plant Pathology
Monroe Rasnake, University of Ky., Department of Agronomy
K. A. Shufran, University of Ky., Department of Entomology
Charles R. Tutt, University of Ky., Department of Agronomy

PREFACE

Agriculture is the world's most important industry. This level of importance will continue due to rapidly expanding populations which demand increased amounts of food and fiber. Crop protection problems associated with this increased production have become more complex. A simplistic approach to pest control leads to serious environmental complications. A truly successful pest management program must take a multi- disciplinary, multi-crop approach in order to supply the farmer with reliable pest control information. An approach to crop production based on sound economic, ecological, technical and social considerations is required to assist the farmer to achieve needed production levels, while maintaining food safety and environmental quality.

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SORGHUM SCOUTING

Scouting for pests in grain sorghum will be similar to the technique used in corn. The following table indicates what type of monitoring stations are required for each type of pest along with the observation procedure to be used each week once the locations are established.

Pests	Monitoring Stations	Procedure/Location
Insects	Random	20 consecutive plants
Weeds	Permanent	100 $Ft.^2$ area
Diseases	Random	10 foot radius or 3-4 rows of plants 20 feet in length

The actual number of locations you monitor depends on field size. Utilize the following table to determine the number of locations and make sure you establish your monitoring locations to insure you sample each representative area of the field.

Field Size	No. of Locations	Field Size	No. of locations
1-14	2	151-164	14
15-24	3	165-174	15
25-34	4	175-184	16
35-50	5	185-200	17
51-64	6	201-214	18
65-74	7	215-224	19
75-84	8	225-234	20
85-100	9	235-250	21
101-114	10	251-264	22
115-124	11	265-274	23
125-134	12	275-284	24
135-150	13	285-300	25

Sorghum Insect Scouting Calendar

Insect	Seedling	Preboot	Boot	Bloom	Dough	Maturity
Aphids	********""""""""""""""""""""""""					
Chinch bug	********"""""""""""""""					
Corn Earworm			"""""""""""******"""			
Fall Armyworm			"""""""""""""""""""******"""			
Sorghum Midge			""""*******"""""""""""""""			
Sorghum Webworm			"""""""""*******			

* Period when economic population may occur

Scouting for Grain Sorghum Insects

Douglas W. Johnson

Seedling Pests

Greenbug

Occurrence: In Kentucky these pests are almost completely confined to seedling stage fields; (full season) in the Purchase area, and the lower tier of counties (KY-TN line) in the Pennyrile area.

When to scout: Pay very close attention from plant emergence until the plant is about 6" tall. Watch for yellowing leaves for remaining season.

Description: These aphids are pale green with a dark green stripe down the center of the back. They are about 1/16" long and usually found in colonies.

Damage: Greenbugs suck plant juices. While doing this they inject a toxin into the plant. This toxin causes plant cells to die, turn brown and may cause red spots on the upper sides of damaged leaves.

How to scout: Examine 20 plants. Look for unthrifty or red spotted plants. Count the number of plants which are infested with colonies.

Record: Record the number of plants which are infested with colonies for each group of 20 plants observed. Describe plant damage.

Economic Threshold: Treat plants from emergence to six inches when there is visible damage with colonies on all plants.

Aphids (other than Greenbug)

Occurrence: A variety of aphids, corn leaf aphid being the most common, will occur from seedling to heading. Populations will usually decrease rapidly as sorghum begins the reproductive stages.

When to Scout: Seedlings to Bloom.

Description: Most aphids on sorghum are similar size and shape. (See Greenbug.) However, the common corn leaf aphid is a very dark blue-green to black and does **not** have a stripe down the middle of the back.

Damage: All aphids have piercing-sucking mouth parts and suck plant juices. However, unlike green bug most aphids on sorghum do not inject a toxin. Note: **Any** damage to a sorghum plant can cause the damaged area to turn red! Plants will support large numbers of aphids with no apparent damage.

How to scout: Examine 20 plants per location. Look for the presence of aphid colonies, especially, in the whorl. Rate infestations on each plant as follows:

1 = 1-50 aphids/plant;
2 = more than 50 aphids/plant;
3 = leaves heavily infested.

Record: Add the ratings of the 20 plants observed and record the total. For example, if twenty plants are observed and all are rated "1", you would record a total of 20 for that site.

Economic Threshold: Control for aphids other than greenbug is rarely justified. Control only if the rating is 3 and plants show unthrifty appearance.

Chinch bug

Occurrence: This insect is almost completely confined to seedling (full season plantings) fields, in the Purchase Area (those on the KY-TN line).

Description: Very small (1/5" long), black and white "bugs" with reddish legs and piercing-sucking mouthparts. Insects are usually gathered around the base of the plants. These pests have a vile odor when crushed.

Damage: These pests suck the plant juices from stems and lower leaves. Damaged plants show an unthrifty appearance, but no removal of tissue.

How to scout: Examine 20 consecutive plants per location for the presence of insects.

Record: Record the total number of insects present per 20 consecutive plants examined. Note the appearance of the plants and the plant stand (density). Indicate if the stand count has been affected.

Economic Threshold: Live insects present, plants have an unthrifty appearance and/or plant stand less than minimum recommended plant density.

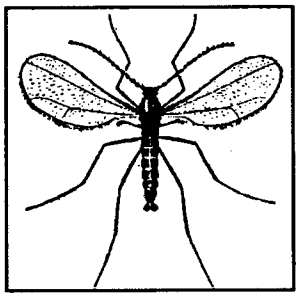
Grain Head Pests

Sorghum Midge

Occurrence: Midges may be present from about boot stage through the remainder of the season. However, only during bloom is this insect a threat!

When to scout: Scout in the early morning hours, **before** 10 AM. Mid-day scouting is no good!

Description: Sorghum Midge is a very small fragile fly. This 1/8" long orange insect may be confused with winged aphids. However, most aphids will be black or dark green. Also, when winged aphids are found, colonies will usually also occur.



Damage: The Sorghum Midge lays its eggs on the developing grain. The maggot hatches out and immediately enters the kernel hollowing the kernel out from the inside. No visible damage will be seen until much later in the season when the damaged head will not fill out.

How to scout: Check twenty heads in each location as follows. Place a clear plastic bag over the head and shake the head, carefully remove the bag.Examine the bag against a light background. Look for small orange insects.

Record: Record the number of insects found per 20 heads examined at each location. Calculate the average number of insects per head.

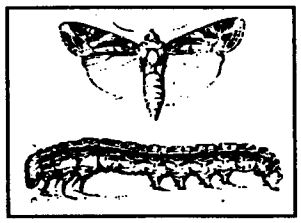
Economic Threshold: Average of one midge per head.

Fall Armyworm

Occurrence: Late planted sorghum is most susceptible to attack. Foliage feeding may occur at any vegetative stage but is most likely on plants knee high (Preboot) or better. Head feeding may occur from bloom to hard dough.

When to scout: Pre-boot (leaf feeding) to hard dough (grain feeding).

Description: Larvae are light tan to green to black with three yellow hair lines down the back. Each side will have a darker stripe above a waxy yellow stripe splotched with red (the red is often hard to see). The front of the head has an inverted "Y" shaped white mark. There are three pair of true legs just behind the head, four pair of fleshy legs near at the center of the body and one pair of fleshy legs near the rear end.



Damage: Fall Armyworm may feed on both the foliage and the grain heads. If foliage feeding occurs it will be very similar to damage on corn. Early damage may look much like European Corn Borer damage.

Larvae will feed in the whorl producing very ragged damage and lots of fecal pellets. Head feeding is characterized by kernel removal but not necessarily accompanied by the obvious production of fecal material.

How to scout: Examine twenty plants per location for the presence of the insect. Count damaged plants and larvae.

Record: Record the number of live larvae found on twenty plants examined at each site.

Economic Threshold: Treat for foliage feeding when 50% of the plants are infested with live larva.

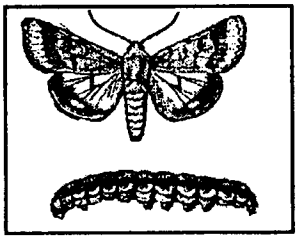
Treat for grain feeding when there is an average of two small larvae per head.

Corn Earworm

Occurrence: Mainly in late planted fields. Usually present after heads begin to fill.

When to scout: Bloom to maturity.

Description: Larval color varies from light green to black, with lighter stripes running the length of the body. When larval development is complete earworms may reach 1-1/2 inches in length. Larvae have three pair of true legs near the head, four pair of fleshy legs near the center of the body and one pair of fleshy legs near the rear end. These larvae may be confused with fall armyworms, however, earworms do not have an inverted "Y" on their heads.



Damage: Earworms are primarily head feeders. Young larvae hollow out the grain while large larvae consume the whole kernel.

How to scout: Examine twenty heads per location for the presence of this insect and count larvae.

Record: Record the number of larvae found per twenty heads examined at each site.

Economic Threshold: Average of two or more small larvae per head.

Sorghum Webworm

Occurrence: Usually in field with grain heads still filling to soft dough stage, during September.

When to scout: Bloom to maturity.

Description: Sorghum webworm is smaller than the fall armyworm or corn earworm, reaches about 1/2" in length when larval development is complete. Webworms are green and "bristly".

Damage: Webworms are head feeders. They feed on developing grain, often consuming only a portion of each kernel. Small white fecal droppings indicate the presence of the webworm.

How to scout: Examine twenty heads in each location for the presence of this insect and count larvae.

Record: Record the number of larvae found per twenty heads examined at each site. Note the average length of the larvae.

Economic Threshold: Average of two or more per head.

Scouting Procedures for Weeds in Sorghum

James R. Martin and J.D. Green

Scouting for weeds in sorghum will be similar to those procedures used when scouting corn. Weeds will be checked each week for their presence in the field. The reason for this season-long survey is to determine when these weeds begin growth in sorghum fields. Many of the weeds to be surveyed will not appear in any of the fields that you will survey. However, these weeds are common in Western Kentucky, and are of great economic importance to the sorghum producers.

When to survey the field:

Beginning within 10 to 14 days after planting and at weekly intervals thereafter. You will be notified when the field is planted and can plan your surveys to best fit your schedule.

Number of locations per field:

The number of survey sites will be determined by the size of the field. The following guide is to be used:

Field Size	No. of Locations
1-14	2
15-24	3
25-34	4
35-50	5

Select the survey sites so they will cover the entire field. Never survey within 100 feet of a fence or roadway. More weeds are found in field margins than in other portions of the field and surveying in these areas could result in an incorrect recommendation being made to a producer.

Sampling Procedure:

At each survey site selected, select one row middle (the area between two rows). Place a wire flag in one of the rows, then measure 75 feet and place another flag in the row. Paint may also be used to mark these areas. This method may require that you paint the markers each time you scout the field. This will be your survey site (one row middle x 75'). When weeds begin to grow during the season, select a 100 $Ft.^2$ area within this survey site where weeds are present, and mark with flags or paint. Survey in this same 100 $Ft.^2$ area each week. It is very important to survey the same area so that we will know when the weeds begin to grow. The number and kinds of weeds vary throughout a field, and if you do not sample the same area, you might not encounter the weeds you are counting.

Your survey sites will be easy to locate early in the growing season, but as the sorghum grows taller, the wire flags will become more difficult to locate. Therefore, pull up the sorghum on each side of the wire flags (about three or four feet in each direction) and mark on your field map the

location of the survey sites (for example, the number of rows in from a fence, roadway, etc.). All flags should be pulled when the last survey is made.

Hopefully there will not be a large number of weeds present in your survey site. However, if you encounter a large number of weeds in a 100 Ft.^{2} area, it is not necessary to count all of them. In heavily grass infested fields, it would not be uncommon to have several hundred plants. The following table can be used to know when to stop counting.

Weed	Maximum number of weeds to count/100 Ft.^{2} area
giant foxtail	80
fall panicum	80
wild cane	80
johnsongrass	80
giant ragweed	40
honeyvine milkweed	40
wild cucumber	40
others	40

How long to survey:

The field should be surveyed **until the sorghum is approximately 15 inches tall**. If no weeds have appeared up to this point, then you can survey at two to three week intervals for the remainder of the growing season.

Record: List the predominate weeds found at each site and the number of each counted. Note the average height of the weeds. Mark your survey sites and problem areas on the map.

Other observations in the field:

As you walk over the field conducting your survey, not only for weeds, but for insects and diseases, be observant. If you see a heavy infestation of weeds, bring it to the attention of your supervisor. It could be that special control procedures will be needed. Certain areas of a field are more likely to have large weed numbers than others. Some of these are near fences, roadways, drainage ditches and in low areas where water tends to stand.

MAPPING FIELDS FOR WEEDS

One of your most important duties as a scout is to prepare a "weed map" of each field that you survey. This map will be of benefit to the grower in planning his weed control program for the coming years.

Steps in preparing a "weed map".

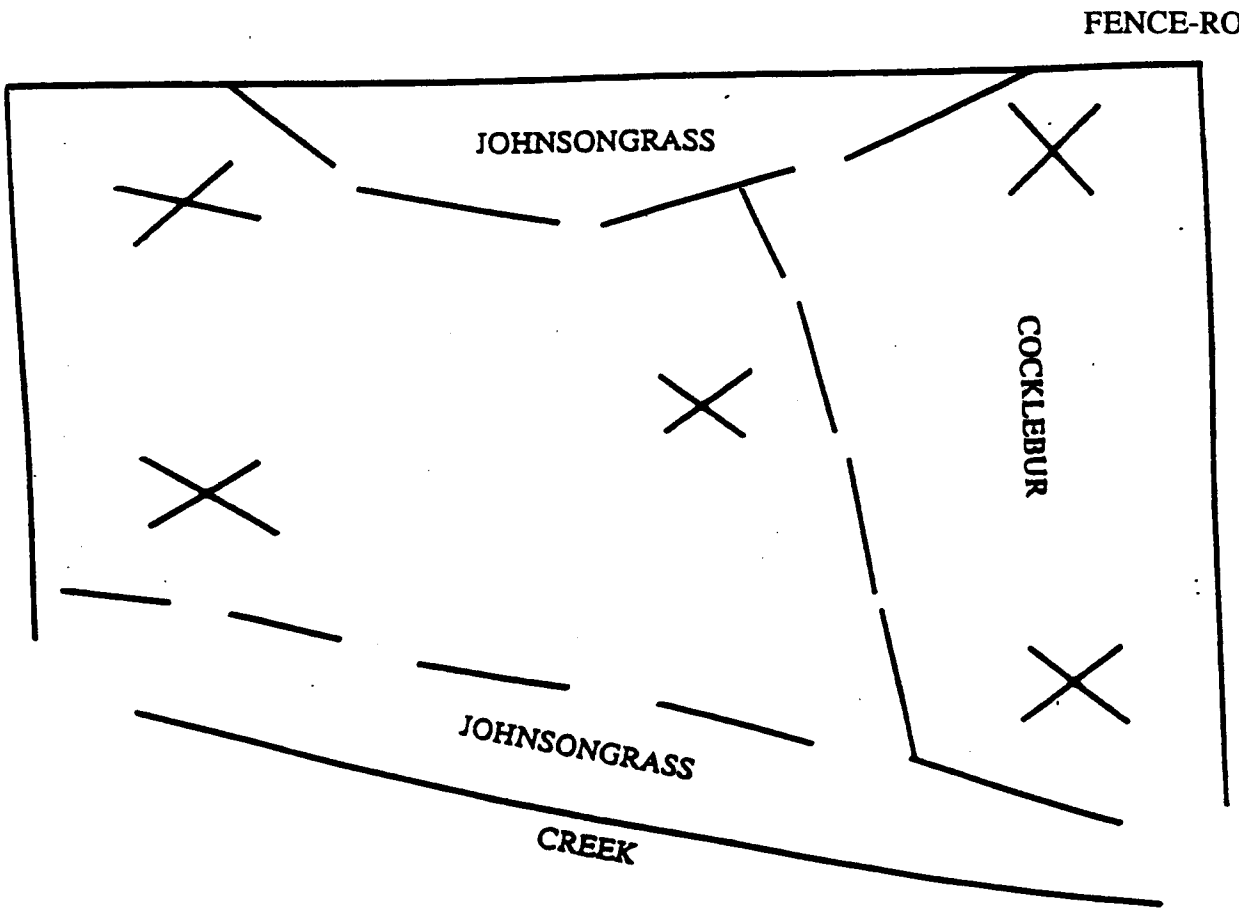
1) Outline the shape of the field on the report form. Make notations as to locations of fences, roads, woods, etc.

2) Mark the approximate locations of severe weed infestations or weeds not listed on the survey form and mark the locations where you make your counts.

3) This map should be drawn each time you scout the field.

4) Be sure and indicate any weed problems on the map that would assist the grower in making management decisions.

The following example can be used as a guide in preparing a "weed map" of your fields.

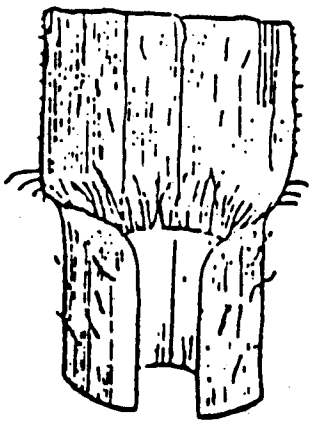


"1993 KY-IPM FIELD CROPS"

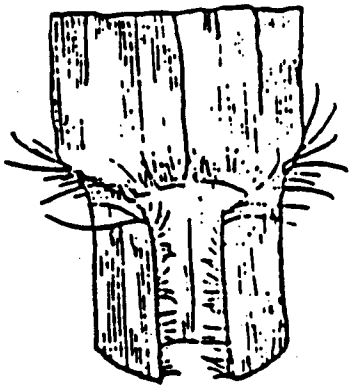
IDENTIFICATION OF COMMON WEEDY GRASSES BY VEGETATIVE CHARACTERISTICS

GRASS	VEGETATIVE CHARACTERISTICS							
	Ligule		Sheath		Blade			
	None	Hairy	Membrane	Smooth	Hairy	Smooth	Hairy	Rough
Large crabgrass			X		X		X	
Smooth Crabgrass			X	X		X	at base	
Giant foxtail		X		X				X
Green foxtail		X		X				X
Yellow foxtail		X	X	X		X	at base	
Goosegrass			X		at top	X	at base	
Johnsongrass		x fused	X	X		X		
Fall panicum		at base		X		X		

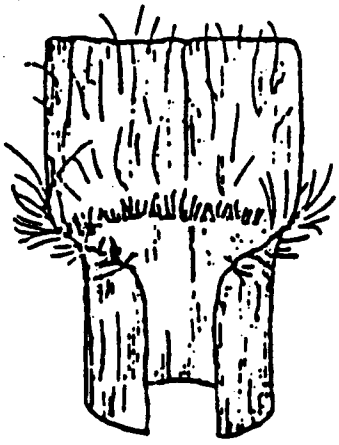
Note: These are the usual characteristics, however, there may be variations.



GIANT FOXTAIL

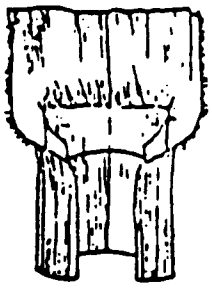


GREEN FOXTAIL

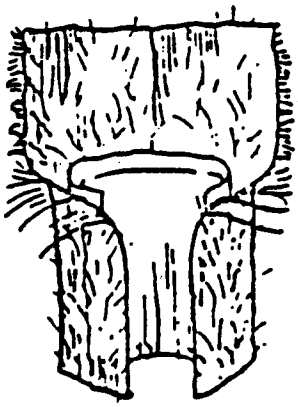


YELLOW FOXTAIL

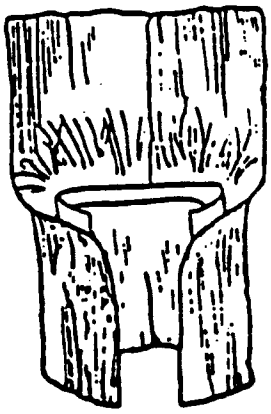
WILD CANE

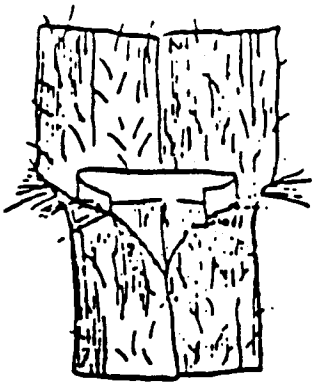


LARGE CRABGRASS

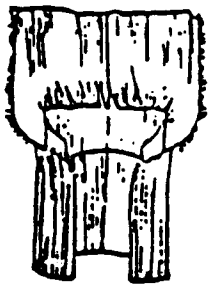


SMOOTH
CRABGRASS

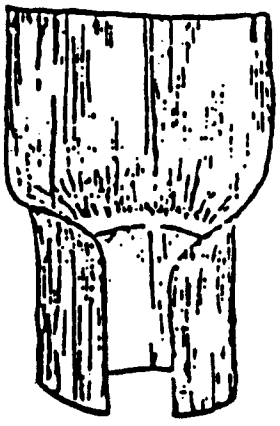




GOOSEGRASS



JOHNSONGRASS



FALL PANICUM

"1993 KY-IPM FIELD CROPS"

IDENTIFYING CHARACTERISTICS FOR CERTAIN SEEDLING BROADLEAF WEEDS

	Cotyledon	Leaf	Other
1. Chickweed	Small and thick Oval shaped Pointed tip	Oval shaped Pointed tip Opposite	
2. Cocklebur	Thick Long and Narrow	Oblong Toothed edges Alternate	
3. Cucumber, Wild	Thick Oblong	Somewhat lobed Alternate	Viney Stem
4. Eastern Black Nightshade	Small and Spoon shaped	Oval shaped Alternate	Lower surfaces of leaves often purple
5. Henbit	Round	Round shaped Toothed margins Deep crevices in surface Opposite	Square stem
6. Honeyvine Milkweed	Heart-shaped Opposite	Viney stem Long stem	
7. Hophornbean Copperleaf	Oval shaped Toothed margins Opposite		
8. Jimsonweed	Thick Long and narrow	Heart-shaped with smooth edges near base and irregular edges at tip Alternate	Pungent odor
9. Lambsquarters	Small and Narrow	First 2 leaves are opposite and subsequent leaves are alternate	Leaves appear white, especially on underside
10. Morningglory Bigroot	Butterfly shaped with long narrow blades	Heart-shaped Hairless Alternate	Viney stem Established plants develop large perennial root
11. Morningglory, Entire leaf	Butterfly shaped	Heart-shaped Hairy Alternate	Viney stem
12. Morningglory, Ivy leaf	Butterfly shaped with prominent veins	3-lobed Hairy Alternate	Viney stem

	Cotyledon	Leaf	Other
13. Morningglory, Pitted	Butterfly shaped with long narrow blades	Shape is variable Hairless Alternate	Stem and leaf margin often purple Viney stem
14. Morningglory, Tall	Butterfly shaped with prominent veins	Heart shaped Alternate	Viney stem
15. Pigweed, Redroot	Narrow and about 1/4 inch in length	Oval Shaped Alternate	Taproot is red Stems are hairy
16. Prickly sida	Oval shaped 3 veins on upper surface	Oval shaped Toothed margins Alternate	2 to 3 spiney projections below each node
17. Ragweed, Common	Thick, spoon-shaped and small	Deeply divided Hairy Opposite	Emits a strong odor when crushed
18. Ragweed, Giant	Thick Spoon-shaped	Develop lobes with growth Opposite	
19. Shepherdspurse	Fleshy Small (2-3 mm) Round shaped	First leaves are round, other leaves are somewhat lobed	
20. Smartweed, Ladysthumb	Fleshy Narrow 3/4 inch long	Oblong and pointed Alternate	Membrane sheath at node is hairy
21. Smartweed, Pennsylvania	Fleshy Narrow 3/4 inch long	Oblong and pointed Alternate	Membrane sheath at node is hairy
22. Velvetleaf	Fleshy and oval shaped Small hairs	Pubescent on leaf and stem Alternate	Pungent odor

Observation Times for Grain Sorghum Diseases

	SEEDLING APRIL	KNEE HIGH MAY	WHORL JUNE	HEAD JULY	BLOOM AUGUST	MATURITY SEPTEMBER
Seed Rots and Seedling Disease	**********					
Maize Dwarf Mosaic Virus		**********				
Leaf Diseases Caused by Fungi			**********	**********	**********	
Northern Leaf Blight						
Southern Leaf Blight						
Anthracnose						
Gray Leaf Spot						
Zonate Leaf Spot						
Rough Leaf						
Bacterial Stripe			**********	**********		
Anthracnose (Stalk, Stem, Head				**********	**********	
Charcoal Rot				**********	**********	
Fusarium Head Blight					**********	

DESCRIPTION OF GRAIN SORGHUM DISEASES

Paul Vincelli

Seed Rots and Seedling Disease

Examination Period: Soon after emergence of sorghum seedlings and two more times at two week intervals. Observe two rows of plants 10 feet in length.

Symptoms: Most grain sorghum stands are lost early in the growing season when hard, packing rains seal the soil surface and soil temperatures are cold. Under these conditions, emergence is slowed and soil organisms are better able to use the seed as a food source, thereby resulting in disease.

After emergence in cold soils, plants may have a purple color and grow very slowly. While organisms can be isolated from plant parts, this symptom is basically nutritional in nature. Phosphorus uptake is poor in cold soils, and purpling is caused by temporary phosphorus deficiency.

Very young seedlings produce two sets of roots. The earliest roots, called primary roots, function for only about two weeks, then perish. Secondary roots are produced at the base of the developing plant before primary roots die. They are permanent and support future plant growth. Occasionally, when soils are very dry, secondary roots do not find enough moisture and fail to develop properly. As the primary roots cease functioning, and since there are no secondary roots, many seedlings may die. This could be considered a seedling disease, but actually the cause is drought related.

Pythium and Fusarium are two fungi that often are associated with seedling disease in Kentucky. Damping-off symptoms may occur before or after emergence. Pre-emergence symptoms often include a soft rot of stem tissues and discoloration of affected areas anywhere from whitish-gray to pink to dark brown. Post-emergence symptoms are yellowing, wilting and death of leaves.

Occurrence: Look for seedling blight in poorly drained, cold, wet soils or very dry soil.

Rating Scale:
0 = no seedling disease observed;
1 = 1-4% of plants affected;
2 = 5-20% of plants affected;
3 = 21-100% of plants affected.

Record: Record a rating of 0 to 3 for each site observed. Observe two rows ten feet in length at each site.

Maize Dwarf Mosaic Virus

Examination Period: Look for mottling and yellow leaves six to eight weeks after planting and the red leaf stage in late July or early August. Observe three or four rows of plants 20 feet in length.

Symptoms: Maize dwarf mosaic virus infection produces a distinctive mottling in leaf tissue. When compared to healthy leaves, infected ones are yellow with light green islands. The symptoms are more clearly seen on young leaves than on older leaves.

Mottling is the most consistent symptom, but other symptoms may also occur. Red leaf occurs when highly susceptible hybrids become infected and growing temperatures fall below 55°F. The symptom is more severe on older leaves, with dead tissue forming in strips and at leaf tips.

Occurrence: Often found in fields with a johnsongrass problem and where susceptible sorghum hybrids are grown.

Rating Scale:
0 = no virus symptoms observed;
1 = 1-4% of plants showing symptoms;
2 = 5-20% of plants showing symptoms;
3 = more than 20% of plants showing symptoms.

Record: Record a rating of 0 to 3 for each site observed. Observe 3 or 4 rows of plants 20 feet in length.

Foliar Diseases Caused by Fungi

Examination Period: Every four weeks from whorl stage to maturity. Observe two rows of plants 10 feet in length.

Symptoms: Symptoms of the most common fungal leaf diseases are contrasted in the following chart.

NAME	PATHOGEN	SHAPE	SIZE	COLOR	CHARACTERISTICS
Northern Leaf Blight	Helminthosporium tercuim	Irregularly shaped	1 inch to many	Gray with tan to reddish borders	Very large elongated spots
Southern Leaf Blight	Helminthosporium maydis	Angular lesions	Small flecks to 1-1/2 inches	Tan color	Minor significance
Anthracnose	Colletotrichum graminicola	Elliptical	1/8 inch to 7/8 inch	Tan to red with distinct margin	Satae and spore masses common in lesions
Gray Leaf Spot	Cercospora sorghi	Elongated to rounded	1/4 inch and larger	Dark purple	Grayish when the pathogen is producing spores
Zonate Leaf Spot	Gloeocercospora sorghi	Irregular to semicircular	Patches of lesions running together	Alternating dark and light bands of tissue	Similar to the red symptoms produced by maize dwarf mosaic virus
Rough Leaf	Asochyto sorghina	Broad, elliptical	1/4 inch by 1/2 inch	Grayish to yellow or purple	Rough to the touch because of raised fruiting bodies

Occurrence: Any time from about mid-season on.

Rating Scale:

0 = no symptoms;

1 = a few lesions on lower leaves of some plants;

2 = nearly all plants have some lesions and lesions are not confined to only lower leaves;

3 = all plants have lesions on nearly all leaves, some or all leaves dried up and killed.

Record: Record a rating of 0 to 3 for each site observed. Observe two rows ten feet in length.

Bacterial Stripe

Examination Period: Every four weeks from whorl stage to maturity. Observe two rows of plants 10 feet in length.

Symptoms: Generally, bacterial stripe produces a linear lesion, which first has a water soaked appearance. The lesion develops into a dry strip of dead tissue with a reflective glaze on the surface when viewed in proper light. This disease seldom causes yield losses.

Occurrence: Any time from about mid-season on.

Rating Scale:
0 = no symptoms;
1 = a few lesions;
2 = nearly all plants have lesions;
3 = all plants have lesions, many of which have developed into dry strips of dead tissue.

Record: Record a rating of 0 to 3 for each site observed. Observe two rows ten feet in length.

Anthracnose (stalk, stem, head)

Examination Period: Every three weeks from heading to maturity. Observe two rows of plants 10 feet in length.

Symptoms: On susceptible hybrids, the stem holding the head (peduncle) becomes infected and a brown sunken area with distinct margins develops. When infected stems are cut lengthwise with a knife, one can see the fungus has penetrated the soft pith tissues and caused a brick red discoloration. Red rot diseases is another term often used to describe anthracnose disease. This type of infection stops the flow of water and nutrients and essentially stops grain development.

This fungus also invades individual grains and the small stems that support them on the seed head. The invading fungus rapidly utilizes the stored food material in the grain, and rapid yield loss occurs.

Occurrence: As plants approach maturity. Anthracnose is more severe when periods of high humidity alternate with relatively dry periods.

Rating Scale:
0 = no disease;
1 = light discoloration at stems and internal discoloration of split stems;
2 = most plants have symptoms described in "1" rating and more severe;
3 = nearly all plants showing stem, stalk and head infection.

Record: Record a rating of 0 to 3 for each site observed. Observe two rows ten feet in length.

Charcoal Rot

Examination Period: Every three weeks from heading to maturity. Observe two rows of plants 10 feet in length.

Symptoms: Grain sorghum plants affected by the charcoal rot fungus fail to fill properly and may lodge in the latter part of the season. The disease is identified easily under field conditions by splitting the stalk lengthwise near the ground line and looking for shredded tissue. Activity of the fungus within the plant tissue causes the

softer portions to be consumed and the tougher vessels to be left. Small, dark, fungal bodies cover the vessel bundles, and they give the tissue a charcoal color.

Occurrence: The charcoal rot fungus actively invades plant tissue when plants are under drought stress at grain formation. Drought does not cause the problem, but it permits the fungus to invade tissues. If drought stress can be avoided with lower planting rates or irrigation, the problem may not develop.

Rating Scale:
0 = no disease;
1 = a few plants with early symptoms, no lodging;
2 = many plants have improper grain fill and a slight amount of lodging present;
3 = nearly all plants affected, considerable lodging present.

Record: Record a rating of 0 to 3 for each site observed. Observe two rows ten feet in length.

Fusarium Head Blight

Examination Period: Every three weeks after head bloom stage until harvest. Observe two rows of plants 10 feet in length.

Symptoms: Structures supporting the grain in the head (panicles and rachis branches) become infected first followed by infection of stalk tissue at and immediately below the head. Weak neck and stalk lodging may follow. Significant yield loss occurs even if harvest grain appears normal. When the organism attacks the rachis branches that hold the grain, the flow of nutrients and water is impaired if not terminated. This results in smaller and lighter grains.

The seed mold phase of the disease is less common. When it occurs, however, a pink mold covers the grain.

Occurrence: The fungus is widely distributed in nature and is capable of infecting sorghum heads at and soon after blooming. The disease is more likely to occur when high moisture conditions are present near harvest time and normal harvest is delayed.

Rating Scale:
0 = no disease;
1 = a few plants show light discoloration of stalk tissue at and below the head;
2 = many plants exhibit symptoms of "1" rating and some stalk lodging is present;
3 = most plants exhibit weak necks and stalk lodging is heavy.

Record: Record a rating of 0 to 3 for each site observed. Observe two rows ten feet in length.

Agronomic Measures

Jim Herbek and Lloyd Murdock

Recognizing Nutrient Deficiencies in Grain Sorghum

Deficiencies in sorghum are much more difficult to recognize because their symptoms often resemble those of diseases. Verification of a deficiency may require a plant tissue or soil analysis. The following are descriptions of nutrient deficiency symptoms in grain sorghum:

Nitrogen (N)

A nitrogen deficient plant will appear stunted and be spindly. It will be a pale green or pale yellow. The tips of older leaves will turn yellow first. The leaves will then turn brown following the main vein of the leaf. This will give the area a "V" shape.

Potassium (K)

Potassium deficient plants will be stunted and have short, thick stems. There leaves will be pale green to a bronze-yellow. The symptoms will appear first in the older leaves and work their way up the stem to the younger leaves. In some varieties a very pale yellow area will develop over the entire length of leaves located at the middle of the plant.

Phosphorus (P)

A mild deficiency will cause unthriftyness and delay maturity but no other obvious symptoms. Symptoms will develop first and be more severe in the older leaves. Older leaves will develop a dark yellow area at the tip. The area will then turn dark brown and move down the edges of the leaf. Eventually the entire leaf turns dark brown and dies. Younger leaves will be a dark green , but maybe be shorter and more erect than normal.

SOIL SAMPLING AND SOIL TESTING

The most important factor of soil testing and fertility recommendations is obtaining a good soil sample. There is more room for error in this step than any other in getting reliable soil test results and recommendations.

Method:

The proper procedures for obtaining a good soil sample are well-established. Publication AGR-16 contains a complete explanation of these procedures.

Time of Sampling:

Recent fertilizer applications can distort the soil test results and fertilizer recommendations. To ensure proper sampling, soil samples should be taken at least six weeks after the last fertilizer application.

Corn presents a special problem. As the height of the plants reach three feet it becomes increasingly difficult to walk through the field and view the terrain for any areas that need separate sampling. In the process of early season scouting notes should be recorded and areas needing special attention should be out lined on the field map. The best overall suggestion when special notes are lacking is to wait at least six weeks but sample while the general crop condition and field are still visible.

Late application of nitrogen to corn and the use of anhydrous ammonia require some special attention. When nitrogen is applied four to six weeks after planting, the best time to sample would be just before the delayed application. When anhydrous ammonia is applied between the row anytime after planting, do not sample within six inches of the application slit.

Soil cores should not be obtained next to corn rows when row fertilizer was used.

Soil samples for alfalfa, small grains and soybeans can be taken anytime in summer or fall as long as it is at least six weeks after the last fertilizer application. In a double-cropping system (small grains and soybeans), sampling a small grain can be accomplished early so that recommendations for the second crop can be obtained.

Soil Sampling Depth:

Crop	Depth of Sample
Alfalfa and pastures	4"
No-till corn or soybeans	4"
Conventional corn or soybeans	6-8"

Field numbers:

Designate fields or areas within fields with letters, numbers or a combination of letters and numbers. If more than one sample is obtained per field, the sampling areas should be clearly indicated on the field map.

The Soil Testing Laboratories of the University of Kentucky at Lexington and Princeton do soil testing for all counties. Read AGR-57 for an explanation of the nutrient tests performed at the laboratories. A copy of an agricultural soil sample form is enclosed. Instructions for completing the soil sample form are printed on the back of the last page (gold color) of the form.

Identifying Compacted Soil

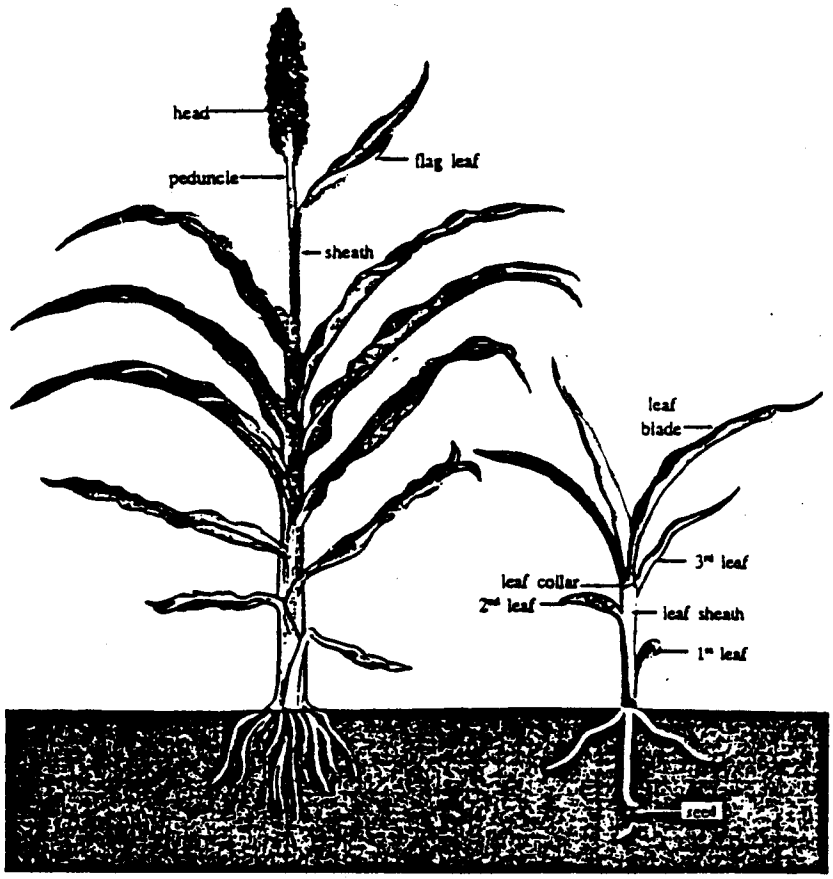
Most compaction results from the use of machinery on soil which is too wet to work well, or from overworking soil and destroying its natural structure. Pressure from tires and tillage tools compress more soil into a given volume. In the process, the natural soil aggregates are broken down and large pores become smaller.
This generally causes the soil to be more difficult for plant roots to penetrate.

A tiling rod or a three foot length of 3/8-inch diameter steel rod sharpened on one end and having a handle welded to the other end are easy tools to use in identifying compacted layers. Such tools should be marked in six inch increments and should uniformly be pushed into the soil when the moisture content is too wet for tillage. Under these conditions, compacted layers can be "felt" due to resistance in pushing the rod through the soil, and depth to and thickness of the compacted zone can be identified.

The best method for identifying soil compaction is with a soil penetrometer. This is similar to a tiling rod but has a gauge that measures the amount of pressure required to push the rod into the soil. An Annual Field Compaction Record Sheet is on page 175 and gives instructions on how to use the penetrometer and how to make a field recording.

Regardless of the method used, a number of sites in each field should be checked (similar to a soil test) and if severe compaction is found it needs to be confirmed. In addition to a compacted soil, the penetrometer will give high readings for a dry soil and heavy clay layer. Therefore, if severe compaction is found in a field then a soil probe or shovel needs to be used to look at the layer that was found compacted and confirm that high readings were not due to a clay or dry layer.

GRAIN SORGHUM GROWTH STAGES



GROWTH STAGE	IDENTIFYING CHARACTERISTICS
Seedling	From emergence to five leaves fully expanded.
Preboot	After five leaves are fully expanded and until the flag leaf is visible.
Boot	All leaves are fully expanded and grain head is extended into flag leaf sheath.
Bloom	Head is in bloom - head flowers from the tip downward in four to nine days - critical period for sorghum midge egg laying.
Soft Dough	Grain is soft with eight to twelve functional leaves (count from top down).
Hard Dough	Grain is getting hard - nutrient uptake is essentially complete.
Maturity	Maximum dry matter accumulation.

"1993 KY-IPM FIELD CROPS"

DETERMINING PLANT POPULATIONS IN GRAIN SORGHUM

Stand counts should be made from two to four weeks after emergence. Count the number of plants in 20 feet of row. The distance is measured by laying a 10 foot rope between the rows. Count the number of plants on both sides of the rope. Do this in five places in the field for each 50 acres or portion thereof, thus giving a total of 100 linear feet of row for each 50 acres or less. Try to pick out representative rows. The exact 20 feet of distance is important due to the nature of the population formula.

Examples of the number of population determinations needed for various field sizes are given below.

41 acre field = one population determination (100 feet of row)
69 acre field = two population determinations (100 feet of row each)
136 acre field = three population determinations (100 feet of row each)
218 acre field = five population determinations (100 feet of row each)

Row width - measure the distance between rows. Do this in several locations. The widths most often encountered are: 30, 36, 38 and 40 inches. Check with cooperators you are scouting for to find out what row widths they used in planting.

Determination of populations per acre - multiply number of plants in 100 feet of row by the "C" (conversion) factor which is determined by row width.

Row Width	C Factor
19"	275.11
20"	261.36
22"	237.60
24"	217.80
26"	201.05
28"	186.69
30"	174.24
32"	163.35
34"	153.74
36"	145.20
38"	137.56
40"	130.68

Example: Stand Count for 100 feet = 420
Row Width = 30 inches
174.24 x 420 = 73,181 plants per acre (record this figure on Report Form)

When more than 50 acres are involved in a field, determine the plant population of the field by averaging the plant populations that were obtained for each 50 acre portion (record this figure on Report Form).

If possible, also show a map of the field indicating the location of each 50 acres or portion thereof counted and the average plant population obtained in each location.

Plant populations in grain sorghum will generally range from 40,000 - 120,000 plants per acre.