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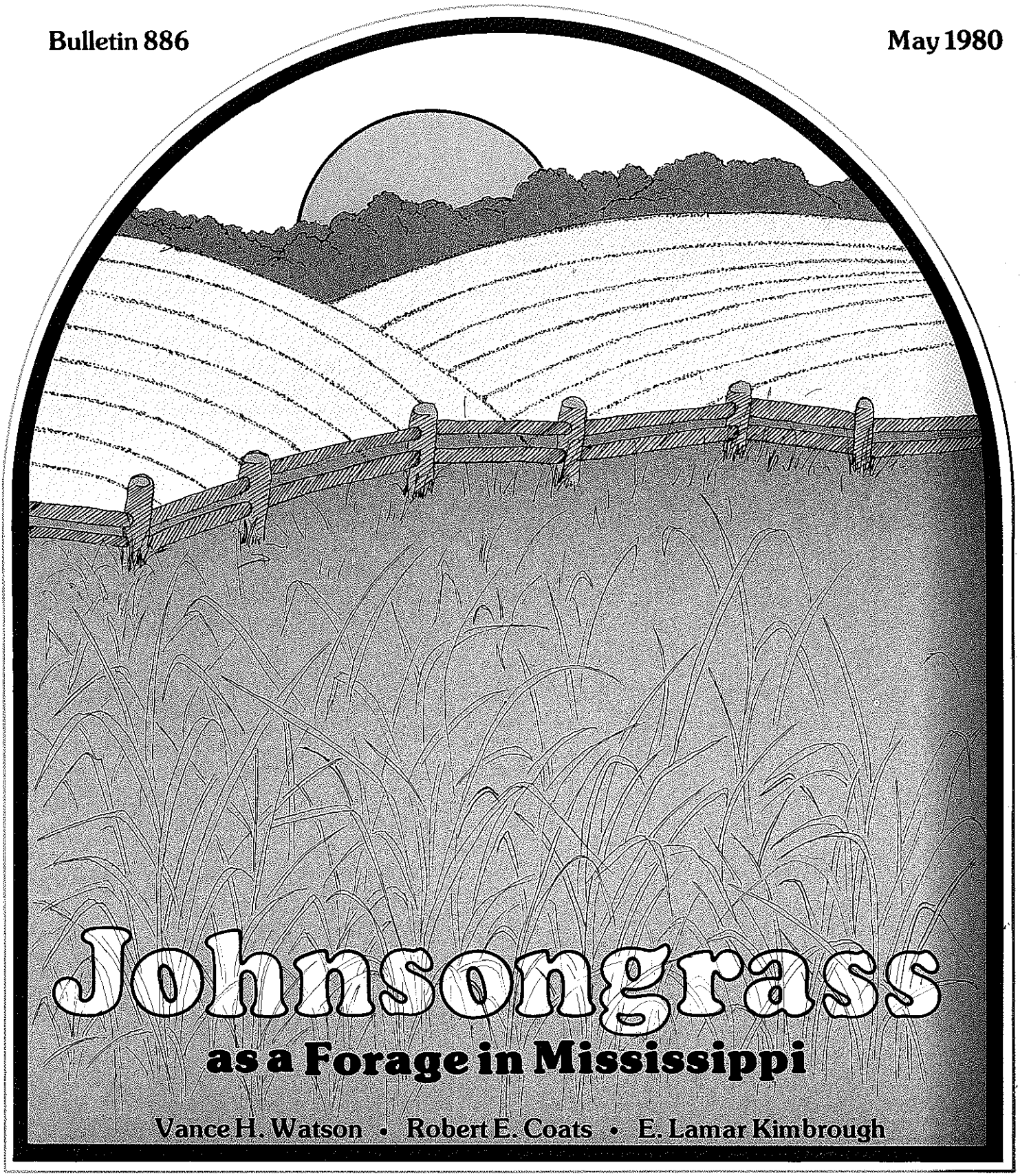

Johnsongrass
as a Forage in Mississippi

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Johnsongrass as a Forage in Mississippi

Johnsongrass [*Sorghum halepense* (L.) pers.] is native to regions that border the Mediterranean Sea from southern Asia to southern Europe. It was introduced into the United States about 1830, but documentation of its distribution was hampered by the use of more than 40 common names and eight Latin names in the 1800s (13). A Colonel Johnson brought the grass to the Black Belt of Alabama where it was named johnsongrass. It is believed to have been distributed throughout the United States by late in the 19th century and became such a pest in field crops that it led to the first federal appropriation specific to weed control. The first report on johnsongrass control was issued in 1902.

Johnsongrass still is best known as a weed in the cotton producing states. However, it is an important grazing and hay crop in the southeastern United States, and its value as pasture and hay outweighs its disadvantages in many production situations. It is particularly well adapted to the dark prairie soils of Alabama, Mississippi and Texas (Figure 1).

Figure 1. Johnsongrass is popular as a hay crop on the dark prairie soils of Mississippi, Alabama, and east Texas.

Value in Dairy and Beef Programs

Lusk et al. (7,8) cut johnsongrass in the boot and late milk stages of maturity and fed the hay to yearling dairy heifers for 64 days. One half of the heifers were fed the hay plus 2 lbs of a 14% protein concentrate mixture per day; the others were fed the hay plus 4 lbs of the concentrate.

Heifers fed the early-cut hay plus 2 lbs of concentrate gained at the expected 0.86 lbs/heifer/day calculated from the most generally used standards, but heifers fed the late-cut hay plus 4 lbs of concentrate gained at less than 0.86 lbs/day. Lactating cows respond more noticeably to the palatability and digestibility of the roughage portion of a ration; therefore, the researchers concluded that johnsongrass cut early for hay should give even more favorable results when fed to the milking herd.

The same researchers compared the value of johnsongrass, soybean, alfalfa and oat hays as roughage for lactating dairy cows. They concluded that alfalfa cut for hay in the 1/10 to 1/4 bloom stage was most desirable for milk production. However, johnsongrass cut in the boot stage, soybeans cut in the late bloom and oats cut in the milk stage made satisfactory hay for milk production.

Browning, Lusk and Miles (4) reported that alfalfa had proven to be the best hay tested for milk production but was not widely grown by Mississippi milk producers. Therefore, they compared the composition and digestibility of hay from johnsongrass and Coastal bermudagrass grown without fertilizer and with applications of 200-100-200 (N-P_2O_5-K_2O) to the johnsongrass and 250 or 300-150-300 (N-P_2O_5-K_2O) to Coastal.

Crude protein content and digestibility of all components were higher for hay from fertilized grass. The greatest differences were in the percentage and apparent digestibility of the crude protein fractions, both of which were about 38% higher for hay produced from fertilized grass. Voluntary consumption of hay from the fertilized Coastal was significantly greater than for hay from the less-heavily fertilized johnsongrass. The more-heavily fertilized Coastal also was higher in crude protein and protein digestibility.

Coats (5) studied the performance of beef steers on johnsongrass fertilized with different rates of N over a three-year period. Returns were lower for johnsongrass fertilized at 240 lbs N/acre than at 60 or 120 lbs because growth at the higher rate was much more rapid and could not be controlled or used as readily.

Hay was harvested from one half of each pasture in 1967 in an effort to maintain quality forage over a longer period. Mowing and recovering clippings after johnsongrass reached the boot stage was not satisfactory because it forced the cattle to eat more of the remaining grass, which was of poor quality. He concluded that mowing to maintain quality requires mowing several times each season to maintain the grass at a height of 8-12 inches.

Results of research with johnsongrass for forage in dairy and beef production systems suggest conclusions as follow:

1. Management of johnsongrass for grazing will be more difficult and animal performance likely will be lower than for other perennial grasses.
2. Production for hay should be the major use of johnsongrass.
3. Fertilizing johnsongrass grown for hay increases yields and improves forage quality, animal performance and stand maintenance.

Botanical Characteristics

Johnsongrass is a warm-season perennial, sod-forming species that spreads by both seed and scaly, creeping rhizomes (Figure 2). The inflorescence is an open panicle that produces abundant seed. A single seed (Figure 3) may produce a plant with from one to two or more than 170 stems, depending upon fertility, moisture, space and inherent differences (2). An average plant will initiate rhizome production at three weeks of age and will produce 20 ft of rhizomes and 4 lbs of seed in a season. Mature plants continue to produce rhizomes that grow until frost, overwinter and sprout new plants the next spring.

McWhorter (9,10,12,14) reported that 80% of the johnsongrass rhizomes produced in sandy loams and clays occurred in the top six inches of the soil. He also stated that johnsongrass in a normal growing season has three sets of rhizomes---primary, secondary

and tertiary. Growth arises in spring from primary rhizomes that decay two or three weeks after growth starts. Young plants initiate growth of secondary rhizomes as the primary rhizomes decay, and growth continues until late summer. Growth of tertiary rhizomes begins in late summer. The tertiary rhizomes generally are not as large or vigorous as secondary rhizomes and usually are more rounded. They grow until frost, remain dormant throughout the winter and become primary rhizomes the next spring.

Figure 2. Johnsongrass plant showing the rhizomes that store carbohydrates for initial growth in spring and regrowth after harvest.

Figure 3. Johnsongrass seed are distinguished from sudangrass seed by being larger and having a cup-shaped apex.

Production Guidelines[1]

Soil Selection---Johnsongrass grows well in many soils, but does best on fertile clay loams and clays with high water-holding capacity. It will produce satisfactorily on soil with pH of 5.8 to 7.5, but optimum growth occurs in the 6.0 to 7.0 pH range. Johnsongrass-legume combinations require soil with pH of 6.0 to 7.0.

Fertilization---Apply lime, phosphate (P) and potash (K) to soil test recommendations. In the absence of a soil test, apply 120 to 160 lbs each of P_2O_5 and K_2O per acre in a 1 to 1 ratio for establishment, and go to 80 lbs/acre in a 1 to 1 ratio thereafter. An additional 60 lbs of K_2O per acre are needed each year if the crop is produced for hay only.

High rates of nitrogen (N) are required for high yields. Best results are obtained when N is applied in split applications beginning April 20 to May 1. Johnsongrass can use 1.0 to 1.3 lbs of N per acre per day; therefore, apply the equivalent of 200 to 250 lbs of ammonium nitrate per acre each second month during the growing season or after each hay clipping. Our trials have demonstrated that dry matter production increases with each increase in N up to 480 lbs/A (Table 1).

Higher rates of N also increase the crude protein content of johnsongrass (Table 2). Values obtained range from 9.4 to 13.5% for 0 to 480 lbs of N/A, respectively. The crude protein level generally considered necessary to meet maintenance requirements of a beef cow is 12%, and johnsongrass fertilized with at least 240 lbs of N/A meets this requirement.

Table 1. Dry matter production of johnsongrass fertilized with different rates of nitrogen, by location, Mississippi, 1963-1968 averages.

Nitrogen Rate[1]	Location		
	Miss. State	Prairie	Brooksville
	----------Forage Lbs/A----------		
0	2354 f[2]	2669 f	3030
30	3992 e	4855 e	---
60	4765 d	5500 de	4397
90	5432 d	6300 d	---
120	6658 c	8600 c	6765
240	9578 b	11000 b	7011
480	13613 a	13922 a	8146

[1]P_2O_5 and K_2O applied to each treatment at 120 lbs/A.
[2]Means in a column followed by a different letter differ significantly at the 5% level of probability as determined by Duncan's Multiple Range Test.

Table 2. Average crude protein content of johnsongrass forage produced by johnsongrass fertilized with different rates of nitrogen, Mississippi State University. 1963-1968, averages.

Nitrogen Rate	Crude Protein	
Lbs.	%	Lbs/A
0	9.43 c[1]	221 e
30	10.75 b	429 d
60	11.25 bc	536 cd
90	11.30 b	613 cd
120	11.95 ab	795 c
240	12.90 a	1235 b
480	13.50 a	1837 a

[1]Means in a column followed by a different letter differ significantly at the 5% level of probability as determined by Duncan's Multiple Range Test.

Adequate levels of P and K also are important. Phosphorous is used primarily in root production, and potassium helps to reduce winter injury and incidence of foliar diseases. These elements also affect the production and carbohydrate content of rhizomes (Table 3), and density and quality of johnsongrass stands are related directly to rhizome production. We found that rhizome production

[1]*The guidelines presented in this bulletin are based on the latest MAFES research results available at the time of printing. Refer to the latest* **Crop and Fertilizer Guidelines for Mississippi** or consult your area or county Mississippi Cooperative Extension Service (MCES) personnel to determine whether guidelines have been changed.

increased with increases in nitrogen application and was nearly doubled when adequate rates of P and K were supplied. Differences were not significant, but there was a trend toward higher carbohydrate levels of rhizomes where P and K were supplied.

Results of several years of research show that good production of pure johnsongrass or johnsongrass-legume combinations can be maintained if soil test levels of P and K are kept medium to high. A rule of thumb for N-P_2O_5-K_2O fertilization is to apply these nutrients each year in a 4-1-2 ratio for grazing and a 4-1-3 ratio for hay production.

Seedbed Preparation--- Johnsongrass germinates and grows best when seeded on soil that has been leveled and firmed after tilling 4 to 6 inches deep. Some success has been obtained with seeding of johnsongrass into thin sods of other species.

Varieties and Seed Production---There are no designated varieties of johnsongrass. Texas is the major source of commercial seed, but seed can be harvested from johnsongrass grown in Mississippi.

Most seed sold in the state are obtained by machine harvest. Seed shatter readily when ripe and reported yields range from 175 to 500 lbs/A.

Johnsongrass seed are relatively dormant when first harvested, and several months may be required for after-ripening. Even then, germination is not complete except when temperature varies in a warm range (15).

Planting---Plant live seed (20-25 lbs/A) 1/2 to 3/4 inch deep between April 1 and July 1. Increase the seeding rate if the seed tag indicates low germination.

Alfalfa, red clover, wild winter peas or vetch may be seeded into johnsongrass between September 1 and October 31[2]. Grazing of interseeded areas should be deferred until spring, and the first application of N may be eliminated. Shading by the legumes will reduce early growth of the johnsongrass, and the first hay harvest may be reduced. Major considerations for adding legumes to johnsongrass sod are to provide limited forage when johnsongrass is dormant and to supply N to the johnsongrass.

Table 3. Production and carbohydrate content of rhizomes produced by johnsongrass fertilized with different rates of nitrogen, Mississippi State University, 1963-1968 averages.

Nitrogen	Rhizome Production		Rhizome Carbohydrates	
Rate	with P&K[1]	No P&K	with P&K[1]	No P&K
Lbs./A.	Lbs./A.		%	
0	257 d[2]	247 b	21.9	18.9
60	367 c	261 ab	23.8	22.9
120	447 bc	333 a	29.1	23.6
240	526 ab	314 a	28.2	20.5
480	607 a	269 a	26.1	20.0

[1]P_2O_5 and K_2O applied at 180 lbs/A of each.
[2]Means in a column followed by a different letter differ significantly at the 5% level of probability.

Table 4. Average forage production of johnsongrass and johnsongrass-legume mixtures at the MAFES Black Belt Branch, 1965-1967 averages.

Treatment	Forage Production
	LBS. DM/A
Johnsongrass Plus	
120 Nitrogen[1]	11321 c[2]
240 Nitrogen	14721 ab
Alfalfa	9208 d
Alfalfa + 120 N	13179 b
Red Clover	13305 b
Red Clover + 120 N	14867 ab
Wild Winter Peas	13815 b
Wild Winter Peas + 120 N	16057 a

[1]Nitrogen was applied at 120 and 240 pounds per acre in split applications to johnsongrass and at 120 pounds per acre to the johnsongrass plus legume plus nitrogen treatments.
[2]Means followed by a different letter differ significantly at the 5% level of probability as determined by Duncan's Multiple Range Test.

Benefits of adding alfalfa, wild winter peas or red clover to johnsongrass were evaluated over a three-year period at the MAFES Black Belt Branch, and seeding red clover or wild winter peas into johnsongrass sod increased forage production significantly over that of johnsongrass grown alone and fertilized with 120 lbs of N/A (Table 4). Also, no yield advantage

[2]*See footnote 1.*

resulted from applying N to the grass-legume mixtures. The poorer performance of the johnsongrass-alfalfa combination was attributed to poor stands.

Weed Control---Weeds are the major pests of johnsongrass, but grass weeds usually are not a problem because they are shaded out by the johnsongrass. Also, quality of forage is not reduced significantly when grass weeds are harvested with the johnsongrass. Acceptable control of broadleaf weeds can be obtained by spraying with 2,4-D or dicamba, or both.[3]

Management Guidelines

Yield, Quality and Stand Maintenance---Realizing the forage potential of johnsongrass requires management to produce acceptable yields of quality forage for several years without stand reestablishment (Figure 4). Production and longevity of johnsongrass stands is dependent on the number of rhizomes present per plant and the carbohydrate levels in the rhizomes. Carbohydrate levels generally increase as the time interval between grazing or harvesting is increased; therefore, johnsongrass responds best to rotational grazing and to proper spacing of hay cuttings.

We found significant differences in five harvest management systems in each year of a three year study at Mississippi State University. Highest yields were obtained and productive stands were maintained longer when johnsongrass was allowed to bloom at least once in each growing season (Table 5). Stands harvested continuously when 15 inches tall were almost destroyed after three years, and dry matter yields were significantly lower than for other harvest combinations. Carbohydrates in the rhizomes are responsible for initial growth and the regrowth of johnsongrass, and the justification for allowing it to bloom once each season is to provide opportunity for replenishing carbohydrates in the rhizomes.

Table 5. Forage production of johnsongrass as affected by frequency of harvest and stage of maturity at harvest, Mississippi State University, 1964-1966.

Frequency of Cutting and State of Maturity	Forage Production 1964	1965	1966
	Lbs. D.M./Acre[1]		
2 X (full bloom)	8000 b[2]	9800 b	11643 a
3 X (boot-boot-bloom)	13900 a	13500 a	12950 a
4 X (boot stage)	14000 a	13960 a	9399 b
5 X (15 inches)	13000 a	11890 ab	3902 c
5 X (15 inches except one cutting at full bloom)	12920 a	13160 a	8975 b

[1]All plots were fertilized with annual applications of 240-120-120 (N-P_2O_5-K_2O) pounds per acre.

[2]Means within a column followed by a different letter differ significantly at the .05 level of probability as determined by Duncan's Multiple Range Test.

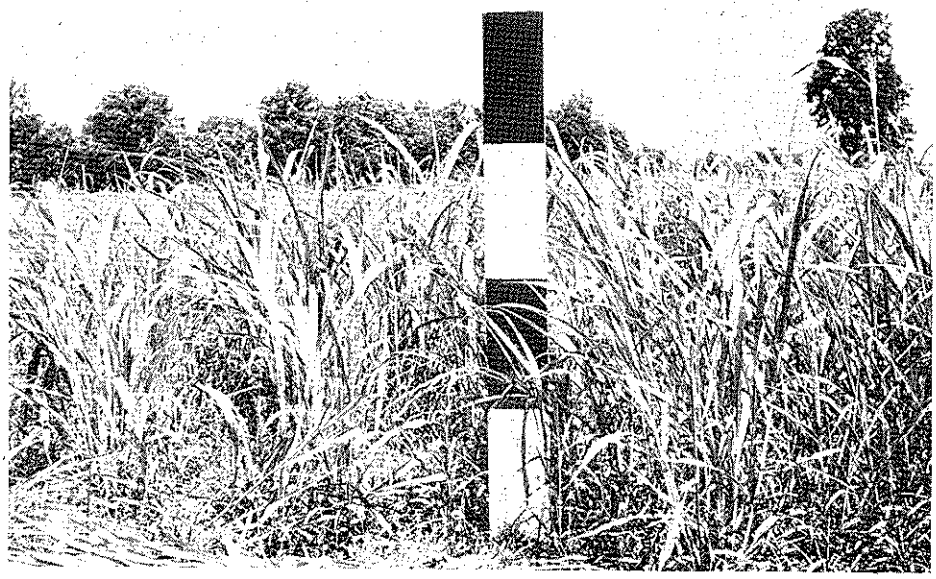

Figure 4. Thin stands (left) of johnsongrass result from low fertility and continuous clipping, and productive stands (right) result from proper fertilization and management. Photo Courtesy J. W. Lusk.

[3]*Consult MAFES Bulletin 872,* **Pasture Weed Control in Mississippi,** *the latest* **Weed Control Guidelines for Mississippi,** *or your area or county Mississippi Cooperative Extension Service (MCES) personnel for recommendations on a specific weed or chemical.*

Diseases and Insects

Johnsongrass diseases are not considered serious in the Southeast (1). However, anthracnose [*Colletotrichum graminicola* (Ces.) G. W. Wils.], zonate leaf spot (*Gloecercospora sorghi* Bain & Edg.), leaf spot (*Cercospora sorghi* Ell. and Ev.), and loose smut (*Sphacelotheca holci*, Jacks) do appear in mature johnsongrass.

Insects generally present little problem where johnsongrass is used in grazing and/or hay systems. However, the sorghum midge (*Contarinia sorghicola* Coq.) and the sorghum webworm (*Celama sorghiella* Riley) interfere some with seed production.

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