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Texas Agricultural Extension Service

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Rice Diseases

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RICE DISEASES

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Rice diseases reduce yields in Texas by an average of 12 percent each year. The yield loss in certain fields with a history of disease may exceed 30 percent in some seasons. Disease development in individual fields depends upon the interaction of several factors including the genetic resistance of the variety planted, cropping practices, environmental conditions (such as temperature, dew periods and rainfall) and presence of inoculum (spores, sclerotia, etc.) of the disease-causing agent. Fungi are responsible for most of the yield-reducing diseases in the Texas Upper Gulf Coast. Producers can reduce losses to many rice diseases through the integrated use of cultural practices, resistant varieties and chemical controls.

The most important cultural factor contributing to disease development in Texas rice fields is the length of time between rice crops. Historically, Texas producers fallowed fields to native pasture for 2 to 4 years between rice crops. In recent years, however, rotation cropping with soybeans, grain sorghum and to some extent wheat has become an economic alternative to cattle for many rice producers. With the shift in rotation crops has come a shortening of rotation length from the traditional planting of rice one in 3 to 5 years to the current row-crop rotations where rice is planted 1 year in two or three. The shorter rotation time greatly enhances the survival potential of many fungi that attack rice.

Most fungi that cause disease have developed methods of surviving between crops by producing weather-resistant structures (sclerotia, spores, etc.). The average survival time of these structures varies for different disease-causing organisms. Sclerotia of *Rhizoctonia solani* (the fungus that causes sheath blight) survive an average of 12 to 18 months in the soil. Kernel smut fungus spores *(Neovossia horrida)* can remain alive more than 10 years. As a result, rotation can have a great effect on sheath blight but much less so on kernel smut.

Another cultural practice that has contributed to the enhanced activity of several soilborne diseases has been the virtual elimination of moldboard plowing. Economic constraints (particularly fuel prices) have all but eliminated this practice that served to reduce initial inoculum of many rice diseases by deep burial of sclerotia and infected crop residue.

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The following information is provided to assist producers in developing disease control programs that improve profit and reduce disease loss. Reference to commercial products or trade names is made with the understanding that no discrimination is intended and no endorsement by the Cooperative Extension Service is implied. Descriptions of major rice diseases are arranged basically in the order in which they would develop during the course of a growing season.

SEEDLING DISEASES (fungi - *Rhizoctonia solani, Pythium spp., Achlya spp.)*

Seed decay is caused by soil-inhabiting fungi that attack seed before emergence. Infections are initiated as germination begins, usually in response to nutrients produced by the developing seedling. Brownish-black lesions are frequently visible on infected roots at or near the soil line on young seedlings. Soil conditions unfavorable for rapid germination and seedling growth often promote seed decay. Poor quality seed lack the vigor necessary to germinate and establish a healthy seedling, particularly when planted early in cool, wet soils. Soil crusting and salinity problems can also reduce seedling vigor and result in reduced stands.

Seedling vigor in rice is optimized when high quality seed are subjected to ideal temperature, moisture and planting depth. Seedling disease is most severe on early seeded (late February and March) and deep drilled rice. Control of seedling disease becomes increasingly important at lower seeding rates. Varieties that are naturally slower to emerge may suffer reductions in stand and potential yield not encountered with varieties that emerge rapidly. Chemical seed treatment is a very cost effective way of minimizing potential damage from seedling disease. See the seed treatment chart (table 1) for specific recommendations.

SOUTHERN BLIGHT (fungus - *Sclerotium rolfsii)*

Southern blight can attack rice in the one- to three-leaf stage and may kill large numbers of plants when weather is warm and moist. A white cottony mold develops on lower parts of affected plants. *Sclerotium*

Table 1. Registered rice seed treatment fungicides.

Material	Rate/100 lb
captan	
- Gustafson Captan 400D	3.0 fl oz
- Gustafson Captan 30-DD	2.7 fl oz
- Orthocide 75 WP	2.25 oz
captafol	
- Difolatan 4-Flowable	4-6 fl oz
carboxin + thiram	
- Vitavax 200	3-4 fl oz
maneb	
- Dithane FZ	4-6 fl oz
- Dithane M-45	2-4 oz
- Manzate 200 F	3.4-6.7 fl oz
TCMTB	
- Nusan 30	1.66 fl oz
thiram	
- Gustafson 42S	3.3 fl oz
PCNB + terrazole	
- Terra-coat L-205 N	4.4-8.8 oz
metalaxyl	
- Apron F1	0.75-1.5 fl oz -water seeded rice only -use in combination with another material to broaden control spectrum

rolfsii attacks a wide range of plants including soybean and sorghum. The fungus initiates infections from soilborne sclerotia that also serve as overwintering structures. Frequent flushing during warm springs can promote southern blight by optimizing conditions for the sclerotia to germinate. To stop the disease, flood fields where significant damage is observed. The fungus will not grow and develop under flooded conditions. Consequently, southern blight is not a problem after permanent flood. Seed treatment is of little or no value for controlling this disease.

SHEATH AND STEM DISEASES

SHEATH BLIGHT (fungus - *Rhizoctonia solani*)

Sheath blight is frequently the most yield-limiting rice disease in Texas and other southern long-grain producing areas. The disease first appears as gray, water-soaked lesions on the outermost sheath 5 to 10 days after permanent flood is established. The disease is initiated from soilborne sclerotia that float with the flood water until they come into contact with a young rice tiller or stem of susceptible weed hosts. These fungal structures then germinate and infect the plant. Lesions remain relatively small during the next week or two. The fungus requires warm temperatures (85° to 95°) and high relative humidity for optimum growth.

When tillering is complete and the final nitrogen application has been made, growth of individual plants is rapid. The crop canopy fills in and finally closes. At this time, humidity near the waterline exceeds 90 percent on most days, and summer temperatures provide near optimum conditions for disease development. The fungus progresses rapidly up the plant moving first onto lower leaves and eventually attacking the flag leaf where grain-fill can be affected. Sheath blight can spread to adjacent plants when healthy leaves come into contact with infected ones. In thick stands where moisture is retained for a large part of the day, the disease can progress very rapidly, resulting in large (2 to 4 feet), circular, diseased areas within a field. Fungicides applied at the panicle differentiation (PD) growth stage and again at heading have been effective in suppressing the fungus development up onto leaves. Subsequent disease spread to adjacent healthy plants can be reduced. However, more than 5 percent of a randomly collected sample of tillers taken at the PD stage should be infected with the fungus to anticipate an economic return from a foliar fungicide program. Consider fields

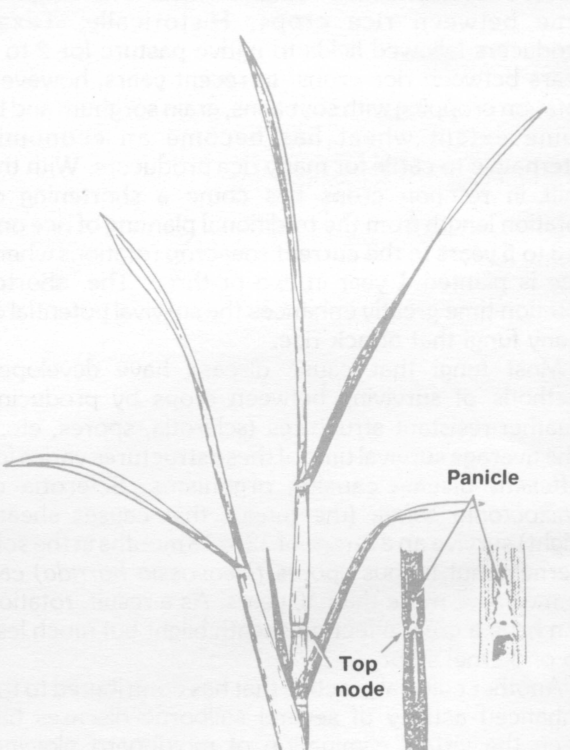

Figure 1. Panicle differentiation growth stage signifies earliest timing of foliar fungicide application for controlling rice sheath blight.

to be in the PD growth stage when three central culms out of a randomly collected sample of ten central culms exhibit a 1/16 inch panicle (figure 1). The distance between the uppermost node and the next lowest node should be more than 1 inch. PD usually occurs 55 to 70 days after emergence.

Cultural practices that minimize the hazard of developing sheath blight include rotation, moldboard plowing and modifications in seeding rate and fertility programs. Rotate fields that have become heavily contaminated with sclerotia of the sheath blight fungus out of rice production for a minimum of two full cropping seasons. Historically, soybeans (east of Houston) and grain sorghum (west of Houston) have been used as rotation crops with rice; however, soybeans are susceptible to *Rhizoctonia solani*. When this fungus attacks soybeans it causes the disease aerial blight. Sclerotia are also produced on diseased soybeans and many of them survive the winter to attack rice planted the following year. Weather conditions that favor aerial blight development include frequent summer rains during the R3 to R8 growth stage. High winds that bring the soybean canopy in contact with the ground also enhance disease development. Drill-planted soybeans are more conducive to disease development than fields planted on raised beds with wider spacings.

STEM ROT (fungus - *Sclerotium oryzae*)

Stem rot is an important disease in all southern rice-producing states and California. Stem rot is caused by a soilborne fungus that survives the winter as sclerotia. The first symptom is the appearance of small, rectangular lesions on the outermost sheath near the waterline. These areas gradually turn black and enlarge with age. As the disease progresses within infected plants, the fungus penetrates the inner sheaths and finally enters the culm, greatly reducing the stalk strength. Stem rot lesions generally develop inward, and the fungus does not develop on the leaves as is the case with sheath blight. Late in the season, as the crop approaches maturity and the flood is pulled, small pepper-grain sized sclerotia are visible inside infected stems. Lodging is frequently seen in areas where stem rot has developed, particularly in fields where heavy nitrogen fertility programs are practiced. But many other factors cause lodging in rice so check suspect areas for the presence of sclerotia of the fungus as soon as the plants go down.

Commercial, long-grain rice varieties lack high levels of resistance to stem rot (table 2), and sclerotia can remain alive in the soil for up to 6 years. Historically, stem rot was controlled in Texas rice with foliar fungicides. However, the currently registered materials, including Benlate®, are not effective in controlling this disease.

Planting early maturing varieties on fields with a history of stem rot may allow producers to escape serious damage if varieties are sown early. Using the lower range of recommended nitrogen fertilizer rates reduces disease severity in fields with a history of stem rot. Although sclerotia survive in soil for several years, crop rotations minimize damage. Moldboard plowing also reduces the number of sclerotia that are available to attack the crop.

FOLIAR DISEASES

BROWN LEAF SPOT (fungus - *Bipolaris oryzae*)

This disease causes a seedling blight and brown spots on foliage and panicles of rice, particularly when the crop is produced in nutritionally deficient or otherwise unfavorable soil conditions. The brown spot fungus also has been implicated in kernel discoloration. Brown leaf spot is a seedborne disease. Leaf

Table 2. Disease reaction of currently grown long-grain rice varieties as assessed in commercial fields in the Texas rice belt.

Variety	Sheath Blight	Stem Rot	Brown Leaf Spot	Narrow Brown Leaf Spot	Rice Blast	Kernel Smut	Straight-head
Gulfmont	VS	S	R	S	R	MR	MR
Labelle	S	S	MS	MS	R	S	R
Lebonnet	VS	VS	MR	S	R	MS	MR
Lemont	VS	S	MS	MS	R	MR	MR
Newbonnet	MS	S	MS	MS	S	S	MR
Rexmont	VS	S	R	MR	MS	MR	MR
Skybonnet	S	S	S	MS	R	S	MS
Starbonnet	MS	S	S	S	MS	S	MR
Tebonnet	MS	S	MR	MS	MR	—	S

R = resistant, MR = moderately resistant, MS = moderately susceptible, S = susceptible, VS = very susceptible. Varieties rated S or VS for a given disease or disorder may allow extensive disease development under favorable environmental conditions. Varieties rated R or MR show less or no damage under similar conditions.

spotting may be evident shortly after emergence and continue until maturity. Typical leaf spots are circular to slightly oval with dark brown to purplish-brown margins. Varieties differ in their susceptibility to brown leaf spot (table 2). Crop rotation, use of high quality planting seed and balanced fertilization are the recommended control practices. Foliar fungicides are not economical for controlling brown leaf spot on varieties that are resistant or moderately resistant.

NARROW BROWN LEAF SPOT (fungus - *Cercospora oryzae)*

Narrow brown leaf spot, sometimes referred to as Cercospora leaf spot, is one of the most common rice diseases in the Upper Gulf Coast particularly in the eastern portion of the rice belt. This disease varies in severity from year to year. It generally becomes more common as the rice plant approaches maturity. The leaf spots are ¼ to ½ inch long and are very narrow with light brown to brown margins and reddish-brown centers. The fungus can also attack the uppermost internode of the rice plant causing the brown blotch phase of the disease. This generally occurs late in the growing season. Diseased areas are reddish-brown, usually 2 or 3 inches long and generally encircle the uppermost internode an inch or so below the base of the panicle.

Varieties differ in susceptibility to the narrow brown leaf spot fungus. Currently grown, long-grain varieties are only moderately damaged by this disease (table 2). Historically, the fungicide Benlate® was used to control narrow brown leaf spot on susceptible varieties. However, recent research shows the fungus has developed resistance to the fungicide Benlate® in certain areas. The presence of resistant strains of *Cercospora oryzae* and the improved resistance levels in currently grown varieties severely limits the economic use of fungicides for controlling this disease in the absence of other yield-limiting rice diseases.

GRAIN AND PANICLE DISEASES

RICE BLAST (fungus - *Pyricularia oryzae)*

Rice blast is the most important disease of rice world-wide. However, in Texas and other southern long-grain producing states, the development and adoption of resistant varieties has greatly limited losses from blast. The blast fungus is one of the most genetically flexible fungi. Over the years, fungus populations have shown the ability to change as resistant varieties are planted across the rice belt.

Extensive yield loss can occur on susceptible varieties when environmental conditions are favorable for disease development. Producers should learn to recognize the elliptical leaf spots with brown margins and grayish centers characteristic of leaf blast. These lesions generally can be seen when plants are in the three- to five-leaf stage, just before permanent flood. Leaf blast is usually most severe on land that has been out of production for 5 or more years and is planted late to a susceptible variety. Under such conditions, excessive nitrogen fertilizer amplifies disease severity.

The blast fungus can also attack the uppermost node and internode of plants at heading causing the familiar rottenneck condition. If the panicle is attacked early, grain in the lower portion of the panicle will be blank or "blasted," giving kernels a silvery or white color. In recent years, U.S. race 16 (IC-17) has been the predominant race of the rice blast fungus found in the southern rice-producing states. This race generally affects only the panicle (rottenneck phase). Leaf lesions are extremely rare when this race attacks the currently grown varieties (table 3).

While most long-grain rice varieties currently used in Texas are susceptible to U.S. race 16 of the blast fungus, they exhibit varying degrees of damage when evaluated in commercial plantings (table 2). Certain varieties, such as Labelle, Lemont and Skybonnet, are

Table 3. Reaction of long-grain rice varieties to current races of the rice blast fungus *(Pyricularia oryzae).*

Variety	US-1	US-2	US-3	US-13	US-16	US-35	US-36
Bellemont	MS	R	MS	MS	MS	MS	MS
Gulfmont	R	R	R	R	MR	MR	R
Labelle	R	R	R	R	MR	MR	R
Lebonnet	R	R	R	R	MR	MR	R
Skybonnet	R	R	R	R	MR	MR	R
Lemont	R	R	R	R	MR	MS	R
Rexmont	MS	R	MS	MS	MS	MS	MS
Newbonnet	R	R	R	S	VS	VS	R
Tebonnet	R	R	MS	S	MS	S	MS

R = resistant, MR = moderately resistant, MS = moderately susceptible, S = susceptible, VS = very susceptible. Reactions based on blast nursery screening trials where varieties are inoculated with isolates of individual races. Currently, races US-16 and US-35 are the most frequently recovered in south central U.S.

seldom affected severely by the disease in commercial plantings. Other varieties, such as Newbonnet and to a lesser extent Tebonnet, have suffered extensive damage in commercial plantings in Arkansas and Louisiana. Fields of Lemont were also damaged in neighboring states although to a lesser degree than Newbonnet.

Blast generally occurs in a scattered rather than a localized pattern in the field. Control measures include early planting and reductions in nitrogen fertilizer applications to fields planted to susceptible varieties. Foliar fungicides are registered and effective for reducing losses caused by blast; however, preventative programs are expensive and are usually cost effective only in fields where the disease occurs annually and susceptible varieties are planted.

KERNEL SMUT (fungus - *Neovossia horrida*)

Kernel smut is a major rice disease that causes losses in both yield and quality. The fungus survives the winter as spores in the soil. During permanent flood, these spores float to the water surface and germinate to produce small bud-spores that become airborne and infect individual flowers of the rice panicle. The endosperm of the developing kernel is attacked by the fungus, causing all or part of the starchy material to be replaced by a black mass of smut spores. The fungus does not kill the embryo of infected seed and consequently diseased seed can germinate.

Kernel smut is easily detected by examining mature panicles after a rain or in the morning following a heavy dew. Moisture causes the dark spore masses to swell and break out of the hull. Although only a small percentage of kernels are infected, monetary losses can be high from grade penalties levied on the load at the buying point. At the mill, spores can affect the color and salability of an entire lot. Lots containing smut are usually assessed a dock of 5 cents per hundredweight for each percent of smut up to 3 percent. Lots exceeding 3 percent smut are not eligible for government loan.

Kernel smut is a difficult disease to control. While varieties differ in their susceptibility to the kernel smut fungus, most commercially produced, long-grain varieties are susceptible (table 2). Heavy nitrogen fertilizer applications and excessive flood depths during flowering increase disease incidence in fields with a history of the problem. Three-year rotation and moldboard plowing may reduce disease severity. The incidence of kernel smut on newer semidwarf varieties is much lower than on standard height varieties. The dense canopy associated with semidwarf production may protect the flowers from spores released at the water surface.

HULL SPOTS/KERNEL SPOTS/PECKY RICE

Rice grains may be attacked by several fungi that result in spotted, stained or otherwise imperfect kernels. Many of these fungi cause spots on the hull that never penetrate into nor damage the grain. During damp weather these fungi become active particularly on the second crop or rice that matures late in the season. Punctures of the developing kernel by the rice stink bug allow these fungi to grow into and further damage individual grains and result in pecky rice. The brown leaf spot fungus *(Bipolaris oryzae)* penetrates and discolors grains both with and without the presence of stink bug injury. Pecky rice is often more severe when rice is planted adjacent to grain sorghum as stink bugs move out of the harvested sorghum and into neighboring rice fields at a time when the rice crop is very sensitive to damage.

The presence of spotted or stained kernels reduces the grade of rice. Kernels that are severely spotted are chalky and break easily in the milling process. As a result, the yield of head rice can be reduced. No control measures other than insect control are recommended.

MINOR RICE DISEASES

The rice plant is attacked by many fungi that cause diseases of minor importance. A disease may be considered minor if it rarely occurs or if it causes little or no loss in net producer profit even when it is commonly observed in the field. Several rice diseases develop late in the growing season on older leaves that are beginning to senesce and are no longer contributing nutrients to the panicle. Starch accumulation in filling grains generally stops between the milk stage and the soft dough stage of development. Several factors affect total nutrients available for grain filling, including available sunlight, total leaf area to receive incoming sunlight and the plant's ability to convert this light energy into organic compounds. Under most conditions, the photosynthetic activity of the top three leaves is most important. The green surface area of the panicle and uppermost internode also contributes. Lower leaves usually are blocked from sunlight during grain fill and contribute minimally to yield.

SHEATH SPOT (fungus - *Rhizoctonia oryzae*)

This disease is similar to the early stages of sheath blight and is caused by a related fungus. Pink-to-salmon-colored sclerotia initiate the disease on the outermost leaf sheath. A reddish-brown lesion develops on the plant near the waterline. During internode elongation, the sheath spot is pushed up above the waterline because of this new growth. With age, the lesion enlarges slightly to assume an elliptical to irregular shape (½ to 1 inch long) with a distinct dark border and a tan-to-straw-colored center. The sheath spot fungus does not develop on the leaves as is the case with sheath blight. Rather, it remains on the outer sheath. The fungus can penetrate inward and sometimes causes a yellowing of the leaf attached to the sheath it has infected. Some reduction in yield may occur in tillers that are infected; however, it is generally minor and too few tillers are affected to result in significant yield loss.

SHEATH ROT (fungus - *Sarocladium oryzae*)

Sheath rot occurs on the uppermost leaf sheath, generally the flag leaf sheath. A tannish lesion with a tan-to-brown margin forms at about the time the panicle is emerging from the boot. Depending on the rate of disease development, the panicle may fail to emerge or may only partially emerge from the flag leaf sheath. Kernels on trapped portions of the panicle may fail to fill. Insect injury is usually required before infection can occur. High populations of stem borers, which cause sheath wounding, facilitate the development and spread of the disease.

BLACK SHEATH ROT (fungus - *Gaeumannomyces graminis* var. *graminis*)

Black sheath rot is usually observed late in the growing season after the field has been drained. Tissues of the sheath may be blackened from the crown of the plant all the way up to and sometimes above the old waterline. Affected sheaths may result in a yellowing of the attached leaf blade and stems may be weakened break at one of the lower nodes resulting in lodged plants. The fungus overwinters on rice stubble.

LEAF SMUT (fungus - *Entyloma oryzae*)

Leaf smut generally occurs late in the growing season and causes little or no economic loss. The fungus causes small, black, slightly raised lesions on both sides of leaves. The spots are generally rectangular shaped. Leaf smut generally appears after grain filling is completed and no control measures are recommended.

STRAIGHTHEAD (physiological disorder)

Straighthead is a physiological disorder that causes the entire head to be blank and remain upright at maturity. Straighthead generally occurs in spots scattered throughout a field and is most easily recognized near harvest when normal plants have downturned heads from the weight of the grain in the panicle. Hulls of affected grain are distorted into a crescent shape or "parrot beak." Affected plants are a darker green and often produce shoots from lower nodes on the plant. The disorder is more frequently found on sandy loam than clay soils and has been associated with arsenic residues remaining in fields that were at one time planted to cotton. Other, as yet unknown, soil factors are also involved in causing straighthead. Often it is found in fields where excessive non-decayed vegetation had been plowed under. Control of straighthead includes planting resistant varieties (table 2) or when planting a susceptible variety on fields with a history of the disorder, draining the field just before internode elongation.

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