Wheat Diseases And Their Control

Austin K. Hagen, Extension Plant Pathologist
Paul Mask, Extension Agronomist
Robert T. Gudauskas, Professor Of Plant Pathology
Daniel Collins, Extension Plant Pathologist

Wheat is subject to many damaging foliar and soil-borne diseases at nearly all stages of growth. Because diseases reduce yield and grain quality, they directly affect the profitability of grain cultivation.

Alabama’s climate, particularly the warm and humid springs, favors the development of many diseases, so farmers must be particularly alert to prevent serious crop losses. To effectively control wheat diseases, you should consider the following strategies: the selection of disease resistant varieties, the use of fungicide seed dressings, crop rotation, deep tillage, proper fertility, and the application of foliar fungicides.

Early identification of diseases is critical to selecting the correct disease management practices. This publication presents descriptions of the wheat diseases common in Alabama and the recommended measures to control them.

Septoria Diseases

Glume blotch and leaf blotch, caused by Septoria nodorum and Septoria tritici, respectively, are among the most common and destructive foliar diseases of wheat. Of the two, glume blotch has had the greater economic impact on Alabama’s wheat crop.

On susceptible varieties of grain, these diseases have caused yield reductions of 15 percent, and far higher losses have been recorded in other regions of the world. The heaviest losses in Alabama, particularly to glume blotch, are most likely to occur in the southernmost counties, although serious damage has been reported in other areas of the state. Glume blotch occurs statewide, while leaf blotch is found primarily in the Tennessee River Valley.

SYMPTOMS

The earliest symptoms of both Septoria diseases are small brown flecks on the oldest leaves. These flecks expand into brown, elongated (leaf blotch) to lens-shaped (glume blotch) spots, often with dark-brown borders (Figure 1). Irregular gray-brown areas of dead tissue appear as the spots continue to enlarge. Heavily spotted leaves often wither and die. Spots produced by the leaf blotch fungus are usually limited to leaves, while those associated with glume blotch also occur on leaf sheaths and nodes.

Both diseases develop initially on the oldest leaves and, depending on weather conditions, progress to the flag leaf. Bending of the stems or lodging may occur when nodes are damaged. On the seed head, glume blotch appears as a gray to brown discoloration of the outer covering of the seed or glumes [Figure 2]. Discoloration usually begins at glume tips and progresses toward the base. Leaf blotch does not directly affect the seedhead.

Brown fruiting bodies (pycnidia) of the glume blotch fungus are usually abundant on seedheads and, to a lesser extent, in the center of spots on other diseased plant tissues. The numerous black pycnidia of the leaf blotch fungus give the leaf spots a speckled appearance.

Figure 1. Lens-shaped spots on leaves are usually associated with glume blotch.

Figure 2. Septoria glume blotch on seedhead. Note the characteristic browning of the glumes.
DISEASE CYCLE

Between wheat crops, these fungi survive mainly on seed and wheat stubble. Infested seed is the primary means of spread of these diseases, particularly onto fresh land. Monocropping wheat or rotating wheat with other small grains increases fungus survival and the possibility of a Septoria disease epidemic.

Tillage practices that leave the stubble or straw of infected wheat and other small grains on the soil surface may also increase the spread of the disease. Spores of the fungi are spread to healthy leaves by wind currents and splashing water.

Infection occurs only if free water is present on plant surfaces for a minimum of 6 to 12 hours. Dry conditions stop plant infection and slow down the enlargement of the spots as well as the formation of pycnidia. Septoria disease outbreaks are associated with frequent rains and mild temperatures in the spring; however, favorable weather conditions may also occur in the fall or winter months.

CONTROL

Production practices that reduce pathogen survival are effective controls for Septoria diseases on wheat. Wheat should not be monocropped or grown behind triticale, rye, or barley. Rotating to oats, annual pasture grasses, winter legumes, or a clean winter fallow for 1 to 2 years between wheat crops may be necessary in fields where serious losses to Septoria diseases have occurred. Reduced-till production systems may increase disease if wheat is sown in the previous year's wheat stubble. Turn under the stubble before planting the next wheat crop.

Most of the adapted wheat varieties widely grown in Alabama are semi-dwarf types that generally do not have good resistance to Septoria diseases. However, early-maturing varieties such as Florida 301 usually suffer heavier damage than mid- or late-maturing varieties.

To control seed-borne fungi, treat seed with a broad-spectrum fungicide just before storing (machine-applied treatment) or planting (hopper-box treatment). Recommended fungicide seed dressings are listed in Extension Circular ANR-458, "Small Grain Pest Management," and ANR-500, "Alabama Pesticide Handbook."

Foliar fungicides will provide some protection from both Septoria diseases. The best yield response following fungicide applications to control glume blotch has been seen on susceptible, early-season varieties in extreme southern Alabama. Foliar fungicides are rarely needed to control glume and leaf blotch in other areas of the state. Fungicides are recommended only when losses are likely on seed production fields. Guidelines for selecting and using foliar fungicides on wheat are also discussed in ANR-458, "Small Grain Pest Management," and ANR-500, "Alabama Pesticide Handbook."

Rust Diseases

Leaf rust, caused by Puccinia recondita tritici, and stem rust, caused by Puccinia graminis tritici, frequently occur on wheat in Alabama. Leaf rust is more common and destructive.

Leaf rust may cause a yield loss of more than 50 percent on a susceptible variety of wheat, but damage is usually lower. Damage is often heaviest when the disease becomes well established on the crop in late winter, and when weather conditions remain favorable through grain-fill for the disease to spread.

Although outbreaks of leaf rust are usually confined to the extreme southern parts of the state, statewide epidemics do occur. Stem rust has the potential to severely reduce wheat yields, but outbreaks of the disease have been scattered and light in recent years.

SYMPTOMS

Leaf rust appears on the upper leaf surfaces and leaf sheaths. It causes small, circular pustules containing a powdery mass of orange to red-orange spores (Figure 3). Scattered pustules on plants in the tillering or jointing stages of growth are usually the first signs of rust, although severe winter infections are sometimes seen.

Figure 3. Leaf rust on wheat. Note the individual orange pustules on the leaves.

Under favorable weather conditions, pustules may increase until the entire leaf surface is covered by the red-orange masses. Badly rusted fields will often have an orange-yellow cast due to the numerous pustules and the discoloration of the foliage.

Black pustules form as the plant approaches maturity. Heavily diseased leaves quickly turn yellow, shrivel, and die. Leaf rust usually develops on the lower leaves and spreads to the flag leaf. Leaf rust causes reductions in tillering, numbers of kernels, and grain test weight.

Stem rust is similar to leaf rust in appearance. Dark reddish brown pustules develop primarily on both leaf surfaces, leaf sheaths, and stems. Unlike
those of leaf rust, stem rust pustules are larger in size, more elongated to spindle-shaped, and their edges appear ragged and torn (Figure 4).

As the plants mature, numerous dark brown spores form, causing the pustules to appear black. Severe infections weaken the stems, resulting in lodging. Yield losses to stem rust are mainly due to reductions in kernels and grain test weights.

**DISEASE CYCLE**

Leaf and stem rust both have complex life cycles with multiple spore stages that may involve host plants other than wheat. Usually, however, only the spore stage that is capable of reinfecting wheat is important. These fungi often survive on certain grasses or on volunteer wheat.

Spores of both fungi are spread across Alabama from sub-tropical areas by wind currents. Wet periods of 6 to 8 hours are sufficient for infection to occur. Depending on weather conditions, pustules containing numerous spores will appear in 7 to 14 days.

The spread of rust occurs primarily in the late winter or early spring. Fall infections serve as important pathogen sources for a field planted to susceptible varieties as well as for surrounding fields. Frequent heavy dews or showers and warm temperatures provide ideal conditions for the development of rust diseases.

**CONTROL**

The use of adapted rust-resistant varieties is the best control measure for both leaf and stem rust. Wheat varieties that are resistant to one rust are often, but not necessarily, resistant to another. Since many types of both fungi exist, disease resistance is not always stable or predictable.

Generally, a wheat variety will be resistant for 4 to 5 years following its release, until new races of rust fungi predominate. Information on the reaction of adapted wheat varieties to rust is contained in the "Small Grain Variety Report," published annually by the Alabama Agricultural Experiment Station (AAES), and in Extension Circular ANR-458, "Small Grain Pest Management."

Planting on recommended dates for grain production reduces fall infections. Maintaining major-element fertility levels according to soil test recommendations helps to minimize the impact of the disease on yields.

Foliar fungicides can provide good rust control. To prevent significant yield losses, make applications before the disease has advanced into the upper canopy. The selection and use of fungicides of wheat for the control of rust diseases is discussed in ANR-458, "Small Grain Pest Management," and ANR-500, "Alabama Pesticide Handbook."

**Powdery Mildew**

Powdery mildew, caused by the fungus *Erysiphe graminis tritici*, is a common disease on wheat throughout Alabama. The heaviest losses to this disease are usually caused by severe outbreaks shortly before or during flowering, but early winter infections may also reduce yields. High seeding rates and excessive rates of nitrogen will increase the incidence of powdery mildew.

**SYMPTOMS**

Powdery mildew occurs on all aerial parts of the wheat plant, but it is most conspicuous on the upper leaf surfaces and leaf sheaths just above the soil line. Symptoms may develop anytime after seedling emergence. The disease is most commonly seen in late winter to early spring.

The fungus appears as discrete, cottony white patches which turn tan to gray as they age (Figure 5). On heavily diseased leaves, individual patches often merge and cover large areas of the leaf surface. Yellow (chlorotic) spots often occur on the leaf surface opposite the fungal colonies. Severely infested fields often have a yellow cast. Numerous small, round, black fruiting bodies (cleistothecia) are usually produced by the fungus as the wheat matures.

**DISEASE CYCLE**

The causal fungus persists as mycelia on volunteer wheat or as fruiting bodies on wheat straw. Spores are spread to wheat anytime during the production season by wind.

Infection occurs over a very wide temperature range with 60° to 70°F (15° to 22° C.) being the optimum, especially when the relative humidity approaches 100 percent. When wheat is rapidly growing, dry, warm days with cool nights are ideal conditions for disease development.
**Control**

Using disease-resistant varieties is the primary method for controlling powdery mildew. Several adapted wheat varieties with good powdery mildew resistance are available, but resistance declines as changes in pathogen races occur. The reactions of adapted wheat varieties to powdery mildew are published annually in the "Small Grain Variety Report" and in ANR-458, "Small Grain Pest Management."

Maintain nitrogen fertility levels and seeding rates according to recommendations given in ANR-497, "Planting Small Grains." These practices will reduce the severity of powdery mildew outbreaks. Clean cultivation and crop rotation may also help prevent the disease.

Since powdery mildew usually disappears before flowering, fungicides are not often used for powdery mildew control. Where there is a risk of serious crop injury, such as possible damage to flag leaves and seedheads, wheat yields may be protected with timely fungicide applications.

Approximately 2 percent of yield will be lost for every 1 percent of flag-leaf area diseased above the 5-percent level. Research is underway to determine the effectiveness of fungicide applications for controlling winter powdery mildew outbreaks on seedling wheat.

**Scab**

Scab, or head blight, is caused by fungi in the genus *Fusarium*. On wheat, barley, and oats, this disease is characterized by the early death of some or all of the seedhead. These same fungi may also cause seedling blight and crown rot of many small grains as well as corn and grain sorghum.

Although scab is found statewide, it is seen most often in the more humid areas of Alabama near the Gulf Coast. Yield losses due to seedhead death are usually not serious, although sizable reductions in grain yield and quality do occur.

The scab fungi may produce substances (mycotoxins) that are highly toxic to livestock. Animals with simple stomachs are more sensitive to these toxins than ruminants.

**Symptoms**

The disease appears at or shortly after flowering as a bleaching of one or more of the spikelets on each seedhead (Figure 6). Healthy tissues below and above blighted spikelets remain green. Later, slimy masses of pink to orange fungal spores and mycelia develop on the margin of the glumes or at the base of the diseased spikelets. Small, round, black fruiting bodies of the *Fusarium* species may be clustered on mature damaged glumes. The discolored seeds in the diseased spikelets are shriveled and often non-viable. Seeds with lesser infections will germinate, but the seedlings are often killed by these fungi.

**Disease Cycle**

The causal fungi survive in the stubble of wheat, cereal crops such as corn and grain sorghum, and other small grains on the soil surface. Wheat seed may also be an important source of the fungus.

Numerous spores are produced during mild humid weather and are spread to the emerging seedheads by air currents. The fungus infects the seedheads at flowering with some secondary spread up through the milk stage of kernel development. Symptoms start to appear after several days when the weather is warm and humid.

**Control**

Do not sow wheat behind corn and grain sorghum, particularly where reduced tillage practices are used. Rotation sequences with a 1-year break between wheat and other grain crops are also suggested.

When scab is present, adjust the combine to blow the light scabby grain out with the chaff. Also, thoroughly clean the seed before applying a seed dressing. Fungicide seed dressings will reduce carryover of the causal fungus on seed. Recommended fungicide seed dressings are listed in ANR-458, "Small Grain Pest Management," and ANR-500, "Alabama Pesticide Handbook." In Auburn University trials, foliar-applied fungicides have provided little protection from scab, although some disease control has been produced with propiconazole and benomyl.

**Loose Smut**

Loose smut, caused by the fungus *Ustilago tritici*, is a common disease of wheat in Alabama. It rarely causes serious crop losses because of the use of disease-resistant varieties and fungicide seed dressings. This disease, however, has the potential to cause significant yield losses if these control practices are ignored. Triticale and rye are also hosts of *U. tritici*, and related fungi can cause loose smut on oats and barley.
Smutted heads often emerge several days before the healthy seedheads. Diseased heads are blackened, in contrast to the normal green color of healthy seedheads. The percent yield of smutted heads is equal to the percent of losses because infected heads produce smut and not seed.

The delicate seed membranes rupture shortly after head emergence, exposing masses of dark-brown to black spores (Figure 7). The spores are spread to nearby healthy plants by wind currents. After the spore mass is dispersed, only the bare rachis or stem remains. Seed infected with the loose smut fungi appear healthy.

Disease Cycle

Infection by loose smut fungi occurs only when wheat is in flower. Fungal spores germinate on the flowers and invade the ovaries and eventually the wheat embryo in the seed. There, the fungus lies dormant until the seed germinates. The fungus grows systemically in the plant and replaces the developing seed with masses of spores. Mild, humid weather favors infection.

Control

Loose smut can be controlled with seed dressings that contain systemic fungicides like carboxin or triadimenol. Contact fungicides used as seed dressings, like thiram and captan, are ineffective against loose smut. Treat all certified, registered, or foundation seed with carboxin or triadimenol.

For best results, apply these fungicides with commercial seed treatment equipment when the seed is cleaned and bagged for storage. Hopper-box treatments containing carboxin are also available.

Fungicide seed dressings labeled for loose smut control are listed in ANR-458, "Small Grain Pest Management," and ANR-500, "Alabama Pesticide Handbook." The use of certified, disease-free seed and disease-resistant varieties will also help prevent losses to loose smut.

Take-All

Take-all is caused by Gaeumannomyces graminis, a soil-borne fungus that attacks the roots, crowns, and lower stems of wheat. The importance of this disease has increased with the intensification of wheat production in Alabama.

Take-all has been found on wheat in all counties north of a line running from Washington to Pike Counties up to Lee County. Cool, wet weather may favor take-all development on wheat. However, successive cropping of wheat appeared to be the chief factor in the severe outbreaks of take-all in the mid-1980s.

Symptoms

Diseased plants are stunted, chlorotic (yellow), and have few tillers (Figure 8). Symptoms are most obvious at heading when stems and heads of diseased

plants turn tan to white, compared to the normal green color of heads of the surrounding healthy plants.

Few, if any, viable seed are produced on these plants, hence the name take-all. Damaged plants occur in scattered patches ranging in size from only a few feet to several acres. Severely diseased plants are easily pulled from the soil because the rotted roots break off, leaving short, brittle, and dark-colored roots. The brown-black dry rot also extends up the crown and lower stem with a shiny, superficial, dark fungal growth on the lower stem beneath the leaf sheaths (Figure 9). Black, flask-shaped reproductive bodies of the take-all fungus may be found embedded in the leaf sheaths.

Figure 7. Loose smut. The delicate membrane ruptures, exposing the black spore masses.

Figure 8. Take-all. Patches of diseased plants die well before the crop matures.

Figure 9. A black dry rot seen on the roots and lower stems is characteristic of wheat damaged by take-all.
Disease Cycle

The take-all fungus persists in the soil on crop stubble and on the roots of cultivated and wild grasses. This fungus also survives on the roots of soybeans. Roots are infected as they grow near stubble that is infested with the take-all fungus. Patches of diseased plants expand as the fungus invades the roots of adjacent healthy plants. The fungus is spread from field to field in crop debris or in soil carried by wind, water, and farm equipment.

Control

Crop rotation is the best control for take-all. Do not plant wheat in a given field for more than 3 years in succession. Fields with a history of severe take-all should be taken out of wheat production for at least 2 years.

Clean fallow or a winter legume is an acceptable substitute for wheat; however, other small grains, particularly triticale and barley, or annual pasture Grasses should not be cropped in place of wheat. Soybean-wheat rotations should be broken with a non-host crop like cotton, corn, grain sorghum, or peanuts. Maintaining fertility according to soil test recommendations will promote root growth, thereby reducing the effects of take-all.

Excessive lime or nitrogen will increase the incidence and severity of the disease. The ammonium form of nitrogen will suppress this disease as will chloride-containing fertilizers. The fungicide seed dressing triadimenol (Baytan) that gives some take-all control is now available.

Seed Rots And Seedling Diseases

Seed rots and seedling diseases are caused by soil-inhabiting fungi such as Rhizoctonia solani, Bipolaris sorokiniana, Pythium species, and Fusarium species. Some of these fungi are also known to cause root rot and leaf spot. Seed rots and seedling diseases occur when conditions do not favor rapid seed germination and seedling emergence. These problems affect wheat yields by thinning stands, reducing tiller numbers, and causing premature ripening of the grain.

Symptoms

Seedling death at or shortly after emergence is the most noticeable symptom of seed rot and seedling diseases. Irregular or thin stands may also be an indication of pathogen activity.

Roots of diseased seedlings are light-brown and appear soaked with water. Secondary roots emerging from the crown are quickly discolored. Invasion of the stem often results in premature crop ripening. Severe root damage is reflected in chlorotic leaves, unthrifty growth, or stunting (Figure 10).

Disease Cycle

The causal fungi survive on crop debris or in the soil. Their spores are spread by wind, water, and on seed. Wheat seed and seedlings are sensitive to attack when weather conditions are unfavorable for rapid seedling emergence and seedling growth. With good soil moisture and a well-prepared seedbed, seed rots and seedling diseases rarely have a serious impact on the stand establishment of wheat or other small grains.

Control

Cultural practices which favor rapid seedling emergence and stand establishment will greatly reduce losses to seed rot and seedling diseases. Sow wheat in a well-prepared seedbed with good moisture for rapid seed germination and seedling establishment.

Seedling diseases can also be reduced by delaying planting until at least mid-November when soil temperatures favor seed germination and seedling growth. Adjust soil fertility and pH to soil test recommendations. Rotating wheat with an annual legume or a clean winter fallow may also reduce disease. See ANR-497, "Planting Small Grains," for further information on recommended production practices for wheat.

Fungicide seed dressings are an inexpensive but effective means of protecting seed and seedlings from seed and soil-borne fungi. Such treatments will protect seed for about 2 weeks after planting. Some seed bought through seed distributors will be treated with a fungicide, but most will not. Contact fungicides such as captan, mancozeb, PCNB, and thiram are widely available as machine and hopper-box treatments. Use these fungicides on all wheat seed.

With any fungicide, thorough coverage is essential for good protection from seed rots and seedling diseases. Fungicide seed dressings are discussed in ANR-458, "Small Grain Pest Management," and ANR-500, "Alabama Pesticide Handbook."
Black Chaff (Bacterial stripe)

Black chaff, caused by the bacterium *Xanthomonas campestris pv. translucens*, is widely distributed on wheat and other small grains in the Southeast. The importance of this disease on wheat in Alabama has not been determined; however, considerable losses have occurred.

**Symptoms**

The bacterium can attack all above-ground plant parts, but symptoms are seen most often on the leaves and seedheads. Leaf symptoms are small, elongated, light-brown, water-soaked spots or streaks which later merge together forming large blotches (Figure 11). During periods of heavy dews or rainfall, cloudy yellow droplets of bacterial exudate, which later dry to a crusty film, may appear on the leaves. Black to brown water-soaked streaks may occur on the glumes.

As the disease progresses, streaks on the glumes merge to produce a dark staining of the seedhead. Grain in the affected areas may be shriveled and of low test weight. Black chaff is easily confused with glume blotch and several other bacterial diseases.

**Disease Cycle**

The bacterium overseasons on seed and possibly on crop debris. Wind-blown rain and possibly insects may spread the black chaff bacterium. Natural openings and wounds serve as entrance points for the bacterium. Mild, wet weather conditions favor the development of the disease.

**Control**

No effective control measures are available for black chaff. Using certified seed may reduce disease, but inspectors in Alabama and most other states do not look for relatively minor diseases such as black chaff. Resistant or tolerant varieties will provide some protection from black chaff.

Wheat Spindle Streak Mosaic

Wheat spindle streak mosaic (WSSM) is a viral disease of wheat found primarily in the eastern and midwestern United States. Recently, this disease was identified on wheat in Georgia. Symptoms similar to those described for WSSM have been seen on wheat in Baldwin County in Alabama; however, the occurrence of the disease on specific varieties has been very sporadic. In experimental trials, grain yields of susceptible varieties have been reduced 14 to 44 percent through reductions in the number of tillers.

**Symptoms**

A yellow-green mottling or streaking parallel to the leaf veins which tapers to form chlorotic spindles appears on the plants (Figure 12). Symptoms are usually confined to the lower leaves. Yellowed, stunted plants are usually most apparent in low or wet areas in late winter. As the weather warms, symptoms on the newly formed leaves are very faint. If temperatures remain cool, reddish streaking or dead (necrotic) spots may occur on the upper leaves. Heading of the diseased plants may be delayed by 7 to 10 days. The milling quality of grain from diseased plants may also be unacceptable.

**Disease Cycle**

Wheat spindle streak mosaic virus (WSSMV) is transmitted by a soil-borne fungus, *Polymyxa graminis*. The fungus invades wheat roots in early winter when the soil is cool (less than 60°F.) and moist. Extended periods of cool, wet weather in mid to late winter are needed for the disease to develop. Few problems with WSSMV will be encountered during a warm, dry winter.

**Control**

To date, outbreaks of wheat spindle streak mosaic in the Southeast have occurred primarily in plantings of the wheat varieties Florida 301, Florida 302, and
Coker 797. Using a wheat variety other than these is the best control for the disease [Figure 13]. Of the varieties commonly grown in the Southeast, Stacy and Coker 916 appear to have the best resistance to the disease. WSSM can be reduced by improving drainage in virus-infested fields and by avoiding wet areas for planting. Crop rotation may give some control, but the pathogen persists for many years in fields not seeded to wheat.

### Barley Yellow Dwarf

Barley yellow dwarf is among the most widely distributed viral diseases of small grains. In Alabama, this disease is recognized more often on oats and barley than on wheat, primarily because symptoms are more distinct on these two crops. Damage from barley yellow dwarf varies according to the cultivar grown, virus strain, time of infection, and climatic conditions. But crop injury has usually been light on wheat in Alabama.

#### Symptoms

Symptoms of barley yellow dwarf vary among the numerous small grain hosts and varieties of each host. Yellowing of the foliage, stunting, and smaller-than-normal, shallow root systems are characteristic of barley yellow dwarf virus (BYDV) infections in wheat [Figure 14]. Depending on varietal sensitivity and growth stage at the time of infection, curling, serration of margins, and other leaf distortions may also occur. The non-specific symptoms of barley yellow dwarf are easily confused with those of nutritional or other nonparasitic disorders.

#### Disease Cycle

BYDV usually persists between small grain crops in a variety of annual and perennial grasses. The virus is spread by the feeding activity of several aphid species. Barley yellow dwarf epidemics usually occur when the weather is mild and humid.

#### Control

Since the incidence of barley yellow dwarf in Alabama's wheat crop is apparently low, specific control practices are usually unnecessary. Delaying seeding until late fall or early winter to miss periods of high aphid activity will reduce the disease. Virus-tolerant wheat varieties may also give some protection from barley yellow dwarf. Control of the aphid vectors has been shown to reduce disease, but the economics of this practice are questionable.

### Soilborne Wheat Mosaic

Soilborne wheat mosaic (SBWM), a viral disease of wheat, is reported throughout the wheat production areas in the central and eastern United States. SBWM was only recently identified on wheat in central Alabama; however, the disease has long been recognized in the Florida panhandle and in other southeastern states as well. Substantial yield losses have been associated with extended periods of cool and wet weather. Yield losses to this disease differ with the variety grown, the virus strain, and weather conditions.

#### Symptoms

A mild green to distinct yellow mosaic or mottling is a typical symptom of SBWM [Figure 15]. Mosaic patterns are usually most apparent in early spring. Unfurling leaves appear mottled due to the
development of parallel dashes and streaks. Some stunting of the shoots may also be seen on wheat infected by the soilborne wheat mosaic virus (SBWMV). Symptoms are suppressed by warming temperatures in the spring.

**Disease Cycle**

SBWMV persists in the soil with its fungal vector, *Polymyxa graminis*. Infection occurs when the fungus enters wheat roots as soil moisture levels approach saturation in late fall and early spring. Disease development is favored by soil temperatures between 50° and 60°F. Higher soil temperatures will suppress disease. Soil cultivation, wind, water, and other factors which permit the dispersal of infested soil will spread SBWMV.

**Control**

Selecting resistant or tolerant varieties is the preferred method of preventing SBWMV outbreaks. Information on the sensitivity of popular wheat varieties to this disease is not available. The disease may also be reduced by delaying planting until late fall or early winter and by crop rotation.

**Disease Management**

Wheat producers must use a combination of production practices to minimize the loss of grain yield and quality to diseases (see Table 1). Since each wheat crop is exposed to several potentially damaging pathogens under a variety of weather conditions over a growing season, no single practice will provide sufficient protection from all diseases. The most effective management strategy, particularly for damaging foliar diseases, is to choose an adapted, high-yield, disease-resistant variety. Several excellent varieties with good resistance to powdery mildew and rust diseases are available. Careful attention to factors that promote rapid stand establishment such as crop rotation, deep tillage prior to planting, planting dates, soil fertility, soil pH, seeding depth, and use of a fungicide seed dressing will also reduce the impact of some diseases.

Foliar fungicides are also an important tool for managing wheat diseases. Effective control of rust and Septoria diseases as well as powdery mildew can often be obtained with fungicides. Fungicide use is most appropriate when a wheat crop has a yield potential of 40-plus bushels per acre, commodity prices are good, the crop will be marketed as certified or foundation seed, and weather conditions favor disease development.

In most Alabama counties, diseases are rarely severe enough to justify costly protective fungicide applications. Visit fields weekly—from jointing when the second node appears through bloom—to monitor the disease situation and determine if fungicide applications are needed. During each visit, check several sites in each field for disease symptoms. Applications may be made whenever flag leaf, neck, and seedhead—which together account for 80 percent of grain fill—are threatened with serious injury. Producers also have the option, regardless of disease pressure, of making one to three preventive applications depending on the fungicide chosen at specific stages of crop maturity. Carefully read label restrictions and follow them when using any fungicide on wheat.

**Table 1. The Effectiveness Of Selected Practices For Controlling Wheat Diseases.**

<table>
<thead>
<tr>
<th>Management Practice</th>
<th>Cultural Practices</th>
<th>Resistant Varieties</th>
<th>Crop Rotation</th>
<th>Tillage</th>
<th>Pesticides</th>
</tr>
</thead>
<tbody>
<tr>
<td>Foliage Diseases</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Septoria Glume Blotch</td>
<td>Pd,F</td>
<td>2</td>
<td>1</td>
<td>2</td>
<td>SD,FF</td>
</tr>
<tr>
<td>Septoria Leaf Blotch</td>
<td>Pd,F</td>
<td>2</td>
<td>1</td>
<td>2</td>
<td>SD,FF</td>
</tr>
<tr>
<td>Leaf Rust</td>
<td>Pd,F</td>
<td>1</td>
<td>3</td>
<td>2</td>
<td>FF,FF</td>
</tr>
<tr>
<td>Stem Rust</td>
<td>Pd</td>
<td>1</td>
<td>3</td>
<td>2</td>
<td>FF,FF</td>
</tr>
<tr>
<td>Powdery Mildew</td>
<td>F,PPd</td>
<td>1</td>
<td>2</td>
<td>2</td>
<td>FF,FF</td>
</tr>
<tr>
<td>Black Chaff</td>
<td>--</td>
<td>2</td>
<td>2</td>
<td>3</td>
<td>--</td>
</tr>
<tr>
<td>Virus Diseases</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Wheat Spindle Streak Mosaic</td>
<td>--</td>
<td>--</td>
<td>2</td>
<td>--</td>
<td>--</td>
</tr>
<tr>
<td>Barley Yellow Dwarf</td>
<td>Pd</td>
<td>2</td>
<td>--</td>
<td>--</td>
<td>--</td>
</tr>
<tr>
<td>Soilborne Wheat Mosaic</td>
<td>Pd</td>
<td>2</td>
<td>--</td>
<td>--</td>
<td>--</td>
</tr>
<tr>
<td>Inflorescence Diseases</td>
<td>H,F</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>SD</td>
</tr>
<tr>
<td>Scab</td>
<td>H</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>SD</td>
</tr>
<tr>
<td>Loose Smut</td>
<td>--</td>
<td>2</td>
<td>--</td>
<td>--</td>
<td>SD</td>
</tr>
<tr>
<td>Root Rots</td>
<td>F,Pd</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>SD</td>
</tr>
<tr>
<td>Take-All</td>
<td>F</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>SD</td>
</tr>
<tr>
<td>Seed Rots and Seedling Diseases</td>
<td>F,Pd</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>SD</td>
</tr>
</tbody>
</table>

1Numerical rating for relative effectiveness of practices: 1 = highly effective; 2 = moderately effective; 3 = slightly effective.

2P = balanced fertility; P = recommended plant density; H = harvest at high moisture; Pd = planting date.

3SD = fungicide seed dressing; FF = foliar fungicide.