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GUIDE
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Foliar diseases of wheat

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Powdery mildew, Septoria leaf blotch, Septoria glume blotch, and leaf rust damage Missouri's wheat crop each year. When severe, these diseases can reduce wheat yields as much as 25 percent. You can reduce the crop damage they cause by accurately diagnosing the diseases and by using proper controls. This guide describes the symptoms of and controls for these four wheat diseases.

Powdery mildew

Cause

Powdery mildew has affected wheat for centuries. It is caused by the fungus *Erysiphe graminis* f.sp. *tritici*, which infects wheat in most humid, semi-arid regions of the world. Yield losses are the result of reduced head numbers and kernel weight. Losses are greatest when plants are infected as seedlings and when disease development continues through flowering. As infections increase, yield losses increase. Powdery mildew usually does not cause serious losses in Missouri, except under conditions of high fertility.

Symptoms

The powdery mildew fungus can infect all aerial portions of the plant, but it is most prevalent on the upper surface of the lower leaves. The fungus grows entirely on the surface of the leaves, except for small, root-like structures—haustoria—that penetrate epidermal cells. The haustoria get food for the fungus from the plant. The superficial fungus growth is white and resembles small patches of cotton on the leaf or stem surfaces (see Figure 1). Yellow spots usually appear on the leaf surfaces directly opposite the fungus growth.

With age and average daily temperatures above 70 degrees F, the fungus turns dull gray-brown. Black, pepper-like structures appear in the gray-brown fungus growth. These round objects, called cleistothecia, are reproductive structures. The fungus also produces microscopic spores. Powdery mildew can develop anytime after seedling emergence, but is most apparent on Missouri's wheat crop in early spring.

Figure 1. Powdery mildew is apparent on wheat leaf.

Disease cycle

Between crops, the fungus survives on wheat straw. The fungus spreads from the straw to new plants and from plant to plant when the wind blows the spores. Powdery mildew develops best in fields of lush, rapidly growing wheat during humid, cool (60 to 70 degree F) weather.

Control

Resistant varieties are a good defense against this disease (see Table 1). Crop rotation and proper field sanitation (plowing down wheat residues from previous crops), also help control the disease. Benefits of these practices are limited, however, because wind can move the fungus from field to field.

This disease is less severe when you use a balanced rate of nitrogen, potassium, and phosphate fertilizer. You can determine your fertilizer needs with a soil test analysis. The fungicides Bayleton and Benlate suppress powdery mildew, but you should use them only when the threat of disease is great. The foliar fungicides labeled for use on wheat in Missouri and a method of determining need for foliar fungicide are shown in Tables 2 and 3.

Septoria leaf and glume blotch

Cause

Septoria leaf blotch and Septoria glume blotch affect wheat yield everywhere and an upsurge has occurred in the last two decades. In the United States, the increase appears to be related to increased foliar density from expanded use of fertilizers.

Generally, *Septoria nodorum* is cited as the cause of glume blotch and *Septoria tritici* as the cause of leaf blotch. Both organisms can attack the same parts of the plant, so they are sometimes called the Septoria complex. The Septoria complex is historically the most damaging wheat disease in Missouri. Seed set is not greatly affected but seed fill is reduced. Losses are greatest when heavy infections develop before heading.

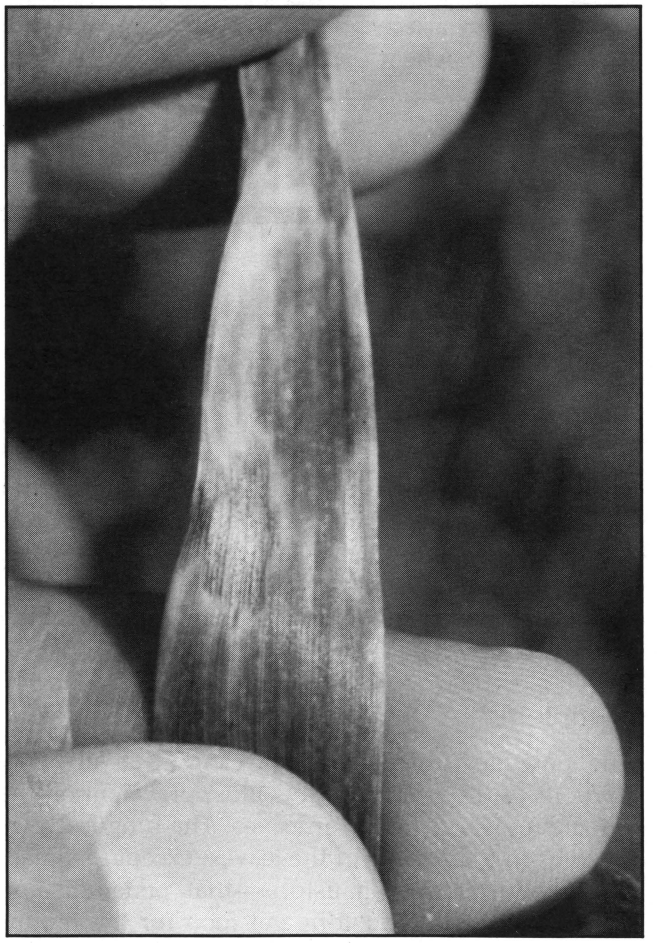

Figure 2. Septoria leaf blotch produces lesions on wheat.

Symptoms

Without a microscope, it is difficult to differentiate between leaf blotch and glume blotch. Symptoms develop throughout the growing season on all aerial parts of the plant. Initial symptoms of leaf blotch appear as chlorotic (yellow) flecks on the lowermost leaves, especially those contacting soil.

The flecks expand into irregular lesions, which are dry and yellow and become red-brown with age. Some develop tan centers. You can see dark specks, called pycnidia, within the older lesions (see Figure 2). The pycnidia are reproductive structures of the fungus. Severely damaged leaves turn yellow and die prematurely.

Glume lesions are rectangular or oblong and are light to dark brown (see Figure 3). Again, you can see pycnidia within the older lesions on the glumes.

Disease cycle

The Septoria fungi survive between wheat crops in wheat residues, or seed, and on volunteer wheat plants. Splashing rain spreads microscopic spores produced by these two fungi to start new infections. Septoria leaf blotch develops best at 60 to 68 degrees F and glume blotch develops best at 68 to 80 degrees F. Wet, windy weather favors disease development, while dry weather slows disease development.

Control

Leaf and glume blotch are best controlled with an integrated control program using the following methods: 1) planting varieties with some level of resistance (Table 1); 2) planting seed that has been cleaned and treated with a seed treatment fungicide; 3) incorporating old wheat stubble into the soil before planting a new wheat crop; 4) rotating the field out of wheat for at least two years; and 5) using foliar fungicides when necessary.

Be sure to use fungicides prudently. When disease pressure is severe, foliar fungicides reduce potential losses. When disease pressure is light, the return on investment from fungicides is not realized. A predictive system for scheduling fungicide applications is shown in Table 3. Fungicides for use in Missouri are listed in Table 2.

Figure 3. Glume blotch lesions appear on wheat heads.

Rust

Cause

Three separate rust diseases have affected wheat worldwide throughout history. They are stem rust, leaf rust, and stripe rust. They are called rusts because they produce reddish-to-yellow "rusty" pustules or stripes on the leaves and stems.

Rust reduces plant vigor and kernel weight. The damage to wheat depends partly on the wheats' stage of growth when attacked. Infections that occur before or during flowering are most detrimental, while infections that occur during the dough stage or later are generally not seriously harmful.

The three wheat rust diseases result from parasitism of wheat by three different, highly specialized fungal pathogens that grow only on living plants. Leaf rust is the most common of the wheat rust diseases in Missouri, so this guide will discuss only it. Stem rust appears in Missouri every year, but it usually arrives so late that it does not cause serious damage.

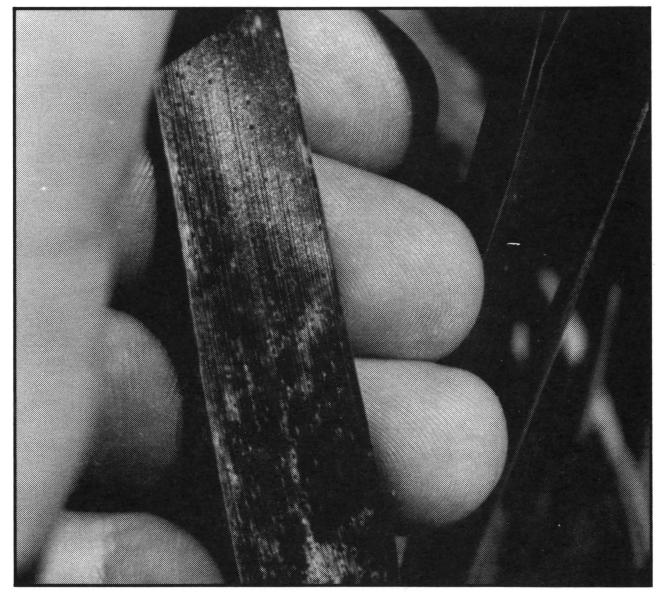

Figure 4. Rust pustule formed on this wheat leaf.

Symptoms

The fungus-causing leaf rust, *Puccinia recondita* f.sp. *tritici*, grows inside the leaf and produces large numbers of spores. Masses of spores force the epidermis of the leaf to break open. The typical 1/16-inch orange-red round-to-oval pustules are then visible (see Figure 4).

Disease cycle

The leaf rust fungus can survive mild winters in southern Missouri, but generally not very well. It overwinters on wheat in several Southern states, including Texas and Louisiana. Spores move north with prevailing winds in early spring. They eventually reach Missouri and infect our wheat. Rust develops best in dense stands of rapidly growing varieties during humid, warm (58 to 78 degrees F) weather.

Control

Leaf rust is best controlled by planting resistant varieties (see Table 1). You can suppress it by foliar applications of the fungicides Bayleton or mancozeb. You'll need one or two applications for rust control, depending on disease progress. Use fungicides when a severe threat of rust exists, but apply before pustules develop on the flag leaf.

Table 1. Disease reactions of selected winter wheat varieties[a,b]

	Stem Rust	Leaf Rust	Powdery Mildew	Septoria Leaf Blotch
Hard Red Winter Wheat				
Wings	I	I	I	I
Newton	R	S-R	I-S	I
Soft Red Winter Wheat				
Arthur 71	I-R	I	I	S
Caldwell	R	R	R	R
Coker (747, 762, 916, 983)	I	I	I	I
Hart	S	I	I-S	I
McNair 1003	I	I-S	I-R	I
Pike	—	I	I	I
Pioneer S-76	I-S	I	I-S	—
Pioneer S-78	I	I	I	I
Pioneer 2550	I	I	I	I
Pioneer 2553	I	I	I	I
Rosen	—	I	I	R

[a]Varieties are those listed in the 1985 Missouri Farm Facts, and which comprise more than 90 percent of wheat planted in Missouri.
[b]I = intermediate; R = resistant; S = susceptible.

Table 2. Foliar fungicides for use on wheat*

Fungicide trade name	Common name	Rate of product per acre[2]	Primary diseases controlled and comments
Bayleton[1]	triadimefon	2-4 oz for powdery mildew	Powdery mildew & rust Apply when symptoms appear on lower leaves.
Benlate + Manzate 200 Flowable	benomyl + mancozeb	4-8 oz + 1-2 quarts	powdery mildew & rust Septoria complex Apply once in pre-boot stage and again 10-14 days later or about early head.
Dithane M-45 or Manzate 200**	mancozeb	2 lbs	rust, Septoria complex Apply once at boot stage and again at 10-14 days later or about flowering.
Tilt[1] (Label Pending)	propiconazole	4 fl oz	powdery mildew & rust Apply when symptoms appear on lower leaves.

[1]Wider spectrum performance has been achieved under experimental conditions with Bayleton and Tilt in combination with mancozeb.
[2]The lower rates can be used if two applications are made. Use higher rates for one application (early head).
*Before using a fungicide, read and carefully observe the cautionary statements and all other information appearing on the product label. Mention of specific product labels does not warrant or imply endorsement by the University of Missouri.
**The addition of a spreader-sticker will improve spray deposition, fungicide redistribution, and weatherability.

Table 3. Wheat foliar fungicide point system

Use this point system as a guide to determine your crop's need for a foliar fungicide. Inspect five areas in each 40 acre field and answer the following questions. Pick the answer that best fits your field and place the points for each "yes" answer in the column on the right labeled "your field." Add up all points. If the total is 20 or more for a seed production field or 24 or more for a grain production field, the use of a foliar fungicide on that field may be justified. Use of this system does not guarantee yields will be increased sufficient to pay for fungicide treatment costs.

Risk factors	Point value if answer is yes	Your field
Cultural and weather conditions		
Wheat in field last year?	2	____
Foliar disease prevalence and severity in wheat last two seasons in your area:		
Moderate	2	____
High	4	____
Corn in field last year	2	____
Double crop soybeans in field last year	1	____
Wheat to be used for seed production	4	____
Conservation tillage-residues on surface	2	____
Rainfall frequency and high humidity in growth stages prior to heading		
Normal	2	____
Above Normal	4	____
Other conditions that favor disease development (e.g. long-range weather forecasts)	4	____
Disease situation		
Wheat variety highly susceptible to foliar disease (e.g. rust or Septoria susceptible)	3	____
Wheat seed was *not* treated with a fungicide	1	____
Lower leaves with rust symptoms at jointing	1	____
Lower leaves with Septoria symptoms at jointing	2	____
Lower leaves with powdery mildew symptoms at jointing	1	____
Economic considerations		
Yield potential greater than 40 bu/acre	2	____
Price of wheat		
$2.50 - $3.00	1	____
$3.01 - $4.00	4	____
$4.01 - up	6	____
	Total	____

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