Michigan State University
Management of Foliar Wheat Diseases

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The most important leaf diseases of wheat in Michigan include powdery mildew, Stagonospora leaf and glume blotch, Septoria leaf blotch, and leaf rust. A serious level of any one of these fungal diseases can cause significant yield loss. The information presented here is intended to help growers identify the individual diseases; understand the conditions and cultural practices that influence the diseases' development; and select an appropriate fungicide if necessary.

Managing foliar diseases is important to help protect the amount of green leaf area available to capture sunlight and making carbohydrates for ample plant development and grain fill. Protecting the flag leaf is most important in determining grain yield and quality, although heavy infections as early as the fully-tillered stage are also capable of reducing wheat yields.

Varietal resistance is the first line of defense in managing foliar disease of wheat. Michigan State University's annual variety trial results for red and white winter wheat include disease resistance ratings. Look at ratings over multiple years, rather than for a single year. (www.css.msu.edu/varietytrials/wheat/)

Cultural practices can serve to prevent or minimize disease development. Wheat should never follow wheat or other cereals if at all possible. In addition, growers should avoid excessive rates of nitrogen fertilizer as overly dense, lush stands tend to promote leaf diseases. Planting wheat prior to the Hessian Fly Free Date may encourage the early establishment of powdery mildew and *Septoria,* while late planting tends to delay crop maturity, inviting greater development of leaf and stripe rust.

Fungicide application may be profitable where a susceptible variety has a relatively high level of disease, the crop has a high yield potential and the extended weather forecast calls for humid or wet conditions. The conditions favorable for the development of each foliar disease and the disease thresholds are provided on pages 2 and 3. The most effective fungicides are listed on page 4. These products represent relatively new chemistries providing plant protective and/or curative activity. Headline and Quadris are in the group of chemical compounds called strobilurins, while Folicur, Propimax, Tilt and Proline are triazoles. Stratego and Quilt are premixes containing both a strobilurin and a triazole. Refer to the table on page 4 for each product's rating for activity against foliar diseases. These fungicides differ in how late they can legally be applied. The table at the bottom of page 4 shows the latest growth stage allowed on the label. Be cautious about applying products that contain strobilurins to headed wheat. Research has shown that increased DON (deoxynivalenol, vomitoxin) levels can result when strobilurins are applied to scabby wheat.

Scouting individual fields is critical to making sound management decisions. Growers should randomly check numerous tillers for symptoms of foliar diseases at several locations across the entire field beginning at the fully tillered stage until flowering.

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MICHIGAN STATE UNIVERSITY EXTENSION

Powdery Mildew

Cause: *Erysiphe graminis* f.s *tritici* (fungus)

Symptoms: Powdery, white to light gray patches may appear on leaves and stems (especially upper leaf surfaces) any time after seedlings emerge. Black specks containing spores may form in the patches of mildew as the season progresses.

Conditions favoring the disease: Cool temperatures (59 to 72ºF) and high humidity (greater than 85%) are optimal for the development of the disease. The pathogen overwinters on wheat or wheat residue.

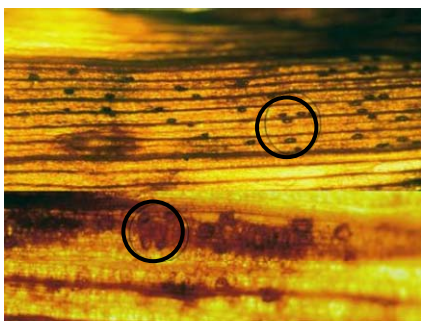
Management: Select resistant varieties. Avoid heavy amounts of nitrogen, which can stimulate rapid growth. Determine the need for fungicide treatment by scouting for powdery mildew at flag leaf emergence and the boot stage. The threshold is an average 2-3 spots per leaf (averaged over 30 to 50 leaves) on the leaf below the flag leaf.

Powdery mildew
Photo credit: Phil Wharton, MSU

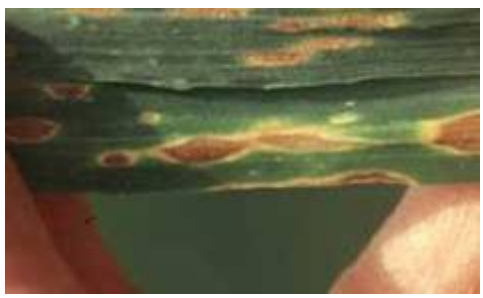
Septoria leaf blotch, Stagonospora leaf and glume blotch

Causes: *Septoria tritici* and *Stagonospora nodorum*, (fungi)

Symptoms: The first symptoms are tiny yellow flecks on the lower leaves. **Septoria** expands to angular, tan to brown lesions containing black, pinpoint specks (pycnidia, which produce spores). It does not infect the glumes. **Stagonospora** lesions are lens-shaped with yellow halos and may contain brown pinpoint specks (pycnidia) within the lesions. **Stagonospora** affects both leaves and glumes. On wheat heads, it starts as gray-brown spots on the chaff and become dark brown blotches with grayish-white centers on the glume.



Black pycnidia of **Septoria (**top), and **brown pycnidia** of **Stagonospora** (bottom) as viewed through hand lens.



Septoria lesions (top) and **Stagonospora** lesions (bottom)

Photo credits: Pycnidia and lesions-Don Hershman, University of Kentucky

Black specks on wheat heads above are **sooty mold**, not glume blotch. These molds appear when weather is wet and humid during the latter stages of crop development through maturity. Grain is not usually affected.
Photo credit: Dan Hudson

Conditions favoring the disease: These fungi overwinter on straw, living plants or seed. Spores are present in late summer and fall, and can germinate over a wide temperature range. Spores are produced during wet weather and can cause infections throughout the growing season. Weather that is wet and windy favors the development of the disease. **Septoria** is more prevalent earlier in the season (50-68°F), during the period from stem elongation to flag leaf emergence. **Stagonospora** tends to appear around heading (68-81°F). Planting successive small grain crops allows inoculum to build up in the field, especially under no till or minimum tillage.

Management: Select varieties with resistance. Use certified seed. Seed treatment may help limit seedborne disease. Rotate out of small grains for two years. Avoid planting into wheat stubble. Determine the need for fungicide treatment by scouting at flag leaf emergence and the boot stage. The threshold is an average 1-2 lesions per leaf (averaged over 30-50 leaves) on the leaf below the flag leaf.

Leaf rust

Cause: Wheat leaf rust, *Puccinia triticina* (fungus)

Leaf rust
Photo credit: Lee Siler, MSU

Symptoms: Infections first appear on the lower leaves. Reddish-orange spore masses of the fungus break through the leaf surface leaving an orange powder that rubs off the leaf. As the crop develops and matures, leaf rust generally appears on upper leaves of plants and severity increases.

Disease cycle: The fungus can survive on wheat during a mild winter or when covered by deep snow, or be carried in on wind currents from more southern areas as the wheat crop develops in spring.

Conditions favoring the disease: Temperatures of 60-80°F, and conditions that promote leaf wetness in the canopy for extended periods of time, such as rain, ground fog, and dew increase the severity of leaf rust.

M**anagement:** The primary means of controlling leaf rust is to use resistant varieties. Scout fields from around heading to flowering. Several foliar fungicides are labeled for control of rusts. Check the label for application timing if a fungicide is used. The threshold for fungicide applications is an average 5-10 pustules/ flag leaf (averaged over 30-50 leaves). Avoid spreading the disease on clothing or farm equipment. Clothing, boots and farm equipment contaminated with rust spores should be cleaned before entering healthy fields.

Stripe rust

Cause: Stripe rust, *Puccinia striiformis*. (fungus)

Stripe rust
Photo credit: Lee Siler, MSU

Symptoms: Stripe rust appears as long stripes of small yellowish orange pustules on the leaves. The pustules are masses of rust spores. It can be confused with leaf rust, but the stripe rust pustules are arranged in rows, or stripes, while the leaf rust pustules are scattered on the leaf. Wheat is the only host for stripe rust.

Disease cycle: Stripe rust usually arrives in the north on wind currents from more southern wheat growing areas. It survives down south on volunteer wheat until it can infect newly planted wheat in fall and winter.

Conditions favoring the disease: Stripe rust is favored by cool, humid weather. Disease development is most rapid between 50 and 60°F. The disease is inhibited when night time temperatures reach 65°F or temperatures for several days in a row reach the mid 80's.

Management: The primary means of controlling both leaf rust and stripe rust is to use resistant varieties. Several foliar fungicides are labeled for control of rusts. Fungicides aren't commonly used for stripe rust unless the disease occurs early in the season. Check the label for application timing if a fungicide is used. Avoid spreading the disease on clothing or farm equipment. Clothing or boots contaminated with rust spores should be cleaned before being worn to walk through healthy fields. Likewise, rust can spread from contaminated farm equipment. Clean contaminated equipment before using it in a field of healthy plants.

Management of Small Grain Diseases (NCERA-184)
Fungicide Efficacy for Control of Wheat Diseases

The North Central Regional Committee on Management of Small Grain Diseases developed the following information on fungicide efficacy for control of certain foliar diseases of wheat for use by the grain production industry in the U. S. Ratings for each fungicide listed in the table were determined by field testing the materials over multiple years and locations by committee members. Efficacy is based on proper application timing to achieve optimum effectiveness of the fungicide as determined by labeled instructions and overall level of disease in the field at the time of application. Differences in efficacy among fungicide products were determined by direct comparisons among products in field tests and are based on a single application of the labeled rate as listed in the table.

Efficacy of fungicides for wheat disease control based on appropriate application timing.

	Product	Fungicide(s)	Rate/A (fl. oz)	Powdery mildew	Stagonospora leaf/glume blotch	Septoria leaf blotch	Stripe rust	Leaf rust	Head scab
Strobilurin	**Headline 2.09 EC**	**Pyraclostrobin 23.6%**	**6.0 to 9.0**	G[1]	VG	VG	E[2]	E	NR
Strobilurin	**Quadris 2.08 SC**	**Azoxystrobin 22.9%**	**6.2 to 10.8**	F(G)[3]	VG	VG	E[2]	E	NR
Triazole	**Proline 480 SC**	**Prothioconazole 41%**	**5.0-5.7**	--[4]	VG	VG	--	VG	G(VG)[3]
Triazole	**PropiMax 3.6 EC**	**Propiconazole* 41.8%**	**4.0**	VG	VG	VG	VG	VG	F
Triazole	**Tilt 3.6 EC**	**Propiconazole* 41.8%**	**4.0**	VG*	VG	VG	VG	VG	F
Premix	**Quilt 200SC**	**Azoxystrobin 7.0% Propiconazole 11.7%**	**14.0**	VG	VG	VG	E	E	NR
Premix	**Stratego 250 EC**	**Propiconazole 11.4% Trifloxystrobin 11.4%**	**10.0**	G	VG	VG	VG	G	NR
Section 18 triazole[5]	**Folicur 3.6 EC[5]**	**Tebuconazole 38.7%**	**4.0**	G	VG	VG	E	E	G

[1] Efficacy categories: NR=Not Recommended; F=Fair; G=Good; VG=Very Good; E=Excellent

[2] Efficacy may be significantly reduced if solo strobilurin products are applied after infection has occurred

[3] (G) indicates greater efficacy at higher application rates.

[4] Insufficient data to make statement about efficacy of this product. Michigan has a 2ee label for powdery mildew for Proline .

[5] At the date of this publication, Folicur does not have a federal label. There is no Section 18 emergency registration in Michigan for 2008.

* There may be other generic propiconazole products available (check with your supplier).

This information is provided only as a guide. It is the responsibility of the pesticide applicator by law to read and follow all current label directions. No endorsement is intended for products listed, nor is criticism meant for products not listed. Members of NCERA-184 assume no liability resulting from the use of these products.

Growth stage limitations for applying certain fungicides

Flag leaf collar visible
(Feekes GS 9)
Propimax- propiconazole

Heading
(Feekes GS 10.5)
Quilt- azoxystrobin+ propiconazole (wheat only)
Headline- pyraclostrobin
Quadris-azoxystrobin
Stratego- Trifloxystrobin + propiconazole

50% flowering
(Feekes GS 10.5.2)
Proline (prothioconazole
Tilt (propiconazole)