

Realities of Disease Management in Wheat

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Considerations for Disease Management

- Variety selection
- **Field scouting and disease identification**
 - Today's emphasis: *fungal diseases*
 - Other things to consider: aphids and viruses
- Growth stage identification
- Knowledge about disease risk
- Crop development
- Weather
- Fungicides
- Commodity prices



Scouting

- Identify the **growth stage**
- The **flag leaf** and its **importance**
- **Scout the entire field** and make assessments from **different locations**
- Identify current **diseases** and **severity levels**



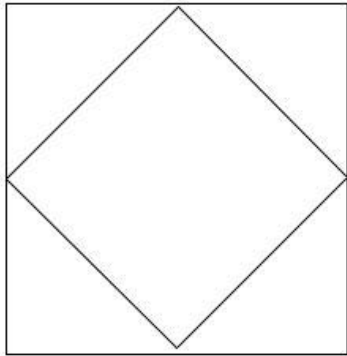


The Flag Leaf

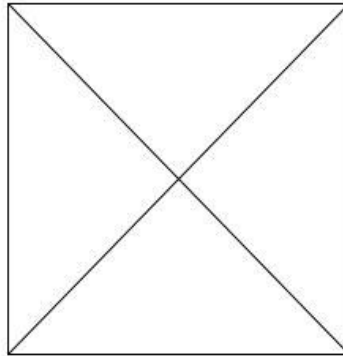
- Fungicide applications are based on the risk of disease on the flag leaf
- Flag leaf becomes visible during Feekes 8
- Most important leaf for yield, accounting for upwards of 50% or more of final yield
- Disease on this leaf at scouting may indicate it is too late for a fungicide to reduce the effects of disease - scout early!



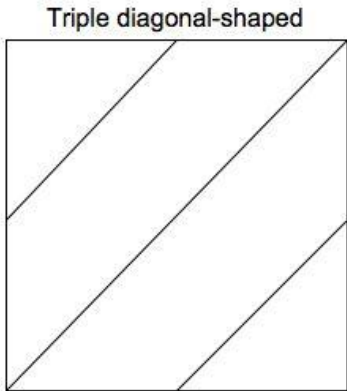
Scouting the Field



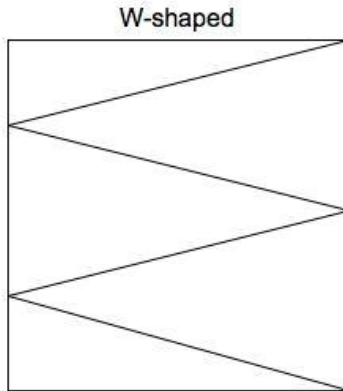
Diamond-shaped



X-shaped



Triple diagonal-shaped



W-shaped

- Scout 10 locations within field
- Examine 10 plants selected at random from each of the locations
- Assess disease presence/absence (**incidence**) and how much area is infected (**severity**)





What Are We Looking For?



Loose Smut



- *Ustilago tritici*
- **Diseased plants produce blackened heads**
- **Most obvious to see just after wheat has headed**
- Reduces yield in proportion to the percentage of smutted heads in field
 - <http://ohioline.osu.edu/a-c-fact/0012.html>



Loose Smut

- Survival as dormant mycelia within embryo of infested seed
- When seed germinates, fungus grows along wheat shoot apex
- **Dispersal to other plants can occur via rain and insects**
- Environmental conditions that favor infection after deposition on head: **light rains or heavy dew; moderate temperatures (60 to 71 °F)**
- Management: resistance, seed fungicide, clean and disease-free seed



Fusarium Head Scab



- *Fusarium graminearum*
- Any part or all of wheat head may appear **bleached**
- Often, part bleached, part green
- Infected spikelets and glumes = **salmon-colored spore masses of fungus** (prolonged periods of wet weather)
- Immediately below head, stem may be infected and have brown or purplish discoloration
- **Kernels shriveled and lightweight**
- Kernels with “tombstone” appearance = dull grayish or pinkish color (not consistent symptom)



Fusarium Head Scab

- Inoculum sources = crop residue; organism surviving soil
- Same organism that causes **Gibberella stalk rot (corn)**
- Spores wind or rain disseminated
- Infection occurs when spores land on heads (florets) of wheat
- Infection favored by prolonged periods of **rain** (or **dew**), high **relative humidity** and **temperatures** from 65 to 85 °F
- Toxin concern: deoxynivalenol (DON) and zearalenone
- Management:
 - Rotation (avoid wheat after corn)
 - Fungicide sprays
 - Prediction tool: flowering date, wheat class (spring/winter), production practices





U.S. Wheat and Barley
Scab Initiative

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Key items to obtain a prediction

Model details

Disease information

Risk map tool

prediction center

prediction center Wheat Fusarium Head Blight



Wheat spikes with symptoms
of Fusarium head blight

Fusarium head blight or head scab is caused by the fungus *Fusarium graminearum*. The disease causes tremendous losses by reducing grain yield and quality in many wheat production regions east of the Rocky Mountains.

The goal of this experimental predictive system is to help growers assess the risk of Fusarium head blight in their region. Major outbreaks of Fusarium head blight are associated with specific weather patterns prior flowering of the wheat crop. Researchers at Penn State University, Ohio State University, Kansas State University, Purdue University, North Dakota State University, and South Dakota State University have worked together to develop models that predict the risk of a major epidemic (greater than 10% field severity) based on observed weather patterns.

You can customize the forecast for your region and production practices by clicking on the wheat scab "[tool](#)" from the menu above.

[Comments/Questions?](#)



Wheat Leaf Rust



- *Puccinia triticina*
- Rust monitoring: Cereal Disease Laboratory
(www.ars.usda.gov/Main/docs.htm?docid=9757)
- **Reddish-orange spore mass**
(pustules or uredinia)
- Approximately 1/32 inch long and 1/64 inch wide
- **Initial symptoms in lower canopy that will progress upwards**



Wheat Leaf Rust

- Survival = either in live winter wheat (mycelia) or on infested dead leaves (urediniospores)
- Infection favored by **moisture** on leaves (6-8 hours of **dew**) and **temperatures** from 60 to 80 °F
 - In general, cool nights and warm days favor
- Management: resistance; fungicides (timing and severity of disease); fertility (excess nitrogen increases susceptibility)



Midwest St. Paul, MN Cereal Disease Laboratory

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Cereal Rust Situation Reports and Cereal Rust Bulletins

[Reports on the Current Rust Situation in the U.S. \(from the Cereal Rust Survey Listserv list\)](#)

2007 Cereal Rust Bulletins:

- [Bulletin #1](#) (3/21/2007)
- [Bulletin #2](#) (4/17/2007)
- [Bulletin #3](#) (5/1/2007)
- [Bulletin #4](#) (5/16/2007)
- [Bulletin #5](#) (5/30/2007)
- [Bulletin #6](#) (6/12/2007)
- [Bulletin #7](#) (6/27/2007)
- [Bulletin #8](#) (7/17/2007)
- [Bulletin #9](#) (7/31/2007)
- [Bulletin #10](#) (Final bulletin for 2007)

Stem rust observation maps

(maps are updated as observations are received)
 Please be aware these are large files.

2007

- [Wheat](#) (updated 7/30/07)
- [Oat](#) (updated 7/30/07)

2006

- [Wheat](#)
- [Oat](#)

Archived Cereal Rust Bulletins

- [2006](#)
- [2005](#)
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Puccinia Pathway



Wheat Stripe Rust



- *Puccinia striiformis* (*Puccinia striiformis* f. sp. *tritici*)
- **Yellowish, long stripes between veins** (leaves and sheaths) that have masses (pustules) of yellow spores
- Young plants = pustules appear in blotches
- Older plants = parallel striping that is distinctive
- **Difference from leaf or stem rust = appearance of reddish brown spore in those diseases**
- **Difference from Septoria leaf blotch = presence of gray leaf blotch with black fruiting body**



Wheat Stripe Rust

- Life cycle is similar to leaf rust
- Initial source of inoculum = urediniospores that survive in crop residue
- Spores are formed during cool, wet weather and are wind-dispersed
- Infection favored by **moisture** on leaves (4-6 hours) and **temperatures** from 50 to 60 °F
 - **Disease progression is ceased when temperatures > 70 °F**
 - Warmer than normal winters followed by cooler April temperatures favor epidemics
- Management: resistance; fungicides (timing and severity of disease)



Septoria Leaf Blotch

- *Septoria tritici*
- Symptoms often part of complex with Glume blotch
- **Light green to yellow spots between leaf veins on lower leaves** (contact with soil)
- Symptoms elongate: irregularly shaped lesions that are tan to red-brown
- **Lesions age = black speckles (pycnidia) can be seen on lesion (good diagnostic sign)**



Septoria Leaf Blotch

- Two phases
 - Fall just after wheat sown
 - Spring/summer on upper leaves
- Inoculum source = pycnidia on infested residue (survive 2-3 years) or mycelia in disease live wheat
- Infection favored by **cool conditions**: 59 to 68 °F
- Six hours of **leaf wetness** required (maximum infection with 48 hours)
- Management: certified disease seed with seed fungicide treatment; some resistance; rotation of at least 2 years; foliar fungicides



Glume Blotch

- *Stagonospora nodorum*
- Symptoms often part of complex with Septoria leaf blotch
- **Brown spots on glumes (outer chaff), lemmas (inner chaff), and awns**
- Damage later (near maturity)
- Symptoms most common at tips
- **Diagnostic indicator = presence of small, round brown or black specks (pycnidia) - can be difficult to see with naked eye**



Glume Blotch

- Similar disease cycle to Septoria leaf blotch
- Primary inoculum = seed or crop residue
- Spores dispersed via wind or rain
- **Temperatures** for infection: 68 to 81 °F
- **Leaf wetness:** 6 to 16 hours
- Pycnidia can produce spores
- Management: certified disease seed with seed fungicide treatment; some resistance; rotation of at least 2 years; foliar fungicides



Powdery Mildew

- *Blumeria graminis*
- **Symptoms include powdery white to gray fungal growth**
- Symptoms on leaves, stems and heads
- Pustules first on lower leaves
- **Late symptoms: small, black fruiting bodies (cleistothecia) that contain spores (ascospores)**



Powdery Mildew

- Primary inoculum = spores on volunteer wheat or spores within cleistothecia
- Infections first occur in fall
- Spores dispersed by wind
- Infection favored under **cool** (50 to 71 °F), **wet weather**
- **High relative humidity**
- Management: resistance; fungicide seed treatments; foliar fungicides when applied between Feekes 6 (1st detectable node) and 8 (flag leaf is visible); balanced fertility (avoid high nitrogen)



Tan Spot



- *Pyrenophora tritici-repentis*
- Symptoms include small tan, spots (lens-shaped)
- **Tan to brown, round to slightly elongate spot surrounded by yellow halo**
- **Center spot often diamond-shaped**
- **Plant matures: fungus invades straw - tiny black, raised fruiting structures (pseudothecia) formed**
- Severe infections: red smudge on seed (quality downgraded)



Tan Spot

- Highest risk: wheat following wheat
- Primary source of inoculum = ascospores (found in crop residue)
- Initial infections under **cool, cloudy, humid** weather and **frequent spring rains**
- **Infection of wheat seed found to be positively correlated with severity of tan spot on flag leaf**
- Management: resistance (multiple mechanisms); foliar fungicides (application earlier than for rusts); tillage and rotation help reduce survival and infection



Management Tactic

Diseases Affected

Rotation	Fusarium head blight; Septoria leaf blotch; Glume blotch; Tan spot
Resistance	Wheat leaf rust; Wheat stripe rust; “Septoria leaf blotch”; “Glume blotch”; Powdery mildew; Tan spot
Seed fungicides	Loose smut; Septoria leaf blotch; Glume blotch
Foliar fungicides	Fusarium head blight; Wheat leaf rust; Wheat stripe rust; Septoria leaf blotch; Glume blotch; Powdery mildew; Tan spot
Soil fertility	Wheat leaf rust; Powdery mildew



For Further Information

- Boerboom, C., et al. 2007. Pest Management in Wisconsin Field Crops, UW-Extension, A3646.
 - Table 5-4, Page 192 = Fungicides for control of foliar diseases of small grains
 - Table 5-5, Page 193 = Seed treatment fungicides for small grains
 - Always consult the label for up-to-date information



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- Craig Grau, UW-Madison
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