Managing Winter Wheat Diseases

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Electronic Resource Sites

http://badgercropdoc.com

http://cropprotectionnetwork.org
Top Wheat Diseases in Wisconsin (Last 5 years)

- Fusarium head blight (scab)
  - Caused by *Fusarium graminearum* and *F. culmorum*
- Stripe rust
  - Caused by *Puccinia striiformis f. sp. tritici* (*Pst*)
- Septoria leaf blotch
  - Caused by *Septoria tritici*
- Leaf rust
  - Caused by *Puccinia triticina*
Other Resources to Track

https://wheat.agpestmonitor.org/stripes-rust/

http://www.wheatscab.psu.edu
Fusarium head blight cycle

Wind and rain spread spores to nearby plants; spores also can be carried long distances.

Susceptibility to infection is greatest when plants are flowering.

Infected spikelets appear bleached and can have pinkish spore masses.

Infected seed can be contaminated with mycotoxins and allow the fungus to overwinter.

The fungus overwinters in wheat, barley, and corn residue.

Non-treated, infected seeds can result in seedling blight.
**FDA Deoxynivalenol (DON; Vomitoxin) Guidelines**

- 1 ppm for finished wheat products (e.g. flour, bran, germ, etc) to be consumed by humans
- 10 ppm for total feed ration for ruminating beef cattle over 4 months
- 5 ppm in the total ration for dairy cattle older than 4 months
- 5 ppm for swine as long as the grain products are not more than 20% of the feed ration
- 5 ppm for as long as the grain products are not more than 40% of the feed ration for all other animals

**In Wisconsin elevators typically start discounting (docking) grain at 2 ppm.**
Multiple Chemotypes Can be found in Agronomic Landscapes – An example from Wheat

- **2016 Samples**
  - Among 195 wheat head samples collected in 2016 in Wisconsin, 145 *Fusarium* spp. were positively chemotyped as 3ADON or 15ADON
  - 90% were of the 15ADON chemotype and 10% of isolates were 3ADON

- **2017 Samples**
  - 185 samples were collected and 120 of them were chemotyped
  - 92% of the isolates were identified as 15ADON chemotype and 8% the 3ADON chemotype
Aggressiveness (AUDPC) by Cropping District

Management of FHB

• Rotation
  - Rotation with soybeans is preferred
  - Avoid rotation behind corn, if possible

• Resistant Varieties
  - No complete resistance – partial only
  - Type 1 Resistance – Resistance to initial infection
    - Pursuing this type of resistance has been elusive
  - Type 2 Resistance – Resistance to spread within the spike
    - Most breeding emphasis has been here
    - $Fhb1$ first gene associated with this resistance

• Fungicide application
  - Product choice important
    - DMI fungicides (Prosaro or Caramba) have been staples
    - DMI plus SDHI (Miravis Ace) is the new product on the scene
    - Strobilurin fungicides (ex. Headline) can make FHB worse
  - Timing of application important
    - Anthesis (Feekes 10.5.1) applications have been the standard
    - More recently applications 5-7 days after anthesis show excellent reductions in DON
    - Applications can be made too early (ex. When the head is still in the boot)
    - All product effective against FHB also effective against stripe rust
Variety Trials Are Key to Making a Decision on What to Plant
Integrated Management is Key - Combining Resistance with Fungicide Application
2019 Integrated Management Trial

*Letters represent LSD at $\alpha = 0.05$ within each cultivar*
2019 Integrated Management Trial

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### 2019 Integrated Management Trial

*Letters represent LSD at $\alpha = 0.05$ within each cultivar*

<table>
<thead>
<tr>
<th>Treatment</th>
<th>DON (ppm)</th>
<th>Harpoon</th>
<th>Hopewell</th>
</tr>
</thead>
<tbody>
<tr>
<td>MIRAVIS ACE 13.7 FL OZ (FEKES 10.3)</td>
<td>5.8</td>
<td>a</td>
<td></td>
</tr>
<tr>
<td>PROSARO 6.5 FL OZ (FEKES 10.5.1), NOT INOCULATED</td>
<td>5.2</td>
<td>a</td>
<td></td>
</tr>
<tr>
<td>NON-TREATED CHECK, NOT INOCULATED</td>
<td>5.1</td>
<td>a</td>
<td></td>
</tr>
<tr>
<td>NON-TREATED CHECK, INOCULATED</td>
<td>4.9</td>
<td>ab</td>
<td></td>
</tr>
<tr>
<td>PROSARO 6.5 FL OZ (FEKES 10.5.1 + 5 DAYS)</td>
<td>4.6</td>
<td>ab</td>
<td></td>
</tr>
<tr>
<td>MIRAVIS ACE 13.7 FL OZ (FEKES 10.5.1)</td>
<td>3.6</td>
<td>b</td>
<td></td>
</tr>
<tr>
<td>PROSARO 6.5 FL OZ (FEKES 10.5.1), INOCULATED</td>
<td>2.5</td>
<td>c</td>
<td></td>
</tr>
<tr>
<td>MIRAVIS ACE 13.7 FL OZ (FEKES 10.5.1 + 5 DAYS)</td>
<td>1.5</td>
<td>d</td>
<td></td>
</tr>
</tbody>
</table>

Field Crops Pathology
Spores are spread by wind to green host plants and can travel long distances. After infection, plants develop symptoms and rust pustules sporulate. In warmer climates, the fungus survives on wheat debris, volunteer wheat, and overwintering wheat. In northern climates, the disease initiates from urediniospores blown in from warmer climates each year. Conducive conditions allow disease to spread to other plants and fields, resulting in rust epidemics as the disease cycle repeats.
Yield Loss Due to Stripe Rust In 2016

Arlington, Chilton, and Sharon (Blue Line)
Fond du Lac (Orange Line)

\[ y = -0.5256x + 125.84 \]
\[ R^2 = 0.5243 \]

\[ y = -0.5184x + 94.449 \]
\[ R^2 = 0.1668 \]
Integrated Management of Stripe Rust in Wisconsin

• 2016 and 2017
• Evaluating Fungicide Application Timing on 3 Winter Wheat Varieties
  • Fungicides
    • Prosaro
    • Headline
  • Fungicide Application Timings
    • Non-treated (Negative Control)
    • 1 app at Feekes 5 (Jointing)
    • 1 app at Feekes 8 (Emerging Flag leaf)
    • 1 app at Feekes 10 (Boot Stage)
    • Full-Season Fungicide Application (Positive Control)
• Varieties
  • Pro Seed 420 (Susceptible)
  • Kaskaskia (Moderately Resistant)
  • Pro Seed 380 (Resistant)
Disease Index 2016

Treatment: $P<0.0001$
Var*Treat: $P<0.0001$

Non treated (Pro Seed 420): 60DI/10DS
Yield In Stripe Rust Trials, 2016

Treatment: P<0.001
Var*Treat: P>0.05
What is the Return on Investment (ROI) for Intensive Wheat Management?

*All treatments applied to 14 winter wheat varieties each year

Table 1. Management treatments at three levels.

<table>
<thead>
<tr>
<th>Management Treatments</th>
<th>Current</th>
<th>MidLevel</th>
<th>HighLevel</th>
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</thead>
<tbody>
<tr>
<td>Base seed treatment</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Base herbicide (14-May)</td>
<td>Huskie 15 fl oz/a</td>
<td>Huskie 15 fl oz/a</td>
<td>Huskie 15 fl oz/a</td>
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<tr>
<td>Seeding rate (million seeds/a)</td>
<td>1.50</td>
<td>1.75</td>
<td>2.00</td>
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<tr>
<td>Nitrogen (lbs N/a) (5-Apr + 3-May)</td>
<td>55</td>
<td>55+30 split</td>
<td>110+30 split</td>
</tr>
<tr>
<td>Growth regulator @ F6 (16-May)</td>
<td></td>
<td>Palisade 12 fl oz/a</td>
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</tr>
<tr>
<td>Micronutrients @ F9 (28-May)</td>
<td></td>
<td>Brandt Smart Quatro Plus (N,S,B,Mn,Mo,Zn) 32 fl oz/a</td>
<td></td>
</tr>
<tr>
<td>Fungicide @ F9 (28-May)</td>
<td></td>
<td>EB Mix (N,S,B,Mn,Fe,Zn) 64 fl oz/a</td>
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</tr>
<tr>
<td>Micronutrients @ F10.5.1 (13-June)</td>
<td></td>
<td>TakeOff Phite MZ 32 fl oz/a</td>
<td></td>
</tr>
<tr>
<td>Fungicide @ F10.5.1 (13June)</td>
<td>Miravis Ace 13.7 fl oz/a</td>
<td>Miravis Ace 13.7 fl oz/a</td>
<td></td>
</tr>
</tbody>
</table>


Average Yields Across all Years, across varieties

Current: 95.2 bu/a  
Mid-level: 107.2 bu/a  
High-level: 113.4 bu/a

Average Yield Preservation all Years, across varieties

Current to mid = 12 bu / acre  
Current to high = 18.2 bu / acre  
Mid to high = 6.2 bu / acre

The “Take-Home”

- Watch your crop rotation – Try to plant what after soybean
- Choose a FHB-resistant variety that also has decent stripe rust resistance
- Feekes 5 applications of fungicide not needed in most years in Wisconsin
- In some years apply fungicides for stripe rust on susceptible cultivars around Feekes 8 (will also control Septoria if needed)
- Plan to apply an FHB fungicide application – especially on susceptible varieties
  - Shoot for Anthesis or up to 5-days after the start of anthesis for Prosaro and Caramba
  - Can go earlier (Feekes 10.5) up to 5-days after the start of anthesis for Miravis Ace
- May need other tactics!
  - Rotate to broadleaf crops (soybean/alfalfa) where head scab is problematic
  - Rotating wheat after corn can increase risk of FHB
  - Watch the “Scab Alerts” – it isn’t perfect, but can help make a decision ([http://www.wheatscab.psu.edu](http://www.wheatscab.psu.edu))
  - Be sure to track Stripe Rust ([https://wheat.agpestmonitor.org/stripe-rust/](https://wheat.agpestmonitor.org/stripe-rust/))
Questions?

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