Wheat Disease Management and Diagnostics

Ronald “Ron” French, Ph.D.
Assistant Professor & Extension Specialist-Plant Pathology
Texas A&M AgriLife Extension Service-Texas A&M System
Amarillo, TX

Contact information
• Website: http://amarillo.tamu.edu/
• http://amarillo.tamu.edu/programs/agrilife_programs/plant_pathology_extension/index.php
• Shortcut: http://sickcrops.tamu.edu/
• rdfrench@ag.tamu.edu
• 806-677-5600

TEXAS PLANT DIAGNOSTIC CLINIC
(Texas High Plains Plant Diagnostic Laboratory)
Texas AgriLife Research and Extension Center
6500 Amarillo Blvd. W
Amarillo, Texas 79106
http://plantdiagnostics.tamu.edu

Diagnostic Form

http://plantdiagnostics.tamu.edu
WHEAT DISEASES

Wheat in LRGV (February)
Wheat? (Feb)

Watermelon (Feb)

Stem Rust

Estimated Yield Loss to Stem Rust

Foliar Diseases
Powdery Mildew

*Optimum between 59 and 71 F
*Activity inhibited at greater than 77 F
*Requires high relative humidity

Septoria tritici (blotch)

Stagonospora nodorum (blotch)

Pyrenophora tritici-repentis (causal agent of tan spot)

Stripe Rust (Puccinia striiformis)

More active in the mid 50s F to low 70s F. Fungus can survive at freezing temperatures.
Stripe Rust (*Puccinia striiformis*)

Leaf Rust (*Puccinia triticina*)

More active in the high 60s F to low 80s F. Fungus can survive at warmer temperatures.

- **SPRING Spore Dispersal**
- **FALL Spore Dispersal**

Windborne Rust Spores
Fungicide Application

<table>
<thead>
<tr>
<th>Product</th>
<th>Company</th>
<th>Rate/Acre</th>
<th>Diseases Controlled</th>
<th>Application Timing</th>
</tr>
</thead>
<tbody>
<tr>
<td>Headline</td>
<td>BASF</td>
<td>6-9 fl.oz./A</td>
<td>Leaf rust, Stripe rust, Powdery mildew</td>
<td>Apply after flag leaf emergence, no later than flowering (Feekes 10.5)</td>
</tr>
<tr>
<td>PropiMax EC</td>
<td>Dow AgroSciences</td>
<td>4 fl.oz./A</td>
<td>Leaf rust, Stripe rust, Powdery mildew</td>
<td>Highest yields usually when applied to emerging flag leaf (no later than Feekes 8)</td>
</tr>
<tr>
<td>Quilt</td>
<td>Syngenta</td>
<td>14 fl.oz./A</td>
<td>Leaf rust, Stripe rust, Powdery mildew</td>
<td>Applied until full head emergence (Feekes 10.5)</td>
</tr>
<tr>
<td>Quadris</td>
<td>Syngenta</td>
<td>4-12 fl.oz./A</td>
<td>Leaf rust, Stripe rust, Powdery mildew</td>
<td>Applied from jointing (Feekes 6) up to late head emergence (Feekes 10.5)</td>
</tr>
<tr>
<td>Stratego</td>
<td>Bayer CropScience</td>
<td>10 fl.oz./A</td>
<td>Leaf rust, Stripe rust, Powdery mildew</td>
<td>Applied until full head emergence (Feekes 10.5)</td>
</tr>
<tr>
<td>Tilt</td>
<td>Syngenta</td>
<td>4 fl. oz./A</td>
<td>Leaf rust, Stripe rust, Powdery mildew</td>
<td>Applied until full head emergence (Feekes 10.5)</td>
</tr>
</tbody>
</table>

STROBILURIN + TRIAZOLE: Two Complimentary Biochemical Modes of Action


disrupts energy production by the fungus. Good preventative action!

Foliar Fungicides- Strobilurin + Triazole:

Inhibits sterol biosynthesis. Sterols are important components of the cell membrane. Good post-infection activity!

Fungal cell

Inhibits electron transfer in cytochrome bc1 complex of mitochondria. Therefore, inhibits energy production by the fungus. Good preventative action!

Triazole

Inhibits sterol biosynthesis. Sterols are important components of the cell membrane. Good post-infection activity!

... also beneficial for resistance management

Courtesy Syngenta (modified)
**Potential Loss of Yield (%) from Stripe Rust based on Growth Stage of Wheat and Host Susceptibility.**

\[ Z = \text{Zadoks Decimal Growth Scale} \]

\[ F = \text{Feekes Growth Scale} \]

**Start of Epidemic (Epiphytotic) Percentage Loss in Crop based on Host Susceptibility**

<table>
<thead>
<tr>
<th>Stage of Epidemic (Epiphytotic)</th>
<th>Percentage Loss in Crop based on Host Susceptibility</th>
</tr>
</thead>
<tbody>
<tr>
<td>First Node (Z31; F6)</td>
<td>85, 75, 55, 25</td>
</tr>
<tr>
<td>Flag leaf (Z39; F9)</td>
<td>75, 45, 15, 5</td>
</tr>
<tr>
<td>Mid-boot (Z45; F10)</td>
<td>65, 25, 7, 2</td>
</tr>
<tr>
<td>First awns visible; First Spikelet of Inflorescence Barely Visible (Z49; between F10-10.1)</td>
<td>50, 10, 3, 1</td>
</tr>
<tr>
<td>Mid-heading, half of inflorescence emergent (Z55; F10.3)</td>
<td>40, 5, 2, 0</td>
</tr>
<tr>
<td>Mid-flowering; Anthesis half way (Z65; 10.52)</td>
<td>12, 2, 1, 0</td>
</tr>
</tbody>
</table>

**Start of Epidemic (Epiphytotic) Percentage Loss in Crop based on Host Susceptibility**

<table>
<thead>
<tr>
<th>Stage of Epidemic (Epiphytotic)</th>
<th>Percentage Loss in Crop based on Host Susceptibility</th>
</tr>
</thead>
<tbody>
<tr>
<td>First Node (Z31; F6)</td>
<td>85, 75, 55, 25</td>
</tr>
<tr>
<td>Flag leaf (Z39; F9)</td>
<td>75, 45, 15, 5</td>
</tr>
<tr>
<td>Mid-boot (Z45; F10)</td>
<td>65, 25, 7, 2</td>
</tr>
<tr>
<td>First awns visible; First Spikelet of Inflorescence Barely Visible (Z49; between F10-10.1)</td>
<td>50, 10, 3, 1</td>
</tr>
<tr>
<td>Mid-heading, half of inflorescence emergent (Z55; F10.3)</td>
<td>40, 5, 2, 0</td>
</tr>
<tr>
<td>Mid-flowering; Anthesis half way (Z65; 10.52)</td>
<td>12, 2, 1, 0</td>
</tr>
</tbody>
</table>

**RUST THRESHOLD: Disease Management for Leaf Rust**

Approximate percent loss of yield caused by leaf rust at combinations of leaf rust severity and growth stage of wheat.

<table>
<thead>
<tr>
<th>Severity (%) of leaf rust on the flag leaf</th>
<th>10</th>
<th>25</th>
<th>40</th>
<th>65</th>
<th>100</th>
</tr>
</thead>
<tbody>
<tr>
<td>Growth stage</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>FLOWERING</td>
<td>10</td>
<td>15</td>
<td>20</td>
<td>30</td>
<td>35</td>
</tr>
<tr>
<td>Milk</td>
<td>2</td>
<td>3</td>
<td>8</td>
<td>14</td>
<td>20</td>
</tr>
<tr>
<td>Soft dough</td>
<td>1</td>
<td>3</td>
<td>4</td>
<td>7</td>
<td>10</td>
</tr>
<tr>
<td>Hard dough</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>3</td>
<td>5</td>
</tr>
</tbody>
</table>

**TEXAS: Stripe Rust Threshold Study to determine potential economic thresholds -2008**

- TAM 111: Leaf rust (S), Stripe Rust (R)
- TAM 112: Leaf Rust (S), Stripe Rust (S)
- TAM 304: Leaf Rust (R), Stripe Rust (mod. S)
- Fannin: Leaf Rust (R), Stripe Rust (R)

S=Susceptible, R=resistant

Sprayed ~ Feekes 10.5 (Fully headed) for all treatments

Split application of Quilt- Feekes 10.5 & 10.51 (mid flowering)

NO RUST AT TIME OF SPRAY

**TAM 111: Leaf rust (S), Stripe rust (R)**

<table>
<thead>
<tr>
<th>Year 1</th>
</tr>
</thead>
<tbody>
<tr>
<td>Quilt (A+P) Headline (P)</td>
</tr>
<tr>
<td>Yield (bu/a)</td>
</tr>
</tbody>
</table>

**TAM 112: Leaf rust (S), Stripe rust (S)**

<table>
<thead>
<tr>
<th>Year 1</th>
</tr>
</thead>
<tbody>
<tr>
<td>Quilt (A+P) Headline (P)</td>
</tr>
<tr>
<td>Yield (bu/a)</td>
</tr>
</tbody>
</table>

**Fusarium foot (crown) rot?**

**Fusarium foot (crown) rot?**
Seedborne (Seedling) Diseases

- Most seedborne diseases are fungal.
- Most seed treatment ingredients are fungicides.
- Manage seedborne smuts and bunts.
- Improve stand establishment.
- Potential for increased tillering with better root health.
- Root rot suppression.
- Manage fall season foliar diseases.
Wheat: *Rhizopus* sp.

Wheat: *Nigrospora* sp.

*Rhizoctonia* sp.

*Rhizoctonia* root rot

*Pythium* spp.

*Pythium* root rot?

*Cochliobolus sativus* (Bipolaris sorokiniana)

*Common root rot*
Loose Smut (*Ustilago tritici*)

Sooting Smut (Common bunt)

Sooty Mold

Black point (Kernel smudge)

*Alternaria* spp., *Cladosporium* spp., *Epicoccum* spp., *Sporobolomyces* spp., *Stemphylium* spp., and others.


*Alternaria* sp.

*Epicoccum* sp.
Fusarium seed scab (Fusarium graminearum/Gibberella zeae)

Common seed treatment fungicides labeled for use on winter wheat

<table>
<thead>
<tr>
<th>Trade Name</th>
<th>Common Chemical name</th>
<th>% Active ingredient</th>
<th>Rate</th>
<th>Additional label information</th>
</tr>
</thead>
</table>
| Dividend XL Syngenta | difenoconazole netbencron | 3.2% / 6.27% | 2.5 fl oz per 100 lbs of seed OR 5.0 fl oz per 100 lbs of seed OR 10.0 fl oz per 100 lbs of seed | Disease control. The 1.0 fl oz rate of Dividend XL RTA are for control of common rust. Dividend XL RTA and the 2.0 fl oz rate are common rust, dwarf bunt, and eye spot and, in the case of corn, Gnetothoron.
| Dividend Extreme Syngenta | difenoconazole netbencron | 7.37% / 1.67% | 1.0 fl oz per 100 lbs of seed OR 2.0 fl oz per 100 lbs of seed OR 4.0 fl oz per 100 lbs of seed | The 1.0 fl oz rate of Dividend XL RTA are for control of common rust, dwarf bunt, general seed rots, Fusarium seed rot, Pythium seed rot, and crown rot. The use of this product is limited to the grains in the 100% forage harvest. 
| Crederol SF Syngenta | thiophanamide | 47.6% | 1.0 fl oz / 100 lb of seed | Insect control: Early season protection including seed treatment and sowing into clean, weed-free fields.
Conclusions

- Fungi are present in soil, seed, roots, foliar tissue, and heads.

- Fungal pathogens will vary with location, so management practices, including fungicide seed treatments, need to be adjusted to what is present in a field.

- Further studies (field, in vitro) will attempt to determine which chemistries work better against a certain fungal population or isolates of a specific fungus.

Viruses and Vectors

Most common viruses

- **Wheat streak mosaic virus** (WSMV)
- **Wheat Mosaic Virus**-WMoV (aka High plains virus -HPV)
- **Triticum mosaic virus** (TriMV)-2006
- **Barley yellow dwarf virus** (BYDV)
- **Cereal yellow dwarf virus** (CYDV)-Subgroup II

<table>
<thead>
<tr>
<th>Plants</th>
<th>Milo increase</th>
<th>WSMV Susceptibility</th>
</tr>
</thead>
<tbody>
<tr>
<td>oat</td>
<td>Poor</td>
<td>Susceptible</td>
</tr>
<tr>
<td>barley</td>
<td>Poor</td>
<td>Resistant</td>
</tr>
<tr>
<td>proso millet</td>
<td>Good</td>
<td>Susceptible</td>
</tr>
<tr>
<td>rut</td>
<td>Poor</td>
<td>Resistant</td>
</tr>
<tr>
<td>sorghum</td>
<td>Poor - Good</td>
<td>Susceptible</td>
</tr>
<tr>
<td>corn</td>
<td>Poor - Fair</td>
<td>Susceptible</td>
</tr>
<tr>
<td>johnsongrass</td>
<td>Fair - Good</td>
<td>Susceptible</td>
</tr>
<tr>
<td>interseese grass</td>
<td>Fair - Good</td>
<td>Susceptible</td>
</tr>
<tr>
<td>wheat</td>
<td>Fair</td>
<td>Susceptible</td>
</tr>
<tr>
<td>durum wheat</td>
<td>Good</td>
<td>Susceptible</td>
</tr>
<tr>
<td>farro</td>
<td>Good</td>
<td>Susceptible</td>
</tr>
<tr>
<td>smooth crabgrass</td>
<td>Poor - Good</td>
<td>Susceptible</td>
</tr>
<tr>
<td>crabgrass</td>
<td>Poor</td>
<td>Susceptible</td>
</tr>
<tr>
<td>bermayed grass</td>
<td>Poor</td>
<td>Susceptible</td>
</tr>
<tr>
<td>yellow foxtail</td>
<td>None - Poor</td>
<td>Susceptible</td>
</tr>
<tr>
<td>green foxtail</td>
<td>Poor</td>
<td>Susceptible</td>
</tr>
<tr>
<td>f. chilipass</td>
<td>Poor</td>
<td>Susceptible</td>
</tr>
<tr>
<td>buffalograss</td>
<td>None</td>
<td>Susceptible</td>
</tr>
<tr>
<td>side cup grama</td>
<td>Poor</td>
<td>Susceptible</td>
</tr>
<tr>
<td>smooth brana</td>
<td>Very poor</td>
<td>Susceptible</td>
</tr>
<tr>
<td>canesia virginia</td>
<td>Poor - Fair</td>
<td>Susceptible</td>
</tr>
<tr>
<td>johnsongrass</td>
<td>Poor - Good</td>
<td>Susceptible</td>
</tr>
</tbody>
</table>

Table 1. Susceptibility of selected plants to milo increase and to WSMV

Wheat Streak Mosaic: Severely infected plants desiccate and can die

**Triticum mosaic virus**

- Wheat, others?
- Transmitted by Wheat curl mite
- Appearance can be confused with WSMV
- Unknown yield potential losses.

J. Price
**Wheat mosaic virus (aka High Plains Virus)**

- Corn, wheat, barley, oats, and rye
- Transmitted by Wheat curl mite
- Symptoms: mosaic and streaking patterns, bright yellow streaks (wheat)
- Potential severe yield losses

Prevention is the Key: Managing the Wheat Curl Mite (*Aceria tosichella*) is the only option. Once the plant has the virus there is no cure.

Waco area

Wichita Falls area
Management of WSMV, TriMV & WMoV(HPV)

Destroy the host for Wheat Curl Mite

Variety selection for WSMV (TAM 112 tolerance)
  - will not hold-up to heavy pressure

Cultural practices
  - Wheat curl mite can not live without a host
  - Remove all volunteer wheat and weeds at least 21 days before planting wheat

Pathogen? Mosaic?

Yes...but caused by a bacterium

Fact Sheets

Climbing the “Probability Ladder” for Foliar Disease Problems.

- Susceptible host
- Continuous crop
- No-till
- Planting Date
- Yield potential
- Irrigation
- Disease activity after flowering

High probability

Alternative hosts

Low probability
THANK YOU!

For more information:

http://sickcrops.tamu.edu