Stripe Rust and the Effect of Fungicide Application on Wheat

- Stripe rust can infect and cause significant yield loss in susceptible wheat products when conditions favor the disease.
- Fungicides effective against stripe rust have been found to protect yield.
- Proper fungicide applications should be timely and chosen for their effectiveness against the specific diseases present.

Spread and Infection of Stripe Rust

Stripe (yellow) rust (*Puccinia striiformis*) can cause yield losses up to near 50% in moderately susceptible wheat products when conditions are favorable for disease development and spread throughout the growing season. Inoculum can be from several sources: dormant mycelium and uredinia, volunteer wheat plants, nearby fields with a different maturity date, alternate hosts such as *Berberis* spp., or winds carrying inoculant from fields in southern United States. Researchers continue to work to develop new wheat products with tolerance to various races of *P. striiformis*.

While several diseases can impact wheat, stripe rust is a predominant rust in some areas and is characterized by its yellow to orange pustules called uredia. Uredia can be seen in stripes generally after stem elongation in wheat (Figure 1). In addition to decreasing active photosynthetic area on leaves, stripe rust also utilizes water and nutrients from host plants. Leaf rust is a similar rust that can be present and is characterized by reddish-orange uredia, scattered on leaves and sheaths of infected plants. Infection can appear on lower leaves or upper leaves depending on if spores overwintered or were deposited from the air, respectively. Stripe rust generally causes more yield loss than leaf rust.

Stripe Rust Management with Fungicides

Fungicides can help protect yield and have prevented multimillion dollar losses. In 1981, a severe outbreak of stripe rust in the Pacific Northwest led to large scale use of fungicides. Without fungicide control, highly susceptible wheat cultivars were destroyed and cultivars with moderate resistance to stripe rust had 50% yield loss.

Learning Center Study at Gothenburg, NE

A study at the Monsanto Learning Center at Gothenburg, Nebraska evaluated the potential benefits of a fungicide application on wheat at boot stage (Feekes 10) when stripe rust was evident. The study was also intended to evaluate potential differences in observed benefits between products that tend to be more curative (Caramba®) compared to products that tend

<table>
<thead>
<tr>
<th>Product Name</th>
<th>Active Ingredient</th>
<th>Fungicide Class</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Headline®</strong></td>
<td>Pyraclostrobin</td>
<td>Strobilurin</td>
</tr>
<tr>
<td><strong>Caramba®</strong></td>
<td>Metconazole</td>
<td>Triazole</td>
</tr>
<tr>
<td><strong>Twinline®</strong></td>
<td>Pyraclostrobin +</td>
<td>Strobilurin + triazole</td>
</tr>
<tr>
<td></td>
<td>metconazole</td>
<td></td>
</tr>
<tr>
<td><strong>Priaxor®</strong></td>
<td>Pyraclostrobin +</td>
<td>Strobilurin + succinate-</td>
</tr>
<tr>
<td></td>
<td>fluxapyroxad</td>
<td>dehydrogenase (SDH) inhibitor</td>
</tr>
</tbody>
</table>

Figure 1. Stripe rust (left) and leaf rust (right).
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to be more protective (Headline®) and the combination of these fungicides (Table 1).

A WestBred® variety Winter-Hawk was planted on October 17, 2014 into a dryland field that was no-till and previously in soybean. Weeds were uniformly controlled using a residual/post weed control program. A blanket application of fungicide at 6 oz/acre was applied to the area on April 29, 2015 (Feekes 5 growth stage). Four fungicides were applied at typical rates with recommended surfactants at the boot growth stage (Feekes 10) on May 21, 2015 (Table 2). The study was a randomized complete block design with four replications.

Study Results

Plots were harvested on July 21, 2015 with moisture content, test weight, and yield recorded. A fungicide treatment provided an 11 to 14 bu/acre benefit compared to the wheat without a fungicide application (Table 3). Depending upon the year, stripe rust can significantly reduce yield potential.

Summary

Cool, wet weather along with a susceptible wheat variety and stripe rust inoculum can lead to a severe stripe rust outbreak. Timely fungicide applications can control the disease and decrease the potential for yield loss. There are different types of fungicide available with some tending to have more curative properties (Caramba®), others tending to have more preventative properties (Headline®), and products with a combination of the two. Farmers should choose the fungicide that best fits the disease(s) present and the conditions in the field.

Table 2. Fungicide rate and formulation for each treatment.

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Fungicide</th>
<th>Formulation</th>
<th>Rate Applied</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>No Fungicide</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>2</td>
<td>Headline®</td>
<td>+ Nonionic surfactant (NIS) 2.09 lb/gal 6 fl oz/acre 0.125% v/v</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Caramba®</td>
<td>+ NIS 0.75 lb/gal 11 fl oz/acre 0.125% v/v</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Twinline®</td>
<td>+ NIS 1.75 lb/gal 7 fl oz/acre 0.125% v/v</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Priaxor®</td>
<td>+ NIS 4.17 lb/gal 4 fl oz/acre 0.125% v/v</td>
<td></td>
</tr>
</tbody>
</table>

Table 3. Average moisture content, test weight, and yield at harvest for each fungicide treatment.

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Moisture Content (%)</th>
<th>Test Weight (lb/bu)</th>
<th>Yield (bu/a)</th>
</tr>
</thead>
<tbody>
<tr>
<td>No Fungicide</td>
<td>12.0b</td>
<td>55.9b</td>
<td>50b</td>
</tr>
<tr>
<td>Headline®</td>
<td>14.0a</td>
<td>59.4a</td>
<td>62a</td>
</tr>
<tr>
<td>Caramba®</td>
<td>14.3a</td>
<td>59.5a</td>
<td>63a</td>
</tr>
<tr>
<td>Twinline®</td>
<td>14.6a</td>
<td>60.5a</td>
<td>64a</td>
</tr>
<tr>
<td>Priaxor®</td>
<td>14.0a</td>
<td>59.2a</td>
<td>61a</td>
</tr>
<tr>
<td>LSD (P = 0.05)</td>
<td>0.98</td>
<td>2.23</td>
<td>5.4</td>
</tr>
<tr>
<td>Coefficient of Variation</td>
<td>4.63</td>
<td>2.46</td>
<td>5.9</td>
</tr>
</tbody>
</table>

* letters ‘a’ and ‘b’ indicate significant differences between treatments.

Sources:

3 Lipps, P.E. Leaf rust of wheat, The Ohio State University. AC-6-96.
4 Chen, X.M. Epidemiology and control of stripe rust [Puccinia striiformis f. sp. tritici] on wheat.

Figure 2. Wheat plot treated with Twinline® fungicide (photo taken before harvest).