Assessment of Fusarium Head Blight Resistance in Registered Spring Wheat Varieties Under Natural Conditions in Manitoba, Canada

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Objectives

• Post-registration assessment of spring wheat varieties in Manitoba for resistance to Fusarium head blight (FHB)
• Provide additional years of data (under natural conditions) for growers and agronomists to use as supplementary information when selecting varieties

Introduction

• FHB has been a major issue facing spring wheat growers in Manitoba since the first major outbreak in the province in 1993
• Varietal resistance and foliar fungicides are the two main methods for managing this disease
• FHB resistance ratings are assigned to varieties based on three years of testing in the Variety Registration Trials located across the Canadian prairies
• The list of registered varieties available to Manitoba growers continues to increase each year with limited disease data available comparing older varieties to newly registered varieties

Materials & Methods

• Composite samples of spring wheat varieties were collected from Manitoba Crop Variety Evaluation Team (MCVET) trials (uninoculated) located across the province from 2009 to 2017
• Collected samples were analyzed for level of FDK (%) as measured per the Official Grain Grading Guide of the Canadian Grain Commission and accumulation of DON (ppm) using the ELISA test method
• Long-term means of FDK and DON were calculated using the mixed model analysis to adjust for factors such as variety, year, site, and their interactions

Results & Discussion

• Generally, spring wheat varieties rated as susceptible (S) consistently showed higher FDK and DON levels (Figures 1 and 2)
• Variability of performance is observed within the five resistance categories ranging from resistance (R) to susceptible (S) (note: not all varieties tested are listed in figures)
• Variance and component analysis of FDK using the mixed model analysis reveal that the variability in the data is influenced by a number of factors: Variety (23%), interaction of Year and Site, Year and Variety (22%), Year (20%), and interaction of Year and Site (19%)
• Conversely, Variety and the interaction of Year and Site represented most of the variability for DON levels (44% and 26%, respectively), with the interaction of all three variables (Year, Site, and Variety) also having an effect (20%)
• Therefore, DON levels may be a more consistent indicator of resistance gene expression versus FDK
• As advances are made in breeding, it is important to evaluate disease resistance of varieties pre- or post-registration

Table 1. FDK and DON levels measured at various MCVET sites from 2009 to 2016

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<tbody>
<tr>
<td>FDK (%)</td>
<td>0.32</td>
<td>2.04</td>
<td>0.82</td>
<td>0.71</td>
<td>1.64</td>
<td>1.41</td>
<td>3.07</td>
<td>4.88</td>
<td>1.40</td>
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<td>DON (ppm)</td>
<td>0.60</td>
<td>1.78</td>
<td>1.07</td>
<td>0.89</td>
<td>1.30</td>
<td>1.39</td>
<td>1.39</td>
<td>1.71</td>
<td>4.95</td>
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• Levels of infection varied over the nine years of study, with the highest levels of FDK and DON observed in 2016 and the lowest levels observed in the first year of the study, 2009 (Table 1)
• Levels of infection also varied by site: from 2011 to 2016 the Boissevain location had the highest or second highest infection level based on FDK and DON whereas the Dauphin location has been amongst the lowest for FHB infection based on FDK and DON (data not shown)

Figure 1: FDK and DON Comparisons of Canadian Western Red Spring Wheat Varieties from 2009 to 2017 (FHB Resistance Rating Indicated)

Figure 2: FDK and DON Comparisons of Canadian North Hard Red, Canadian Prairie Spring Red, and Canadian Western Special Purpose Wheat Varieties from 2009 to 2017 (FHB Resistance Rating Indicated)

• Multi-year, multi-site data will increase accuracy in predicting variety reaction to FHB
• Further analysis of this data such as seeding date and maturity may also offer further insight of the influence of variety and local weather conditions on the productions of symptoms and DON content which can help validate local FHB prediction models
• Additional analysis can also be done with this data to monitor the relationship between FDK and DON based on year, location, and variety

Acknowledgements