

# Effect of Fusarium Head Blight on Winter Wheat Varieties in 2014

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## Background & Introduction

Fusarium head blight (FHB) is a major disease of wheat in Manitoba and can impact producer's profitability through reduced grain yield and quality. The annual Winter Wheat FHB Survey conducted by Manitoba Agriculture, Food and Rural Development measured the 2014 FHB Index at 11.6%, higher than the 10-year average of 3.4%. Factors contributing to the higher levels in 2014 included: (1) favourable conditions for inoculum development and infection, (2) winterkill and injury causing variable crop staging within fields, resulting in difficulty timing fungicide applications, and (3) the large number of acres grown to varieties rated moderately susceptible or susceptible (over 90%).

In winter wheat, FHB will be a Priority 1 Disease effective 2015 where evaluating reaction to FHB will be a requirement for variety registration. Fortunately, many winter wheat breeders have already been evaluating FHB reaction of proposed lines in disease nurseries during the registration process, providing the resistant ratings found in *Seed Manitoba 2015 – Variety Selection & Growers Source Guide*. However, the data generated provides limited comparisons with other registered varieties over limited locations, and often only uses Visual Rating Index (VRI) data. In some cases, those three years of testing may not provide sufficient information about the disease reaction to FHB. Therefore, further testing is required to provide additional information on disease reaction to FHB to help producers with variety selection.

## Objective

➤ To evaluate how winter wheat varieties being tested post-registration in the Manitoba Crop Variety Evaluation Trials (MCVET) respond to fusarium head blight under non-misted conditions (natural infection) by measuring severity in-field, and assessing harvested samples for fusarium damaged kernels (FDK) and deoxynivalenol (DON) accumulation.

## Materials & Methods

Composite samples of ten registered winter wheat varieties were collected from the three replicates at five MCVET sites: Arborg, Beausejour, Carberry, Isabella and Winnipeg. The resistant ratings of the varieties to FHB as presented in *Seed Manitoba 2015* are: Emerson - Resistant (R), CDC Buteo - Moderately Resistant (MR), AAC Gateway - Intermediate (I), CDC Chase - Moderately Susceptible (MS), and Broadview, CDC Falcon, Flourish and Moats - Susceptible (S). No ratings are available for Sunrise and Swainson.

BioVision Seed Labs in Winnipeg, Manitoba conducted the analysis. The level of FDK (%) was measured as per the Official Grain Grading Guide of the Canadian Grain Commission. The accumulation of DON (ppm) was measured using the ELISA test method.

FHB severity was assessed at four of the five locations by determining FHB Index (% incidence x % mean spike proportion infected / 100) approximately three weeks after anthesis.

## Results

No fungicides were applied to the trials and the severity of FHB was a result of natural infection. Severity ratings indicate the higher infection levels were consistent with commercial winter wheat fields. The higher infection levels allowed for good varietal differentiation to FHB.

The highest levels of FDK and DON were measured in Arborg, while the lowest levels of infection occurred in Winnipeg (see Table 1). The variety Emerson, rated as Resistant (R), had lower levels of FDK and DON compared to the other varieties (see Figure 1) and consistently had lower visual symptoms or severity as expressed by the FHB Index (data not shown).

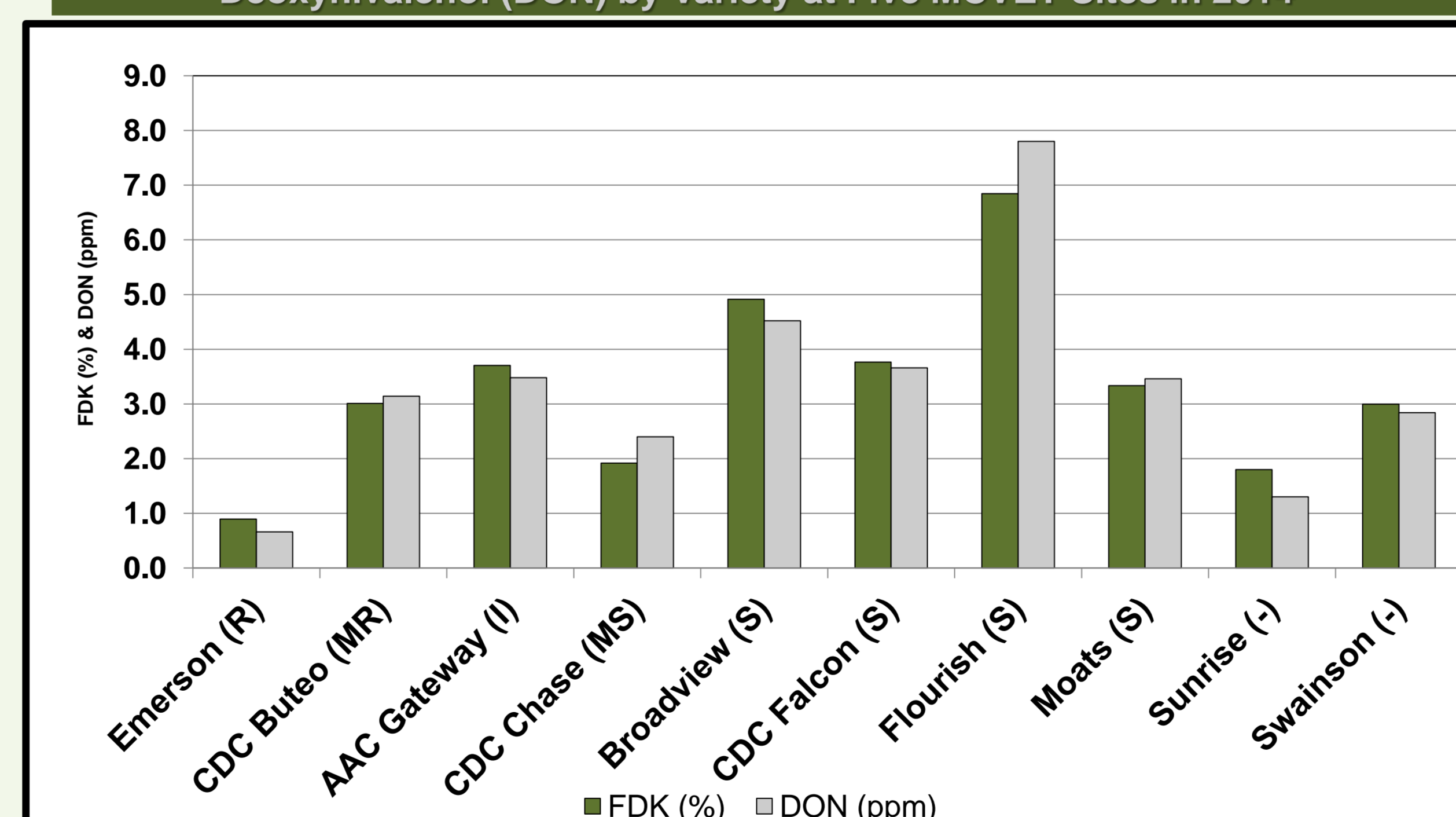
Table 1: Fusarium Damaged Kernel (FDK) and Deoxynivalenol (DON) Comparisons at Five MCVET Sites in 2014

Class/Variety	2014 Average		2014 FDK (%) & DON (ppm)										
	FDK	DON	Arborg		Beausejour		Carberry		Isabella		Winnipeg		
			FDK	DON	FDK	DON	FDK	DON	FDK	DON	FDK	DON	
<b>Canada Western Red Winter</b>													
AAC Gateway	3.7	3.5	7.3	6.5	2.3	4.0	3.5	2.5	4.2	3.8	1.2	0.6	
CDC Buteo	3.0	3.1	3.9	4.5	1.1	2.5	5.6	4.0	3.8	4.1	0.6	0.6	
CDC Chase	1.9	2.4	2.7	2.8	1.6	3.2	2.2	2.4	2.1	2.5	1.0	1.1	
Emerson	0.9	0.7	1.9	0.8	0.5	0.6	1.1	1.3	0.7	0.5	0.3	0.1	
Flourish	6.8	7.8	9.0	10.0	4.3	8.0	7.5	6.0	11.4	13.0	2.0	2.0	
Moats	3.3	3.5	5.7	5.0	1.4	3.9	4.5	3.5	3.2	3.7	1.9	1.2	
<b>Canada Western General Purpose</b>													
Broadview	4.9	4.5	8.1	6.0	1.9	4.2	8.9	6.0	4.2	5.0	1.4	1.4	
CDC Falcon	3.8	3.7	6.2	3.0	1.9	4.6	4.7	5.5	4.7	4.1	1.3	1.1	
Sunrise	1.8	1.3	3.0	1.2	0.4	2.4	2.6	0.6	2.3	2.1	0.7	0.2	
Swainson	3.0	2.8	4.6	4.0	1.9	2.9	4.1	3.0	2.7	3.3	1.6	1.0	
<b>GRAND MEAN (% &amp; ppm)</b>	<b>3.3</b>	<b>3.3</b>	<b>5.2</b>	<b>4.4</b>	<b>1.7</b>	<b>3.6</b>	<b>4.5</b>	<b>3.5</b>	<b>3.9</b>	<b>4.2</b>	<b>1.2</b>	<b>0.9</b>	

Some varieties rated as Susceptible (S) consistently showed higher FHB severity, FDK and DON levels across all sites. However, data also shows there is variability of performance within the four resistance categories of Moderately Resistant (MR) to Susceptible (S).

Average FDK and DON levels of 3.3% and 3.3 ppm, respectively, over the five locations (Table 1) showed a close relationship between the two parameters. However, at two sites, average DON accumulation was higher than the FDK levels, with DON levels more than double the FDK value at the Beausejour site. Some varieties tended to have lower DON accumulation compared to its FDK value across majority of sites (excluding Beausejour), while others tended to have higher DON levels in comparison to FDK (Figure 1). However, there was again variability between varieties and between locations in the relationship between FDK and DON.

Figure 1: Average Levels of Fusarium Damaged Kernel (FDK) and Deoxynivalenol (DON) by Variety at Five MCVET Sites in 2014



## Discussion

Extensive research over the past 20 years shows using multiple management options, including crop rotation, fungicide application and variety selection, is the best way to mitigate the risk of FHB. Although FHB infection will always be highly influenced by environment, the first step is to select varieties with improved resistance and then use them in combination with other management strategies. In years where there is higher disease pressure, such as 2014, variety selection will be critical to minimize the impact of FHB on yield and quality. However, under high disease pressure yield and quality loss due to FHB can still happen in varieties that have improved resistance as resistance does not equal immunity.

## Summary & Next Steps

➤ To reduce the risk of fusarium head blight, producers should select varieties with improved resistance as the study indicates varieties with improved resistance generally had lower severity, FDK and DON levels. However, caution must be used with one year of data, as presented in this study. Using data derived over two or more growing seasons over multiple sites is always recommended to provide the best indicator of variety performance.

➤ As advances are made in breeding, it is important to evaluate disease resistance of varieties pre- and post-registration so expectations can be managed in how varieties with improved resistance levels will perform relative to current varieties. Providing additional information on variety reaction to FHB will be critical going forward as some grain buyers now require DON testing prior to delivery and are not relying as heavily on FDK as the grading factor. Changes to merit testing requirements for evaluating FHB reaction during the variety registration process may be required. For winter wheat, measuring DON accumulation in addition to VRI is recommended.

➤ Varieties are normally tested by MCVET for three to four years, and this turnover of varieties requires on-going evaluation of newly registered varieties. It is hoped funding may be secured to gather long term FDK and DON data to assess how varieties perform in post-registration trials to FHB. Multi-year data over many MCVET sites will increase accuracy in predicting variety reaction to FHB. A combination of pre- and post-registration testing of severity and DON accumulation will provide much needed data for producers and the entire wheat value chain.

➤ Continually monitoring the relationship between FDK and DON is important as FDK is the grading factor used by the industry to predict DON levels. If the relationship between the two factors starts to change where FDK is not accurately predicting DON levels, modifications to the grading standards may be necessary.

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## Sources

➤ *Seed Manitoba 2015 - Variety Selection & Growers Source Guide*, [www.seedmb.ca](http://www.seedmb.ca)  
 ➤ Official Grain Grading Guide, August 1, 2014. Canadian Grain Commission, <http://www.grainscanada.gc.ca/gggg-gocg/ggg-gcg-eng.htm>  
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