Factsheet: An on-farm approach to evaluate the interaction of management and environment on Fusarium Head Blight development in wheat

Objective:

The project objective of this study is to examine the additive and interactive effects of multiple management and environmental variables on FHB development in wheat under commercial production.

Methodology:

The study was conducted on commercial farms, in collaboration with local producers in three locations, Indian Head, Melfort, and Scott, Saskatchewan, for three growing seasons, from 2018-2020. The fields chosen for the study were approximately 160 acres in area but could be part of larger management units. The geographical coordinates of 3 or 4 representative sample sites in each field was marked for repeated sampling. The sample sites were located along roads for quick access but at sufficient distance to avoid headlands, and were isolated from each other as much as possible within a field. The replicates were arranged hierarchically, in that sample sites were nested within fields, fields were nested within operations, and the same operations could potentially be included over the 3 years of the study. As each operation had multiple fields of wheat that were seeded successively in the spring, this provided a range of different environmental conditions for each replicate throughout the growth stages of the crop. The number of replicates at each level over the 3 years of the study is summarized in Table 1. Over the 3-year duration of the study, data was collected at 314 sample sites, in 91 fields from 12 different operations in the three locations.

Table 1. Replication at the sample site, field, and operation level in each growing season over the duration of the study.

Year	Location	Producers	Fields	Sample Sites
2018	Indian Head	4	14	52
	Melfort	3	9	27
	Scott	3	9	35
	Total	*10*	*32*	*114*
2019	Indian Head	4	12	41
	Melfort	3	9	30
	Scott	3	9	34
	Total	*10*	*30*	*105*
2020	Indian Head	3	12	39
	Melfort	3	9	32
	Scott	3	8	24
	Total	*9*	*29*	*95*
	Total	**12***	**91**	**314**

*7 producers x 3 years, 3 producers x 2 years, and 2 producers x 1 year each

Key Findings:

- The management practices most often recommended for FHB risk management in commercial fields include the use of resistant varieties and a timely fungicide application.
- Results of this study suggest that the choice of variety and fungicide product are highly influential on FHB development, but that the timeliness of fungicide application was less important.
- Environmental conditions have been shown to be highly influential on the development of FHB, FDK, and DON, and the use of forecasting tools for predicting FHB development in a crop is also highly recommended.
- Results indicate that environmental variables affecting the development of FDK in the crop during pre-anthesis stages were mainly related to temperature, while influential variables during post-anthesis stages were related to moisture.
- Results of this study have also shown that environmental variables are mainly interactive with FHB risk management practices, and the effects are not additive. Yet, the effects of environmental variables are usually isolated from the effects of management in the development of predictive models.

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- As FHB risk management practices are commonly applied in commercial wheat fields, these findings confirm that in order to advance our ability to forecast the risk of FHB infection, it will be necessary to more thoroughly evaluate the interactive effects of management and environment.
- Based on the results of this study, it would be most insightful to compare genetic FHB resistance or effectiveness of different fungicide strategies (products and timing) as a function of various environmental conditions.

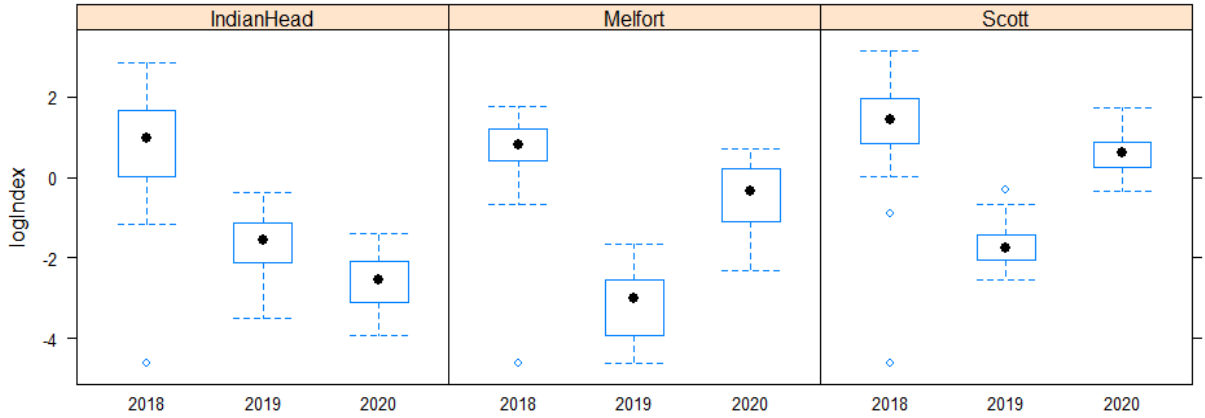

Figure 1. The distribution of *Fusarium* Head Blight (FHB) Index (log-transformed values) within years and locations. Upper and lower limits of the boxes indicate the first and third quartiles, and whiskers indicate the range of values outside the quartiles, with extreme values shown as single points. The centre point indicates the mean.

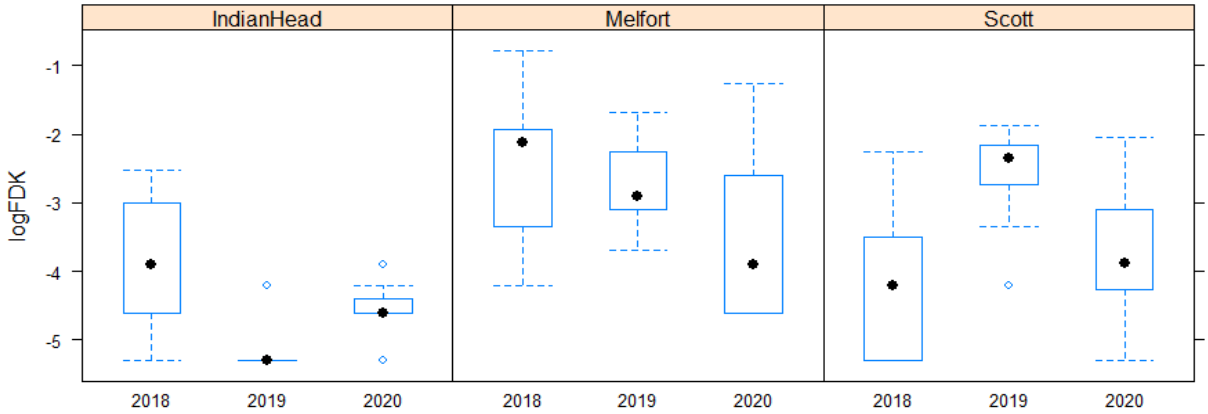

Figure 2. The distribution of *Fusarium* damaged kernels (FDK, log-transformed values) within years and locations. Upper and lower limits of the boxes indicate the first and third quartiles, and whiskers indicate the range of values outside the quartiles, with extreme values shown as single points. The centre point indicates the mean.

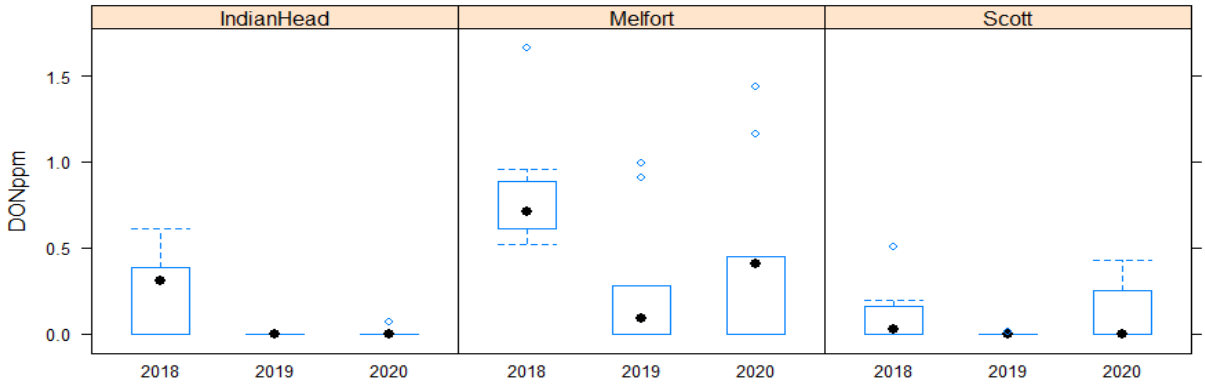

Figure 3. The distribution of deoxynivalenol (DON) level in parts per million (ppm) within years and locations. Upper and lower limits of the boxes indicate the first and third quartiles, and whiskers indicate the range of values outside the quartiles, with extreme values shown as single points. The centre point indicates the mean.

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