The impact of agronomic practices on the development of Fusarium head blight in eastern Saskatchewan

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Fusarium Head Blight (FHB) in wheat and barley, also known as scab or tombstone, has the potential of becoming an important disease in SK. Since its detection in the early 1990's FHB has slowly spread westward from the Manitoba border through eastern SK. This spread has had a major negative impact on yield and quality of common and durum wheat and barley in this area. Further, it has caused many producers to reduce their production of these crops, often having to resort to less profitable crop choices.

There are many *Fusarium* spp. that can cause FHB. The most pathogenic ones are *F. graminearum* and *F. culmorum.* The most common *Fusarium* spp. isolated from infected cereal heads in SK have been *F. avenaceum*, *F. poae* and *F. sporotrichioides*, all considered to be weak pathogens (Fernandez et al., 2001). *F. graminearum* has been commonly isolated from infected wheat and barley fields in southeastern SK but remains at very low levels or absent in the rest of the province.

Until cereal cultivars resistant to FHB are developed, and even afterwards, we need to find management practices that will reduce the damage caused by FHB in affected areas and prevent its further spread.

In 1999, we initiated a 5-year (1999-2003) study, funded by the Agriculture Development Fund, to identify agronomic factors that might be associated with FHB-infected fields. The objective of this project is to identify risk production factors that might lead to the development of FHB and provide recommendations to producers for managing this disease.

Crop districts 1B and 5A were selected for this study because of the presence of FHB in previous years. A total of 159 cereal (common/durum wheat and barley) fields in 1999 and 198 fields in 2000 were sampled in these crop districts. Head samples taken from each of these fields at the milk stage were analyzed for the presence of Fusarium infection and species identification. Producers were asked to supply information regarding agronomic practices used on the field(s) in question, such as cultivar, seed source, seed treatment, seeding rate and date, crop history, fertility, herbicide history, tillage and straw management, fungicide use, harvest, grade, among others. We also obtained weather data for the areas surveyed.

A database was created with the results obtained from the field sampling and the information provided by producers. A preliminary analysis has been done on some of these data. The cultivar, rotation and tillage effects are presented below.

Table 1 shows the percentage of fields infected with FHB and the mean severity (FHB index=% of heads affected X mean severity of infection)/100) for those fields. These were divided into fields planted to tolerant and susceptible cultivars. Tolerant cultivars comprised mostly AC

Barrie and other cultivars rated as "fair" (Varieties of Grain Crops 2001) while susceptible cultivars included other hard red spring, Canada Prairie Spring and durum wheat cultivars, all rated "susceptible" or "very susceptible". Percentage of fields infected with FHB was lower in 1999 than in 2000, which was attributed to lower temperatures and drier conditions at the time the crops were most susceptible. The FHB index was also lower in 1999 than in 2000. There was little difference between resistant and susceptible cultivars in the incidence of FHB infection in either year, and no difference in the FHB index in 1999 when the number of infected fields was low. However, a lower mean FHB index for the tolerant than the susceptible cultivars was observed in 2000 when disease pressure was higher. Similar observations were made when only fields infected with *F. graminearum* were analyzed (Table 2).

Table 1: Percentage of FHB-infected fields planted to tolerant and susceptible common/durum wheat cultivars, and FHB index.

	Tolerant Cultivars	Susceptible Cultivars
	----- % -----	
1999		
% fields with FHB	38	33
FHB index[1]	0.6 (n=19)	0.5 (n=11)
2000		
% fields with FHB	93	100
FHB index	1.8 (n=50)	3.3 (n=51)

[1] FHB index (%of heads affected x mean severity of infection)/100.

Table 2: Percentage of FHB-infected fields planted to tolerant and susceptible cultivars where *F. graminearum* was isolated, and FHB index.

	Tolerant Cultivars	Susceptible Cultivars
	----- % -----	
1999		
% fields by *F. graminearum*	4	6
FHB index[1]	0.5 (n=5)	0.7 (n=6)
2000		
% fields by *F. graminearum*	52	53
FHB index	2.7 (n=28)	5.1 (n=27)

[1] FHB index (%of heads affected x mean severity of infection)/100.

Rotation effects were analyzed for 2000 only. There did not appear to be any effect of rotation practice on the incidence of common/durum wheat and barley fields infected with *F. graminearum* (data not presented). Cereal crops that were preceded by a non-cereal crop for up to two years had a similar percentage of fields infected with *F. graminearum* than those that were preceded by another cereal crop.

Table 3: FHB index of infected common/durum wheat fields, percentage of fields with *F. graminearum* and FHB index of the latter fields under conventional, minimum and zero-till in 2000.

Tillage System	FHB Index[1]	% fields with *F. graminearum*	FHB index of fields with *F. graminearum*
Conventional	2.0 (n=33)	48	3.5 (n=16)
Minimum-till	3.3 (n=34)	68	4.3 (n=23)
Zero-till	2.3 (n=34)	47	3.7 (n=16)

[1] FHB index (% of heads affected x mean severity of infection)/100.

Table 4: FHB index of infected tolerant and susceptible common/durum wheat cultivars under conventional, minimum- and zero-till in 2000.

Tillage System	Tolerant Cultivars	Susceptible Cultivars
	----- % -----	
Conventional	2.0 (n=20)	2.2 (n=13)
Minimum-till	2.5 (n=13)	4.1 (n=19)
Zero-till	1.2 (n=16)	3.3 (n=18)

[1] FHB index (% of heads affected x mean severity of infection)/100.

For 2000, common/durum wheat fields under conventional and zero-till had a similar FHB index, which was lower than that of crops grown under minimum-till management (Table 3). This was also true for percentage of fields infected by *F. graminearum* and for the FHB index of the latter fields. When tolerant and susceptible cultivars were analyzed separately (Table 4), tillage effects appeared to depend on the susceptibility of the crop. Differences in FHB index among tillage systems was greater for susceptible than for tolerant cultivars. The highest mean FHB index was for susceptible cultivars under reduced tillage, whereas the lowest was for tolerant cultivars under zero-till management. In addition, differences between tolerant and susceptible cultivars appeared to depend on tillage system. Susceptible cultivars had a higher mean FHB index than tolerant cultivars under reduced tillage only.

Conclusions:

✓ Environmental conditions (temperature, moisture) and susceptibility of the crop were the most important factors in the development of FHB in eastern SK. Tolerant cultivars sustained less damage by FHB than susceptible ones in 2000 when disease pressure was higher than in 1999.

✓ For tolerant cultivars, zero-till did not result in a greater FHB severity than conventional-till. Suceptible crops planted under minimum-till management sustained the most damage due to FHB.

✓ A crop rotation of up to two years with a non-cereal crop did not reduce the incidence of *F. graminearum* in common/durum wheat and barley.

Continuing research into agronomic factors associated with high levels of FHB will allow a better understanding of the development and spread of FHB in SK. We hope that this information will help to stop the spread and/or minimize the impact of this disease and will therefore be of great benefit to producers and the grain industry.

References

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