

# What Agronomic Practices Can Reduce the Effect of Fusarium Head Blight on Durum Wheat in Saskatchewan?

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## Abstract

Fusarium head blight (FHB) has become an important disease of cereals in moist regions of western Canada. This disease has played an important role in contributing to lower grain yields and substantial downgrading of durum wheat (*Triticum turgidum* L. var. *durum*). The objective of this study, conducted at three locations on the Canadian prairie, two in Saskatchewan and one in Manitoba, from 2001 to 2003, was to determine the effect of seeding density, nitrogen supply, fungicide treatment, and durum wheat cultivar on FHB development, grain quality, grade protection and economic return. A four-way factorial design was used with two seed densities (150 and 300 viable seeds m<sup>-2</sup>), two nitrogen rates (75 and 100% of recommended rate), three cultivars (AC Avonlea, AC Morse and AC Navigator), and four fungicide treatments (no application, Tilt at flag leaf, Folicur at anthesis and Tilt at flag leaf followed by Folicur at anthesis). Increasing the seed density decreased FHB at 4 out of the 7 site year when FHB occurred, however increasing the seed density tended to increase leaf disease severity. The application of Folicur did not affect fusarium levels. The application of Tilt and /or Folicur decreased leaf disease at 6 out of 9 site years and affected yield at 5 out of 9 site years. There was no consistent effect from nitrogen or cultivar.

## Introduction

Durum wheat (*Triticum turgidum* L. var. *durum*) markets demand assurance of minimum quality standards. Under moister conditions, leaf spotting diseases, and kernel diseases, particularly red smudge, black point and fusarium head blight (FHB) increase on durum wheat. In past years these diseases have played an important role in contributing to lower grain yields and substantial downgrading of durum wheat. Crop management techniques that allow producers to minimize the probability of their durum crops being downgraded will have a significant effect on their net return. For example, crop rotation, cultivar susceptibility and tillage system have been found to affect levels of FHB and/or kernel infection (Dill-Macky and Jones, 2000; Fernandez et al., 2003).

The overall objective of this study was to develop knowledge that will permit durum wheat producers to implement crop and soil fertility management strategies geared to improving grain quality, yield and achieving a higher grade for the grain they produce. To meet this objective an experiment was conducted to determine the effect of seed density, nitrogen supply, fungicide treatment, and cultivar on grain quality, grade protection and economic return, at three locations over three years.

## **Materials and Methods**

This experiment consisted of a four way factorial conducted at three locations Indian Head, SK, Swift Current, SK and Melita, MB in 2001, 2002 and 2003.

- I) CWAD cultivars: AC Avonlea, AC Morse, and AC Navigator
- II) Seed density: 150, and 300 viable seeds m<sup>-2</sup>
- III) Nitrogen(N): 75% of required N required to optimize yield and protein(soil NO<sub>3</sub>-N plus fertilizer N)( Swift Current - 60 kg ha<sup>-1</sup>, Indian Head and Melita, - 88 kg ha<sup>-1</sup>) and to 100% of required N required to optimize yield and protein(soil NO<sub>3</sub>-N plus fertilizer N) ( Swift Current - 80 kg ha<sup>-1</sup>, Indian Head and Melita, - 118 kg ha<sup>-1</sup>)
- IV) Fungicide None, propiconazole (125 g active ingredient)(Tilt) at flag leaf emergence, tebuconazole (126 g active ingredient)(Folicur) at anthesis, and both Tilt at flag leaf emergence and Folicur at anthesis

The crop received a blanket application of P, K, and S at rates that will ensure these nutrients did not limit growth. Seeding density and nitrogen rates are within the ranges recommended to producers. The experiment was replicated four times at each location. The variables measured were soil nutrient status to 60 cm before seeding, plant density, heads m<sup>-2</sup>, plant height, lodging, leaf spots, grain yield, hard vitreous kernels, protein, test weight, kernel weight, *Fusarium* - damaged kernels (FDK) and visual downgrading factors.

## **Results and Discussion**

### **Fusarium Head Blight**

The percent FDK varied among sites and years with very high levels of FDK at Melita in 2001 and 2002 (Table 1) and no FDK at Swift Current in 2001 and 2003 (data not shown). Increasing the seeding rate decreased the level of FDK in the harvested sample at 4 out of 7 site years. Nitrogen and cultivar (data not shown) had very little effect on FDK. In addition the application of Folicur at anthesis only reduced FDK on AC Navigator at Indian Head in 2001 (Table 2).

### **Leaf Spots**

The application of fungicides did have a large effect on leaf spots (Table 3). Folicur was as effective as Tilt in controlling leaf spots when leaf spots developed later in the growing season (Indian Head 2002, 2003 and Melita 2003). Increasing the seeding rate increased the severity of leaf spots at 5 out of 6 site years. Nitrogen and cultivars (data not shown) did not have a consistent effect on leaf spots.

**Table 1.** The Effect of Fungicide, Nitrogen rate, Seeding Rate and Cultivar on Percent *Fusarium* - Damaged Kernels of Durum Wheat Seed

Fungicide	Indian Head			Melita			Swift Current
	2001	2002	2003	2001	2002	2003	2002
	)))))))))))))))))))))))))) % ))))))))))))))))))))))))))))))))						
None	0.41 <sup>Z</sup>	1.05a <sup>Y</sup>	0.03a	10.8a	8.64a	0.40a	0.73a
Tilt	0.41	0.99a	0.02a	11.0a	9.11a	0.34a	0.77a
Tilt + Folicur	0.21	1.04a	0.02a	10.3a	8.79a	0.35a	0.80a
Folicur	0.19	0.96a	0.01a	10.0a	7.89a	0.39a	0.81a
<b>Nitrogen rate</b>							
75 %	0.30a	1.03a	0.02a	10.8a	8.44a	0.36a	0.72b
100%	0.31a	0.99a	0.02a	10.2a	8.78a	0.38a	0.83a
<b>Seeding rate</b>							
150	0.33a	1.10a	0.02a	11.0a	9.29a	0.40a	0.79a
300	0.28a	0.92b	0.02a	10.0b	7.93b	0.34b	0.76a
CV	101	44	163	27	31	59	45

<sup>Z</sup> significant interaction see Table 2.

<sup>Y</sup>a-c Values for, fungicide, nitrogen rate, seed rate or cultivar within a column followed by the same letter are not different at  $P=0.05$  using a protected LSD.

### Grain Yield

None of the factors consistently affected grain yield (Table 4). The application of fungicides increased grain yield at 2 out of 6 site years and increasing the nitrogen rate increased yield at 2 out of 6 site years. None of the factors had any effect on the grade of harvested samples (data not shown).

**Table 2.** The Effect of Cultivar and Fungicide on Percent *Fusarium* - Damaged Kernels of Durum Wheat Seed at Indian Head, 2001

Fungicide	Cultivar		
	AC Avonlea	AC Morse	AC Navigator
None	0.26 <sup>aZ</sup>	0.30 <sup>a</sup>	0.67 <sup>a</sup>
Tilt	0.33 <sup>a</sup>	0.28 <sup>a</sup>	0.62 <sup>a</sup>
Tilt + Folicur	0.30 <sup>a</sup>	0.15 <sup>a</sup>	0.18 <sup>b</sup>
Folicur	0.19 <sup>a</sup>	0.14 <sup>a</sup>	0.25 <sup>b</sup>
CV	101		

<sup>Z</sup>*a-c* Values for cultivar within a column followed by the same letter are not different at *P*#0.05 using a protected LSD.

### Conclusions

- 1) Increasing the seeding rate tended to lower the percent FDK in the harvested sample
- 2) Application of Folicur at anthesis did not affect percent FDK
- 3) Neither nitrogen and cultivar had a consistent effect on percent FDK
- 4) Increasing the seeding rate increased the severity of leaf spots
- 5) Both Tilt and Folicur reduced the severity of leaf spots
- 6) None of the factors studied improved the grade of the harvested grain.

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**References**

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**Table 3. The Effect of Fungicide, Nitrogen Rate, Seeding Rate and Cultivar on Leaf Spots in Durum Wheat**

Fungicide	Indian Head			Melita		
	2001 <sup>Z</sup>	2002	2003	2001	2002	2003
	)))))))))))))))))) 0-11 <sup>Y</sup> ))))))))))))))))))))					
None	8.9a	10.3a	8.1a	10.0a	8.9a	11.0a
Tilt	7.2b	9.6b	6.8b	8.1b	8.0c	10.4b
Tilt + Folicur	6.1c	7.9c	5.6d	7.4b	7.8c	9.4d
Folicur	7.1b	8.1c	6.6c	9.7a	8.3b	10.1c
<b>Nitrogen rate</b>						
75 %	7.5a	9.0a	6.8a	9.0a	8.2a	10.3a
100%	7.2b	9.0a	6.8a	8.6a	8.3a	10.2a
<b>Seeding rate</b>						
150	7.2b	8.9b	6.7b	8.4b	8.1b	10.3a
300	7.5a	9.1a	6.9a	9.2a	8.4a	10.2a
CV	13	6.5	8.3	28	7.7	5.3

<sup>Z</sup>a-c Values for, fungicide, nitrogen rate, seed rate or cultivar within a column followed by the same letter are not different at P#0.05 using a protected LSD.

<sup>Y</sup> McFadden Scale

**Table 4.** The Effect of Fungicide, Nitrogen Rate, Seeding Rate and Cultivar on the Seed Yield of Durum Wheat

Fungicide	Indian Head			Melita		
	2001	2002	2003	2001	2002	2003
	)))))))))))))))))))))) Mg ha <sup>-1</sup> ))))))))))))))))))))))))					
None	2.50a <sup>Z</sup>	3.80c	2.15a	2.03d	1.47a	2.59a
Tilt	2.55a	3.86bc	2.22a	2.38c	1.49a	2.69a
Tilt + Folicur	2.72a	4.06a	2.09a	2.88a	1.57a	2.71a
Folicur	2.57a	3.95ab	2.22a	2.63b	1.52a	2.66a
<b>Nitrogen rate</b>						
75 %	2.59a	3.88a	2.09b	2.47a	1.54a	2.47b
100%	2.58a	3.94a	2.26a	2.49a	1.48a	2.85a
<b>Seeding rate</b>						
150	2.57a	3.99a	2.19a	2.46a	1.30b	2.55b
300	2.59a	3.84b	2.15a	2.50a	1.72a	2.77a
CV	18	9.4	13	9.6	29	12

<sup>Z</sup> a-c Values for, fungicide, nitrogen rate, seed rate or cultivar within a column followed by the same letter are not different at *P*≠0.05 using a protected LSD.