

Economic Cost of Fusarium



Farm-Level and Regional Economic Impact of Fusarium in Alberta

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Economic Cost of Fusarium: Farm-Level and Regional Economic Impact of Fusarium in Alberta

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(This is an update of the report, originally produced by Richard Heikkila in May 2015)

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Introduction

Fusarium head blight (FHB) is a fungal disease that affects cereal crops, particularly wheat, barley, corn and oats. The three main species of Fusarium are *F. culmorum*, *F. avenaceum* and *F. graminearum*. *Fusarium graminearum* imposes the greatest economic costs due to its much more aggressive nature, resulting in yield and grade losses. *F. graminearum* also produces mycotoxins in the grains, which when consumed can be harmful to humans and animals (especially monogastric animals such as swine and poultry).

The two main disease factors used in this assessment are the frequency and severity of outbreaks. Frequency is often referred to as incidence or prevalence in crop reports. It represents the percentage of samples or fields (respectively) in an area that have Fusarium damaged kernels (FDK). The severity of the disease outbreak is the proportion of FDK in a sample measured on a percentage weight basis amongst the samples that have exhibited any presence of FDK.

The Canadian Grain Commission (CGC) establishes tolerance levels for the severity of Fusarium damage by grade for Canadian Western Red Spring (CWRS¹) wheat as follows:

Table 1. Fusarium tolerance levels

CWRS grade	% of FDK in sample (by weight)	
	Before 2014	2014 and after
No. 1	0.25	0.25
No. 2	0.8	1.0
No. 3	1.5	2.0
Feed	4.0	5.0

Source: Fusarium Head Blight of Barley and Wheat, AF²

The following provides an economic overview of the possible impact of FHB outbreaks at the farm-level and at regional/provincial levels. It is an overview, since various assumptions are used in view of the complexity of disease and data limitations.

¹ CWRS constitutes three quarters of Alberta's total acres planted to wheat and two thirds to three quarters of total wheat production. CWRS is chosen to be a proxy for estimating impact of Fusarium outbreak in Alberta.

² Available: [https://www1.agric.gov.ab.ca/\\$department/deptdocs.nsf/all/agdex92#grading](https://www1.agric.gov.ab.ca/$department/deptdocs.nsf/all/agdex92#grading)

Farm-Level Economic Impact

The purpose of this assessment is to describe the economic costs to the farmer if a field (or a farm) becomes infected. In this case, it is assumed that the entire field has Fusarium (100% incidence) and the analysis is performed using 2016 wheat prices. In Table 2, the impact on a field of grade #1 CWRS is shown at three different disease severity levels (0.5%, 1.2% and 2.2%), which were selected to be just slightly over the 2014 threshold, warranting downgrading. These levels of outbreak result in a downgrade from grade #1 to #2, #3 and feed wheat, respectively. There is a small decrease in yields³, but the main economic impact is from the lower grade values. With 0.5% disease severity, the total revenue loss from reduced yield and downgrade to grade #2 is about \$12 per acre⁴. When the wheat is downgraded further to grade #3 or feed wheat, the economic impact increases significantly to \$35 and \$101 per acre, respectively.

Table 2. A Case Example of the Cost of Fusarium Outbreak in Alberta

Initial grade	#1 CWRS (13.5% protein)		
Yield (bu/ac) ^a	55.5		
Average price (\$/t) ^b	231.8		
Grade impact	#1 - #2	#1 - #3	#1 - Feed
Disease severity	0.5%	1.2%	2.2%
Price spread (\$/t) ^c	7.5	22.8	66.0
Yield loss (bu/ac)	0.06	0.13	0.24
Value of grade loss (\$/t)	7.49	22.75	66.04
Revenue loss (\$/ac)	11.66	35.11	100.85

^a Average yield 2016 (Statistics Canada, Table 32-10-0359-01)

^b Average annual #1 CWRS price, Agriculture Financial Services Corporation (AFSC)

^c CWRS price spread between #1 - #2, #1 - #3, #1 - Feed, AFSC and Alberta Agriculture and Forestry (AF), 2016

³ Yield loss is assumed to be a 20% reduction of the volume of affected grain.

⁴ Here and thereafter the monetary impact is expressed in Canadian dollars.

Regional Economic Impact

FHB caused by *F. graminearum* was first reported in eastern Canada in the early 1900s. The disease became a significant and costly problem in southeastern Manitoba in the mid-1980s and established very rapidly in that province and southeastern Saskatchewan. The pathogen began to move westward and in the late 1980s, *F. graminearum* was reported in Alberta. It is now commonly found in many fields in southern Alberta, and there is increasing evidence that it is spreading to new areas of central and northern Alberta as well. The following is a general assessment of the possible economic impact of Fusarium in Alberta crop districts, based on incidence and severity data collected through the CGC Harvest Sample Program from 2004 to 2017. The original report included analysis from 2004 to 2012. The current report is an update based on 2013 to 2017 information.



In addition to FHB, many other factors, especially weather related factors and other diseases like ergot, affect wheat grades. These factors vary considerably from year to year. For this assessment, it is assumed that these factors are held constant, and that a generalized grade distribution of CWRS in each year is applied as follows:

Table 3. CWRS wheat grade distribution

CWRS grade	% of crop
No. 1	38
No. 2	34
No. 3	19
Feed	10

Source: Sample Harvest (CGC), 2011-2015 average

Based on this initial crop grade distribution, the CGC incidence and severity measures were applied to estimate how much of the crop production by grade was affected by FHB, and how it was downgraded. First, production of CWRS wheat in each crop district by each grade was

calculated, based on the above generalized grade distribution. The incidence level for the crop district as a whole was then applied to each of the wheat grade production levels. Next, the crop district severity rating was applied to determine how each production grade level was to be downgraded.

The graphs below show results for the province and for the individual crop districts in Alberta. Each graph presents historical analysis from the original report covering 2004 to 2012 (bars with lighter shades), and current analysis covering 2013 to 2017 (bars with darker shades). The first graph shows for the province as a whole how production of some grades of CWRS (below the X-axis) transfers to other grades (above the X-axis).

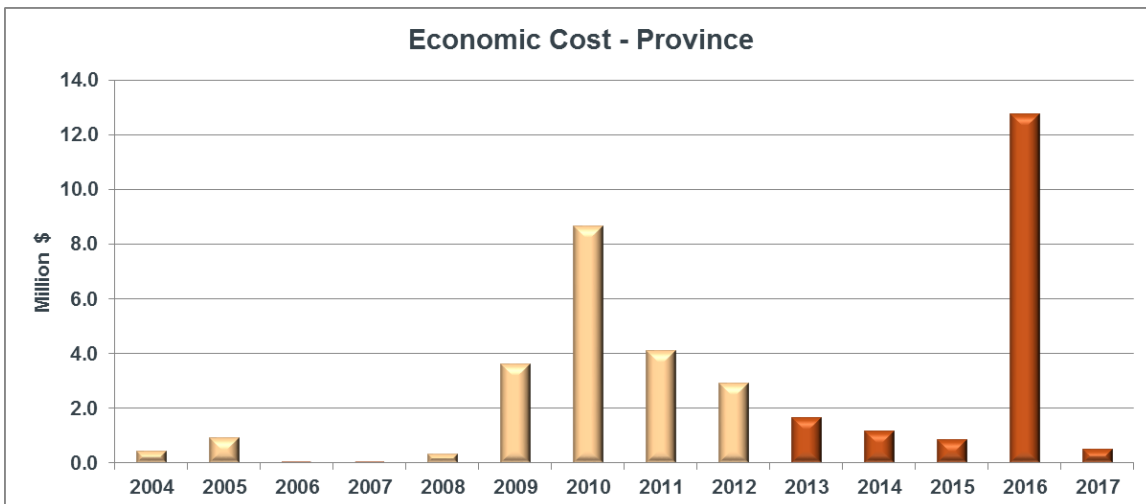
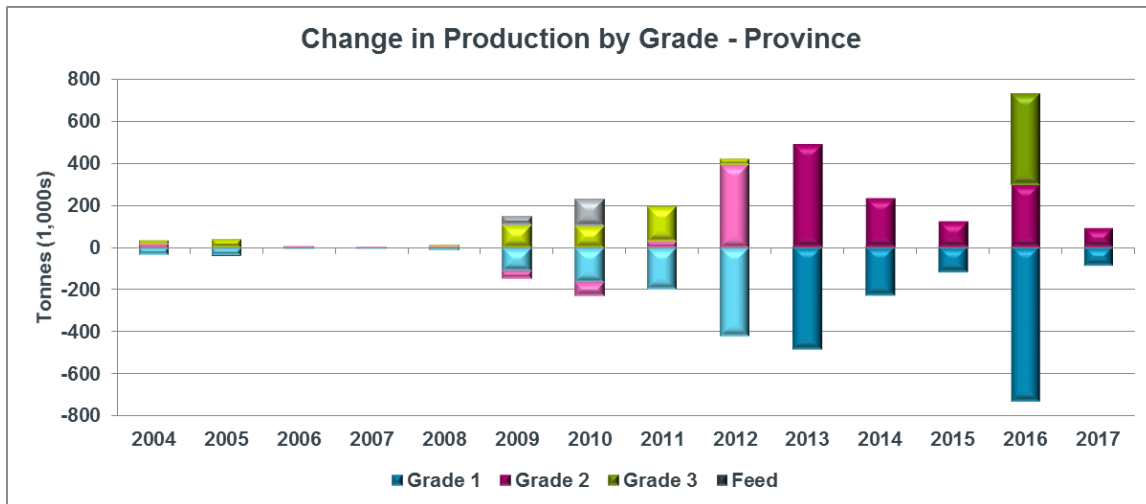
The second graph shows economic cost on a provincial level as a result of CWRS wheat downgrades. For example, in 2012 a large amount of CWRS production, over 400 thousand tonnes, was downgraded from grade #1 primarily to grade #2, with a very small amount further downgraded to grade #3. Since the price discount is fairly low, the total provincial cost was a modest \$3 million. That compares to 2010, where a smaller amount of production was downgraded, but all to grade #3 and to feed wheat at a total cost of about \$8.7 million. In 2016, the losses were particularly bad, resulting in downgrading of over 700 thousand tonnes of grade #1 to grades # 2 and #3, with the corresponding economic cost of \$12.8 million.

The last fourteen figures show the results by crop districts. Crop district 2 and 4 were the most affected with the highest quantity of wheat downgrades in 2016, amounting to 300 thousand tonnes and over 400 thousand tonnes respectively. Crop district 2 registered the most costly production loss in 2016, since most affected grain was downgraded to grade #3, thereby incurring large price reductions. However, the most costly production loss in crop district 4 occurred in 2010, since most of affected grain was downgraded to feed grade. The next most affected districts were districts 1, 3 and 5, and the least affected are northern districts 6 and 7, although 2016 was a particularly bad year in terms of Fusarium incidence and severity across the whole province.

These results should be interpreted with caution. The cost impact may be overstated, since the CGC disease data include all FDks, even those caused by fungi other than *F. graminearum*, and these other species are less damaging and costly. However, *F. graminearum* is the most aggressive species and high levels of FDks that lead to downgrading are most often due to this pathogen.

Another word of caution is that economic cost calculation depends on and is very sensitive to a price spread between grades. In some years, lower grade wheat that contains a high percentage of protein can be valued at a relatively higher price. As a result, the price spread between grade

#1 and #2, or grade #2 and #3 and so on will be nominal⁵. Grade price spreads fluctuate based on various market forces unrelated to the incidence or severity of crop diseases.



Please note, the same scale is used for all the graphs by crop district to show the difference between levels of impact.

⁵ For the purpose of this analysis, average annual prices of wheat are used to calculate economic cost of *F. graminearum*. In reality, the revenue losses may still be substantial depending on the grade price spreads at a particular elevator.

