# Survey for Head Blight of Cereals and Stalk Rot of Corn caused by *Fusarium graminearum* in Alberta in 2010

# FINAL RESULTS REPORT


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## Executive Summary


- A province-wide survey was undertaken in 2010 to update information on the prevalence and geographical distribution of Fusarium Head Blight (FHB).

- Over 900 fields were surveyed between July and October for FHB infection in cereals and stalk rot in corn caused by *Fusarium graminearum* (*Fg*), the primary pathogen causing these diseases and a declared pest under the Agricultural Pests Act.

- Head and stubble samples were gathered from cereal fields and stalk samples from corn fields. The average percentage of cereal fields infected with *Fg* was 6.0% for cereal stubble samples, 13.6% for cereal grain samples, and 42.2% for corn stalk samples. The majority of infected fields were in the irrigated areas of southern Alberta.

- Four cereal fields in central/northern Alberta were identified with *Fg*, two in Ponoka County and one each in Wainwright and Two Hills Counties. The incidence of *Fusarium* infection in these fields was extremely low. All other *Fg*-infected fields were located within seven municipalities in southern Alberta.

- Of the 289 *Fg* isolates obtained from the cereal and corn samples collected during the survey, 90% were the "old" 15ADON chemotype and 9.7% were the "new" 3ADON type. The percentage of the 3ADON chemotype in Alberta cereal grain samples has remained relatively low compared to levels in Manitoba and Saskatchewan; however the more damaging 3-ADON chemotype appears to be gradually displacing the 15-ADON type.

- The M.D. of Taber had the highest proportion of cereal seed samples with *Fg* (48.6%). The County of Lethbridge had the highest proportion of cereal stubble samples with *Fg* (36.7%). The proportion of corn fields with *Fg* was extremely high (86.4%).

- FHB caused by *Fg* remained well established in southeastern (Crop District 1) and south-central (CD 2) Alberta. *Fg* was also detected in several counties in the southwest (CD 3) and occurred sporadically outside of these areas at very low levels. The heaviest levels of *Fg* infection were in wheat and corn fields in the irrigated districts of the south.

- For 2011, the following survey priorities are recommended:
    - Survey those municipalities that were missed or where field numbers were well short of those originally targeted for the 2010 survey.
    - Re-visit Ponoka, Wainwright and Two Hills counties where a few *Fg*-infected fields were detected in 2010.
    - Re-survey the "perimeter municipalities" bordering the heavily infested counties in southeastern and south-central Alberta to the north and west.

## Background

Fusarium head blight (FHB), caused by *Fusarium graminearum* Schwabe (*Fg*) (teleomorph *Gibberella zeae* Petch) and an number of other pathogenic *Fusarium* species, is a serious fungal disease of wheat, barley, oats and other small cereal grains and corn. It can also affect forage grasses. FHB has also been called scab, tombstone, head blight, pink mold and whitehead in some older published reports. FHB was first described in 1884 in England and initially recognized as a fungal disease in North America about 120 years ago. Repeated severe epidemics of FHB occurred in the U.S.A. from 1915 through the 1920s. The first report of this disease in Canada was in 1919. In the 1940s, FHB erupted in eastern Canada and the east-central U.S.A. FHB was reported less frequently during the 1950s, 60s and 70s, but in the early 80s there were large outbreaks of FHB in eastern Canada, Manitoba, and in the U.S. wheat states from North Dakota to Kansas. A severe outbreak in Manitoba in 1993 brought the problem to prominence for the Canadian Prairies (Stack 2003). Outbreaks of FHB can usually be traced to four main scenarios: 1) Widespread planting of highly susceptible varieties, 2) Existence of colonized residue from previous crops, 3) Presence of corn in rotation with small grains, and 4) Weather conditions favourable for *Fusarium* infection (Stack 2004).

FHB causes problems in two main ways. Firstly, it can reduce yield and grade by causing fusarium-damaged kernels (FDK), and secondly, it can have a significant negative effect on the end-use quality of grain used for feed, milling, malting, brewing and ethanol production because it produces fungal toxins (vomitoxins), such as deoxynivalenol (DON), and reduces the quality of grain fractions, such as starch, bran and germ. *Fg* is only one of many species of *Fusarium* that can cause FHB, but it is considered the most important one in Canada because of the significant impact it can have on yield and grain quality, its ability to produce several different toxins, and its abundance in eastern Canada and the eastern prairies. (Clear and Patrick 2010)

Economic losses from FHB in the Northern Great Plains and central U.S.A. were estimated at $2.7 billion from 1998 to 2000. Losses from FHB in Canada have ranged from $50 million to $300 million annually since the early 1990s (Nganje et al. 2002). In 2005, a report on "Economic Risk Assessment of the Potential Future Development and Impact of FHB caused by *Fusarium graminearum* in Alberta" was published by Alberta Agriculture and Food, Edmonton (Heikkila and Verchomin 2005). The average annual projected total costs to Alberta crop production over a nine-year period ranged from $3 million to a high of $49 million per year, with the risk analysis suggesting that total losses could be as high as $64 million in a year. Actual costs may have been even higher since the modeling was based on actual conditions in Manitoba in 2003, which were unusually dry, resulting in limited FHB development that year. Additional costs incurred by livestock producers or grain processors were not considered in the assessment.

Disease surveys by Agriculture and Agri-Food Canada (AAFC), the Canadian Grain Commission (CGC) and Alberta Agriculture since the early 1990s, along with anecdotal reports from industry agronomists and local producers, showed that *Fg* was being found with increasing frequency in southern Alberta, especially in highly susceptible durum and soft white wheat varieties being grown under irrigation (Clear and Patrick 2010; Turkington et al. 2005; Laflamme 2006). Seed growers in southern Alberta reported that more and more of their fields were infected with low levels of *Fg*. Fortunately, however, the pathogen was rarely encountered in central and northern Alberta.

References

**Clear, R., and S. Patrick. 2007**. Fusarium head blight in western Canada. Canadian Grain Commission. Revised January 25, 2010 http://www.grainscanada.gc.ca/str-rst/fusarium/fhbwc-foc-eng.htm

**Heikkila, R., and S. Verchomin. 2005.** Cost of Fusarium in Alberta – the potential economic impact of Fusarium head blight in Alberta. Alberta Agriculture, Food and Rural Development Economic and Competitiveness Division. 15 pp.

**Laflamme, P. 2007.** 2006 Survey for fusarium head blight caused by *Fusarium graminearum* in Alberta wheat fields. Report of NIF Project #879078106, Alberta Agriculture and Food, Edmonton, AB.

**Nganje, W.E., D.A. Bangsund, F.L. Leistritz, W.W. Wilson, and N.M. Tiapo. 2002.** Estimating the economic impact of a crop disease: the case of Fusarium head blight in U.S. wheat and barley. 2002 National Fusarium Head Blight Forum Proceedings. East Lansing: Michigan State University, pp. 275–281.

**Stack, R.W. 2003.** History of Fusarium head blight with emphasis on North America. Pp. 1-34 in K.J. Leonard and W.R. Bushnell, eds., Fusarium Head Blight of Wheat and Barley, APS Press, St. Paul, MN.

**Stack, R.W. 2004.** Fusarium in the big picture. Western Grains Research Magazine, Western Grains Research Foundation, Saskatoon, SK.

**Turkington, T.K., R. Clear, T. Demeke, R.M. Fernandez, J. Gilbert, R.B. Irvine, R.M. Lange, F.J. Larney, D.L. McLaren, P.K. Mishra, A. Tekauz, J.P. Tewari, K. Xi, and J.L. Zantinge. 2005.** Reducing the impact of *Fusarium graminearum* on Alberta's cereal value chain. Final Report to the Alberta Agricultural Research Institute, Edmonton, AB. 414 pp.

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**Agriculture Service Boards**

- Athabasca County
- Camrose County
- County of Barrhead
- County of Grande Prairie
- County of Lethbridge
- County of Newell
- County of St. Paul
- County of Stettler
- County of Two Hills
- County of Vermillion River
- County of Warner
- Kneehill County
- Lac La Biche County
- Lamont County
- M.D. of Acadia
- M.D. of Big Lakes
- M.D. of Provost
- M.D. of Smoky River
- M.D. of Wainwright
- M.D. of Willow Creek
- Mountain View County
- Northern Sunrise County
- Parkland County
- Rockyview County
- Special Area No.2
- Special Area No.4
- Starland County
- Strathcona County
- Wheatland County

## Agriculture Research and Extension Council of Alberta (ARECA)

| Applied Research Association | Municipal Districts Surveyed |
|---|---|
| **Battle River Research Group (BRRG)** | County of Paintearth<br>Flagstaff County |
| **Chinook Applied Research Association (CARA)** | M.D. of Acadia |
| **North Peace Applied Research Association (NPARA)** | County of Northern Lights |
| **Peace Agricultural Research and Demonstration Association (PARDA)** | M.D. of Fairview |
| **Smoky Applied Research and Demonstration Association (SARDA)** | M.D. of Big Lakes<br>M.D. of Greenview<br>Northern Sunrise County |
| **Southern Applied Research Association (SARA)** | Cardston County<br>County of Forty Mile<br>County of Lethbridge<br>County of Newell<br>Cypress County<br>M.D. of Taber<br>M.D. of Willow Creek<br>Vulcan County |

## Other Participating Organizations

| Organization | Municipal Districts Surveyed |
|---|---|
| **Agriculture and Agri-Food Canada (AAFC)<br>Lacombe Research Centre, Lacombe, AB** | Beaver County<br>Clearwater County<br>Lacombe County<br>Ponoka County<br>Red Deer County<br>Sturgeon County<br>Westlock County |
| **Alberta Innovates Technology Futures (AITF)<br>Vegreville, AB** | County of Minburn<br>Smoky Lake County |
| **Alberta Agriculture and Rural Development,<br>Crop Diversification Centre North<br>Edmonton, AB** | County of Minburn<br>County of Thorhild |
| **Innovotech Inc.<br>Brooks, AB** | County of Lethbridge<br>County of Newell<br>M.D. of Taber |

## Survey Protocols

### *1. Introduction*

A comprehensive survey for fusarium head blight (FHB) of cereals and corn was carried out in Alberta in 2010. This survey was coordinated by Alberta Agriculture and Rural Development (AARD) and included the following components:

- A pre-harvest survey for FHB symptoms and causal agents in wheat and barley heads collected from late July to mid-August
- A post-harvest survey of above-ground residues (lower stem node pieces) of samples of cereal stubble taken from mid-August to late October
- A post-harvest residue survey of corn stalks sampled from late August to late October

The main focus of the survey was to determine the prevalence of FHB and level of seed/residue infection in wheat, with secondary emphasis on corn, barley and oats. Collaborators were given the option of conducting a head or residue survey, or a combination of the two, depending on crop growth stages, and time and labour availability.

### *2. Pre-Harvest Survey in Cereals*

The main focus for the FHB survey in cereal crops was on wheat because it is more prone to FHB and symptoms on wheat are easier to recognize than those on barley. The expression of head symptoms is dependent on a favourable environment for disease development, a susceptible cereal variety, and the presence of a virulent species of the *Fusarium* pathogen. The goal of the survey was to determine FHB levels in commercial fields province-wide and the prevalence of the key causal agent, *Fg*. The cooperation of municipal staff, applied research association personnel and AARD and Agriculture and Agri-Food Canada (AAFC) staff enabled a large number of fields to be sampled and made the survey more representative on a provincial basis. Each cooperator was provided with colour posters illustrating typical head and seed symptoms of FHB caused by *Fg*, as well as symptoms of other diseases that can be confused with FHB. These posters were intended to help surveyors specifically collect crop samples with symptoms that were most likely caused by *Fusarium* species, especially *Fg*, rather than other common head and seed pathogens.

The number of fields to be sampled in a municipality was arbitrarily set at 1-2% of the seeded cereal and corn acreages specified in the 2001 Census of Agriculture (Harry 2005). AARD provided a table of the 2001 cereal acreage data to cooperators to assist them in determining the number of fields to target in their respective municipalities (Table 1). Staff from AARD, AAFC, Agriculture Service Boards, Applied Research Associations, and other organizations participated in the survey (see pages 7- 9). A general goal for the 2010 FHB survey was to assess 700 cereal and corn fields across the province for infestations of *Fg*. Figure 1 presents a map of the Counties, Municipal Districts and Special Areas of Alberta that was referenced in conducting the 2010 FHB survey.

<u>Reference</u>

**Harry, M. 2005.** Alberta Municipality Profiles – 2001 Census of Agriculture, Alberta Agriculture and Rural Development, Edmonton, AB. http://www1.agric.gov.ab.ca/$department/deptdocs.nsf/all/sdd9508.

***Sample collection, storage and shipping***

Samples were collected along a diamond- or W-shaped path starting at least 50 m in from the edge of each field (see Figures 2 and 3). At each of three sites along a transect, 100 heads (300/field total) were randomly selected and examined when plants were at the late milk to early dough stage (Feekes growth stages 11.1-11.2; Zadoks growth stages 77-84). It was critical to assess and collect samples at the correct growth stage in order to recognize typical FHB symptoms because these symptoms were difficult to see on mature heads. Care was taken that each sampling site was at least 50 - 100 m apart. At each site, the number of heads with typical symptoms of FHB was recorded. Presumptive infected heads were collected and placed in separate, labeled paper bag(s) for each site and field.

The location of each field surveyed and the type and stage of growth of the crop were recorded when disease levels were assessed and samples collected. Background information relating to the variety, rotation, tillage system, irrigation regime, and rainfall for the sampled fields were also collected, where time allowed. Sampled heads were brought back to an office, lab or shop for air drying and storage. Sampled heads were placed into a sturdy cardboard box and shipped to CDC South at Brooks, AB for processing. At CDCS, the heads were threshed by hand using a shallow plastic pan with a piece of ribbed rubber matting in the bottom and a hand-held block with a piece of the same matting glued to the bottom. The heads were threshed by placing them in the pans and rubbing them against the bottom mat with the block until all of the kernels had been extracted. The chaff was blown off with a stream of compressed air and 100 kernels were counted out at random, packaged and sent to BioVision Seed Labs, Edmonton, AB for an agar plate test for *Fg*. The threshing pans, mats and blocks were washed and sterilized between samples to avoid cross-contamination.

<u>References</u>

**Large, E.G. 1954.** Growth stages in cereals: Illustration of the Feekes scale. Plant Pathology 3: 128-129.

**Zadoks, J.C., T.T. Chang, and C.F. Konzak. 1974.** A decimal code for the growth stages of cereals. Weed Research 14: 415-421.

### *3. Post-Harvest Residue Surveys in Cereals and Corn*

As part of the provincial survey, mainly wheat and corn residues were surveyed for the prevalence and levels of *Fg*. The goal of this survey was to determine whether this pathogen could be commonly found on stubble and stalk samples (lower stem node pieces) collected from cereal and corn fields across the province. Field quotas and survey personnel were the same as described above for the head survey.

#### *Sample collection, storage and shipping*

In the late summer/early fall, cereal and corn residue samples were collected from standing stubble along a diamond-shaped (Figure 2) or W-shaped (Figure 3) path starting at least 50 m in from the edge of each field with at least 50 m between sampling sites. For cereal stubble, 10 plant bases, i.e. the bottom portion of the stems including the first node and the root systems were collected non-selectively at each of 10 sites along the survey path. Corn stalks were collected from standing residue along a similar transect starting at least 50 m in from the edge of each field with at least 50 m between sampling sites. AARD was the primary agency conducting the corn residue survey. At each of 10 sites along sampling path, 10 corn stalk pieces were collected non-selectively. Stalk pieces were approximately 15 cm in length and included a node towards the base of the stalk. For both cereal and corn fields, individual sampling sites were at least 50 m apart. Sampled residues were placed in separate, labelled paper bag(s) for each site and field. If necessary, the samples were air dried at room temperature for several days to ensure that pathogens present in the collected residues remained viable and that sampled plant material was not colonized and decomposed by environmental saprophytes.

At CDC South, 10 pieces of lower stem node tissue from each of the 10 sampling sites within each field were selected from the dried plant tissues. Subsamples of these pieces were cut approximately 1-2 cm long for cereal tissues, and 3-5 cm for corn tissues, including stem tissue above and below the lowest node on the stem. Samples were packaged, labeled and sent to BioVision Seed Labs, Edmonton, AB to determine whether *Fg* could be detected in the samples.

### 4. Sanitation Protocols

In municipalities where clubroot, a destructive soil-borne disease of canola and mustard was known or suspected to occur, surveyors followed recommended sanitation procedures for footwear, vehicles and equipment to prevent accidental spread of the disease.

## Results and Conclusions

### Growing Season Overview

The 2010 growing season was one of contrasts between northern and southern areas of the province. Moisture levels in the Peace Region were well below normal in most areas, except for the extreme north (Figure 4). In central and northern areas, precipitation levels ranged from normal to above normal. The southern region had the highest levels of growing season precipitation and the percent departure from normal reached 200% in a few localized areas. Cooler-than-average temperatures reduced growing degree day (GGD) accumulations in southern and central areas of the province (Figure 5). In contrast, northern areas and the Peace Region experienced normal to above-normal GDD levels. As the result, cereal and corn crops tended to mature earlier-than-normal in the Peace Region, near-normal in central and northern areas, and later-than-normal in the south. In some cases, delayed maturity may have extended the flowering period and therefore lengthened the window for *Fusarium* head infection in cereal crops in these areas.

### Influence of Environmental Conditions on Fusarium Head Blight Development

For *Fusarium* head infection to occur in cereal crops, three conditions must coincide. Firstly, a susceptible variety must be planted. Secondly, inoculum in sufficient quantity for infection must be available. Thirdly, an environment suitable for infection is needed. This is often referred to as the "Disease Triangle." For high levels of head infection to occur, it is essential that an adequate supply of *Fusarium* inoculum be available at anthesis and this must coincide with a favourable environment (moist and warm) for infection (Calpas et al. 2003; McMullen et al. 2008). The most favourable conditions for infection are prolonged periods (48-72 hours) of high humidity and warm temperatures of 24 - 29° C. However, infection can occur at cooler temperatures, e.g. 9-10°C when high humidities (>90%) persist for longer than 72 hours. In the absence of precipitation, irrigation can provide a favourable environment for infection, which has led to relatively high FHB levels in the irrigated regions of southern Alberta in recent years.

Wheat is at its most susceptible to *Fusarium* infection during anthesis (flowering) (Feekes growth stage 10.5.1 – 10.5.3) (Sutton 1982). In Alberta, depending on year and location, anthesis in spring cereals can occur anywhere from early to late July. Given the above-normal precipitation over much of central and southern Alberta in July, 2010 (Figure 4), conditions in this area were favorable for the development of FHB in cereals and corn.

Although detection of *Fg* in past field surveys and grain sample analyses has mainly occurred in southern Alberta over the past decade, this pathogen has been found in all seven crop districts in Alberta at one time or another. Figure 6 presents data from the Canadian Grain Commission that confirmed that *Fg* was isolated from wheat samples from CDs 1 to 7 in 2008.

References

**Calpas, J., R. Howard, K. Turkington, R. Clear, and I. Evans. 2003.** Fusarium Head Blight of Barley and Wheat. Agri-Facts factsheet, Alberta Agriculture, Food and Rural Development, Edmonton, AB.

**McMullen, M.P., S. Zhong, and R.W. Stack. 2008.** Fusarium head blight (scab) of small grains. – North Dakota State University, Fargo, ND.

**Sutton, J.C. 1982.** Epidemiology of wheat head blight and maize ear rot caused by *Fusarium graminearum*. Can. J. Plant Pathol. 4:195–209.

**Survey Overview**

Over 900 cereal and corn fields were surveyed across Alberta between July and October, 2010 (Table 2). The majority of fields visited were in southern Alberta (47.8%), followed by central and northern Alberta (40.8%), and the Peace Region (11.4%). Cereals comprised the majority of fields surveyed (95.0%), with the largest proportion of samples collected being stubble (53.8%), followed by seed (46.2%). About 5.0% of the total fields surveyed were corn. The average percentage of cereal fields infected with *Fg* based on stubble samples was 6.0%, while for cereal grain and corn stalk samples it was 13.6% and 42.2%, respectively. *Fg* was detected only in corn samples from southern Alberta, while it was mainly detected in cereal samples from southern Alberta and not detected from the Peace River region (Figures 7, 8). Four cereal fields in central/northern Alberta had *Fg* based on an analysis of stubble samples. Two of these fields were in Ponoka County and one each in Wainwright and Two Hills Counties. The incidence of *Fusarium* infection in these fields was extremely low.

Not all municipalities ended up being sampled for a variety of reasons. Some did not have the manpower to conduct the survey at the correct stage of crop development or they were unable to sample as many fields as planned within the scope of the growing season. A few samples were also lost due to damage in transit, mixing of samples or excessive molding due to improper dry-down.

These results compare favorably with records of FDK (Fusarium-damaged kernel) analyses carried out by the Canadian Grain Commission for the 2008 harvest sample survey for FHB in Alberta. These results are presented in Figure 6, which illustrates the difference in species resulting in FDK in Alberta. Although *Fg* was dominant in crop districts 1, 2, 3 and 6, very few FDK were found outside of CDs 1 and 2. Therefore the results for CDs 3 and 6 must be considered in light of this fact. Additionally, *F. avenaceum* and *Septoria nodorum*, not *Fg*, dominated the few FDK samples found outside of southern Alberta.

**Identification and Characterization of *Fusarium* Isolates**

Analysis of cereal seed, cereal stubble and corn stalks for *Fg* was carried out by BioVision Seed Labs, Edmonton, AB, under the direction of Ms. Holly Gelech. The lab used an agar plate method to isolate *Fusarium* species from tissue samples. Presumptive *Fg* isolates were selected based on cultural characteristics, such as mycelial color, growth characteristics and conidiospore morphology, and subcultures were retained for chemotype analysis. The latter analyses were done at the Canadian Grain Commission Laboratory in Winnipeg by Dr. Randy Clear and Dr. Tom Graefenhan. This work consisted of molecular confirmation by polymerase chain reaction (PCR) and high performance liquid chromatography (HPLC).

<u>Identification of *Fusarium* species by Region</u>

The results of the *Fusarium* identification work by crop type and region are summarized in Table 3. One hundred and nineteen presumptive FHB-positive fields were detected out of a total of 907 surveyed (13.1%). Three hundred and ninety-six *Fusarium* subcultures were obtained from these 119 fields. Most of these originated from cereal and corn samples taken in southern Alberta. *Fg* comprised 88.1% of the total number of *Fusarium* isolates originating in the south, while *F. pseudograminearum* (*Fpg*) and *F. culmorum* made up 11.6% and 0.26%, respectively. *Fpg* is indistinguishable from *Fg* based on visual cultural characteristics, hence its occasional detection amongst the isolates. *Fpg* isolates came almost entirely from cereal stubble samples, as this fungus is primarily a root and crown pathogen. Of 103 *Fusarium* isolates identified from cereal stubble samples taken in southern Alberta, 41.7% were *Fpg*, while 57.3% were *Fg. T*he predominant *Fusarium* species obtained from seed samples (99.0%) from southern Alberta was *Fg*, while *Fpg* was much less frequently encountered (1.0%) from seed. The one culture of *F. culmorum* identified from cereal stubble in southern Alberta was probably a contaminant, although this species and *F. avenaceum* are known to be major incitants of FHB across Alberta based on historical annual analyses of *Fusarium*-damaged kernels in elevator grain samples conducted by the Canadian Grain Commission Laboratory. However, Randy Clear (personal communication) indicates that when *Fg* is either not present or is found at low levels other *Fusarium* spp. such as *F. culmorum* and *F. avenaceum* tend to be more commonly found. Once *Fg* increases in prevalence in an area it tends to become the predominant *Fusarium* species found, while other species such as *F. culmorum* become much less frequently detected.

Across the province, 42 of 464 (9.1%) cereal stubble samples taken during the course of the survey were infected with *Fg* (Tables 2 & 3), while for cereal seed and corn stalk samples the percentages were 14.3% and 44.4%, respectively. The majority of theses samples came from known *Fg*-infested areas in southern Alberta. As previously mentioned in the survey overview, four presumptive FHB-positive cereal fields in central/northern Alberta had *Fg* based on an analysis of stubble samples and one seed sample had *Fpg* (Table 3). Two of the fields with *Fg* were in Ponoka County and one each in Wainwright and Two Hills Counties. The incidences of *Fusarium* infection in these fields were extremely low.

Determination of *Fusarium* Chemotypes

The results of chemotype analyses of the 289 isolates of *Fg* are given in Table 4. These isolates were obtained from 101 confirmed positive fields visited during the survey are given in Table 4. The chemotype analyses were carried out in the Canadian Grain Commission Laboratory in Winnipeg by Dr. Randy Clear and Dr. Tom Graefenhan. Overall, 90.0% of the isolates were the "old" 15ADON type and 9.7% were the "new" 3ADON type. A single isolate of *Fg* from a corn field in southern Alberta was the NIV (nivalenol) chemotype. The percentage of the 3ADON chemotype in Alberta cereal grain samples has remained relatively low compared to levels in Manitoba and Saskatchewan; however, the 3-ADON chemotype appears to be gradually displacing the 15-ADON type. The significance of the NIV chemotype identification is not fully known at this time. The nivalenol chemotype is rare in North America, but is important in other areas of the world such as Asia.

Occurrence of *Fusarium graminearum* on Different Crop Types

A summary of the percentage of fields confirmed to have *Fg* by crop type is given in Table 5. In southern Alberta, where the highest presence of FHB was documented, the highest proportion of fields with *Fg* was seen in seed samples (avg. = 23.5%) compared to stubble samples (avg. = 21.7%). In seed, the average proportion of fields with *Fg* by crop was durum wheat (40.0%), followed by spring wheat (24.0%), barley (5.6%) and oats (0%). In stubble and stalk samples, average *Fg* levels were highest in corn (86.4%), followed by durum (15%), barley (14%), wheat (12.9%) and oats (0%). In central/northern areas of the province, *Fg* was only detected in four samples of spring wheat stubble, where it occurred at very low levels (avg. = 2.5%). No *Fg* was isolated from any cereal or corn samples taken from the Peace Region.

Occurrence of *Fusarium graminearum* in Alberta Municipalities

Data on the percentage of fields with *Fg* by county, municipal district or special area are presented in Table 6. Seven of 14 municipalities in southern Alberta had *Fg*-positive fields. The M.D. of Taber had the highest proportion of infected cereal fields (48.6%) based on analyses of seed samples, followed closely by the County of Forty Mile at 45.7%. The County of Lethbridge had the highest proportion of cereal stubble samples with *Fg* (36.7%) amongst the seven counties that were sampled. The County of Forty Mile was the next highest at 25.0%. The proportion of corn fields with *Fg* in southern Alberta was extremely high (86.4%), with all of the fields in the County of Lethbridge and M.D. of Taber being infected.

**Conclusions**

The 2010 survey results confirmed that FHB caused by *Fg* remains well established in southeastern (CD 1) and south-central (CD 2) Alberta. *Fg* was also detected in several counties in southwestern Alberta (CD 3) and occurred sporadically outside of these areas at very low levels. The heaviest levels of *Fg* infestation are in wheat (especially durum) and corn fields in the irrigated districts of southern Alberta. Climatic conditions in Alberta in 2009 and 2010 were relatively conducive for the development of FHB, so the survey was well-timed to detect this disease.

Cereal growers in southern Alberta have come to realize the importance of FHB and its impact on yield and quality. Many are actively taking steps to manage the disease by following best management practices advocated in the Alberta *Fusarium graminearum* Management Plan and crop protection guides. The corn industry seems relatively unconcerned about the fusarium ear and stalk rot at this time because growers feel that yield losses have not reached economic levels. Producers in central and northern areas of the province remain concerned about FHB spreading into their areas and are taking preventative steps to deter this from happening. Many of the producers and cooperators involved in the 2010 FHB survey stressed the importance of continuing to monitor the spread of FHB and *Fg* in Alberta to periodically determine the relative disease risk and to assess the effectiveness of the preventative and best management practices currently in use. Thus, there are very different disease management strategies required in areas such as CD1, CD2 and possibly CD3, where the disease is well established compared to those areas where Fg is not commonly found.

**Recommendations for Future Surveillance Activities**

A number of short- and long-term options exist for future surveillance activities for FHB in Alberta. The choice of these options at any given time will mainly depend upon current survey priorities within the Pest Surveillance Branch of AARD, the degree of economic impact that FHB is having on the cereal industry, and perceived significant changes in the causal *Fusarium* species and/or chemotypes involved in the FHB disease complex.

For 2011, the following survey priorities are recommended:

- Survey those municipalities growing cereals and/or corn that were missed or where field numbers were well short of those originally estimated for the 2010 survey, e.g.
    - Municipalities missed in 2010 include Pincher Creek, Special Area No. 3, Bonnyville, Brazeau, Lac Ste. Anne, Leduc, Wetaskiwin, Woodlands, Yellowhead, Birch Hills, Clear Hills, Mackenzie, Peace, Saddle Hills, and Spirit River
    - Municipalities significantly short of the 2010 surveying quota include Kneehill, Starland, Beaver, Sturgeon, Special Area No. 2, Warner, Vermillion River, and Westlock
- Re-visit the three counties in central Alberta, namely Ponoka, Wainwright and Two Hills, where one or more fields infested with *Fg* were detected in 2010. The number of fields examined should be expanded in order to more accurately assess the geographical distribution and incidence of the FHB caused by *Fg* in cereal fields in these areas.
- Re-survey the "perimeter municipalities" bordering the heavily infested counties in southeastern and south-central Alberta to the north and west to include more cereal and corn fields in order to determine if *Fg* is becoming well entrenched in these areas as well. The municipalities that would be surveyed again include Cardston County, M.D. of Pincher Creek, Wheatland County, Special Areas 2 and 3, and M.D. of Acadia.

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Survey Support

- Agriculture Service Board Fieldmen (see page 7)
- Applied Research Associations (see page 8)
- Agriculture and Agri-Food Canada, Lacombe
- Alberta Agriculture and Rural Development, Edmonton and Brooks
- Alberta Innovates Technology Futures, Vegreville
- Innovotech Inc., Brooks

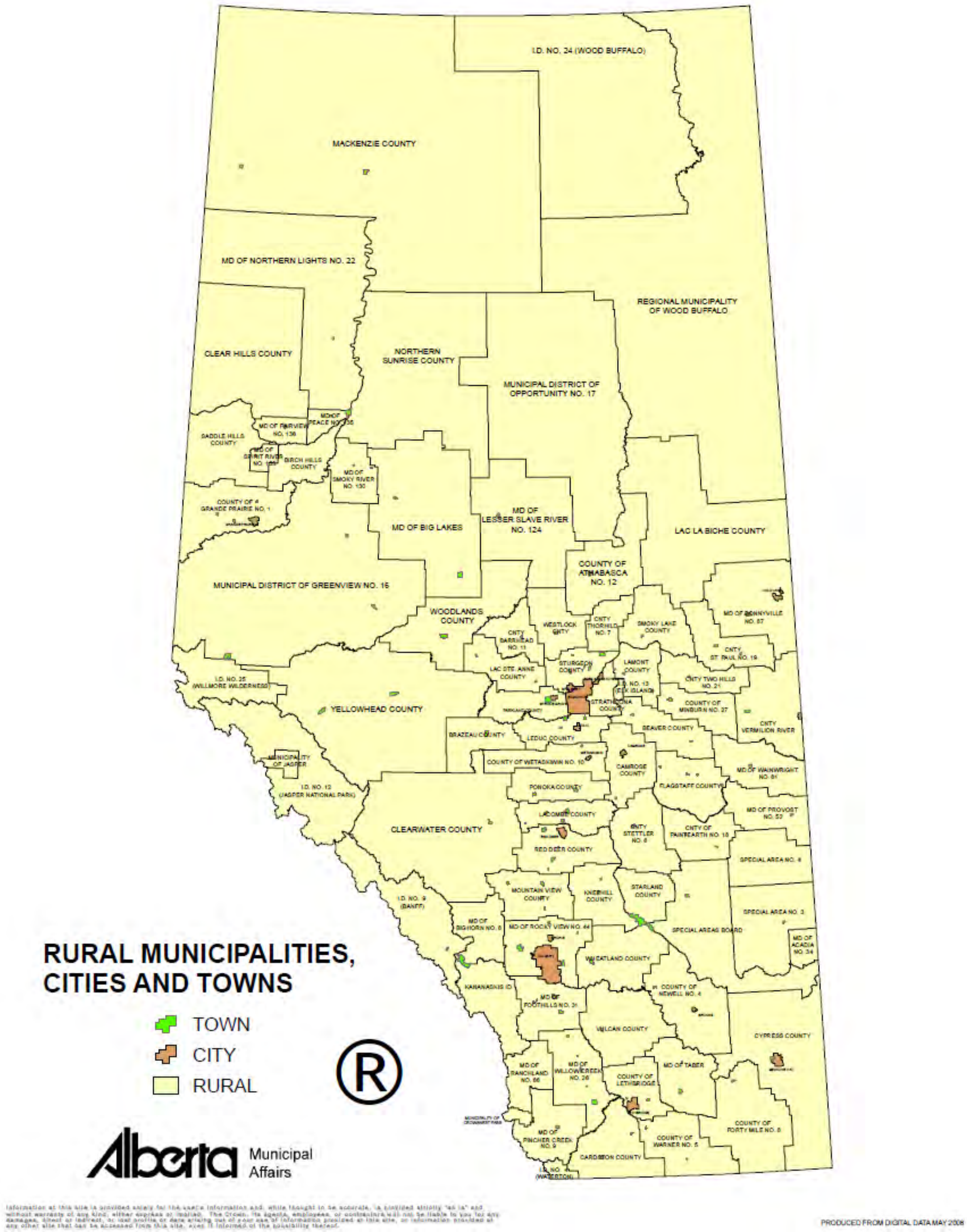


**Figure 1. Map of Alberta Counties, Municipal Districts and Special Areas**

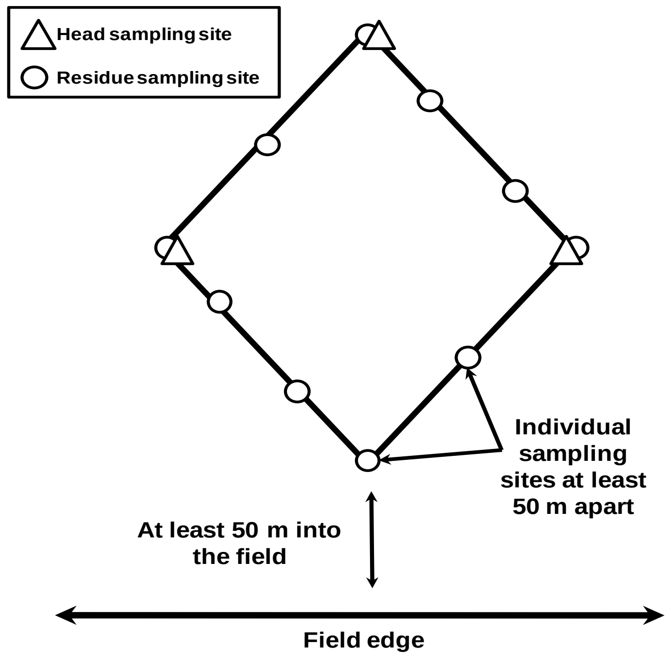


**Figure 2. Diamond-shaped sampling path showing head and residue sampling sites.**

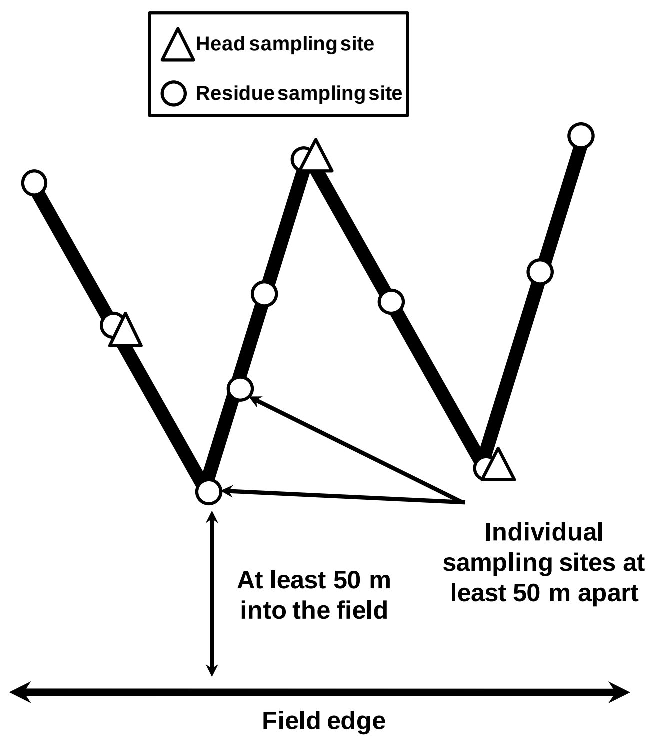


**Figure 3. W-shaped sampling path showing head and residue sampling sites.**

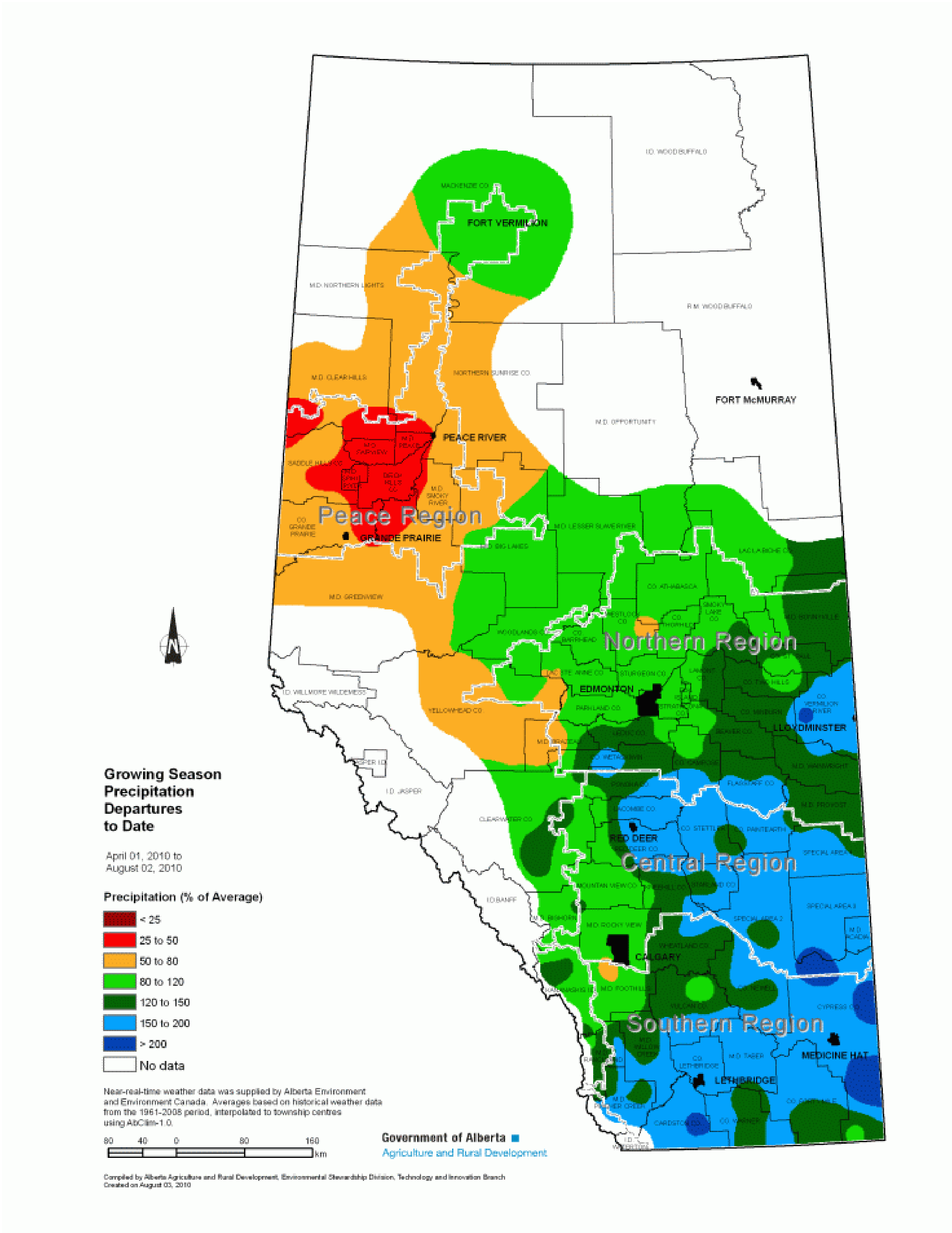


**Figure 4. Growing season precipitation as percent departure from normal for Alberta in 2010.**

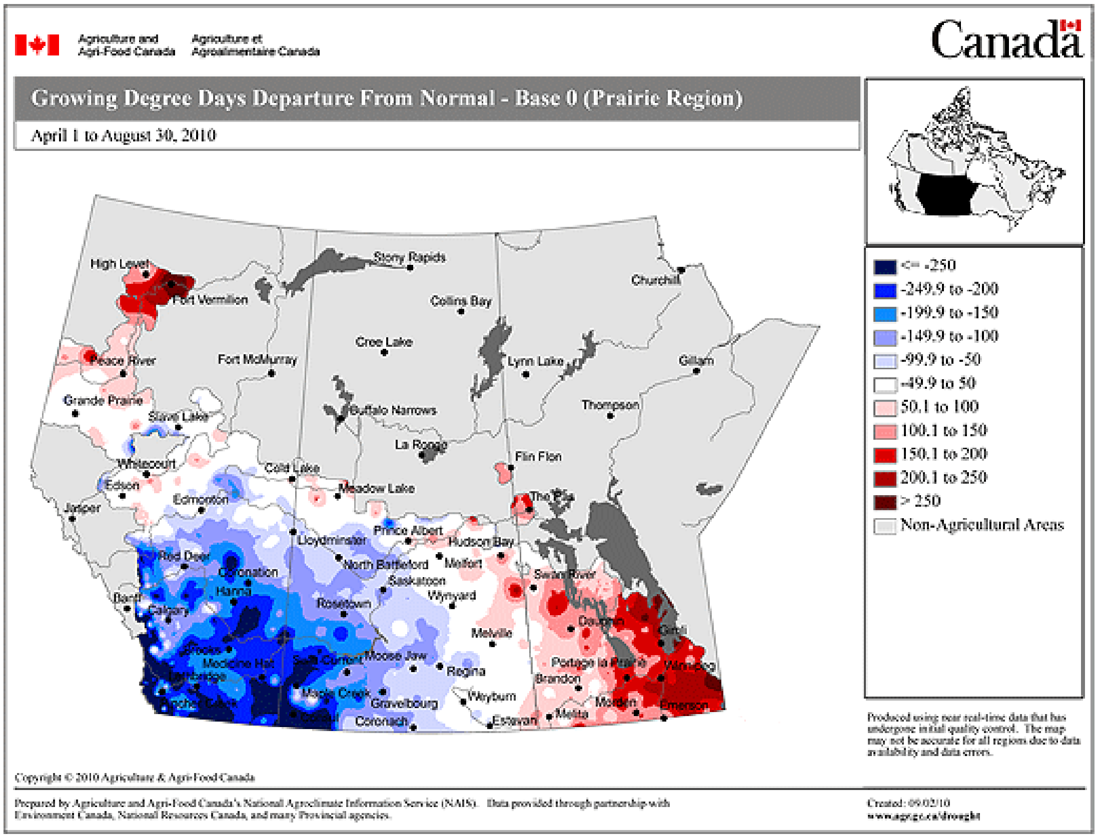


**Figure 5. Growing degree days as departure from normal for the Prairie Provinces in 2010.**

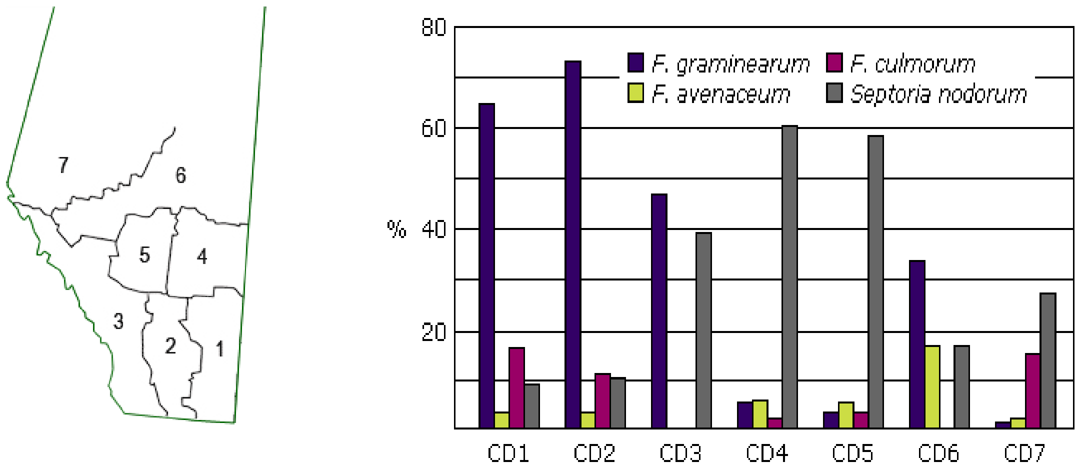


**Figure 6. Map of the Canadian Grain Commission crop districts (CDs) in Alberta and fungal species infecting fusarium-damaged kernels (FDK) in Alberta CDs in 2008 based on analysis of wheat samples delivered to grain elevators.**

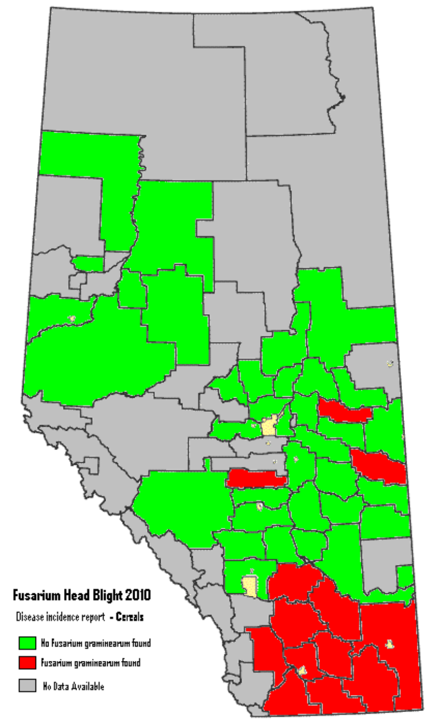


**Figure 7. Map of Alberta municipalities in which *Fusarium graminearum* was detected in cereal samples in 2010.**

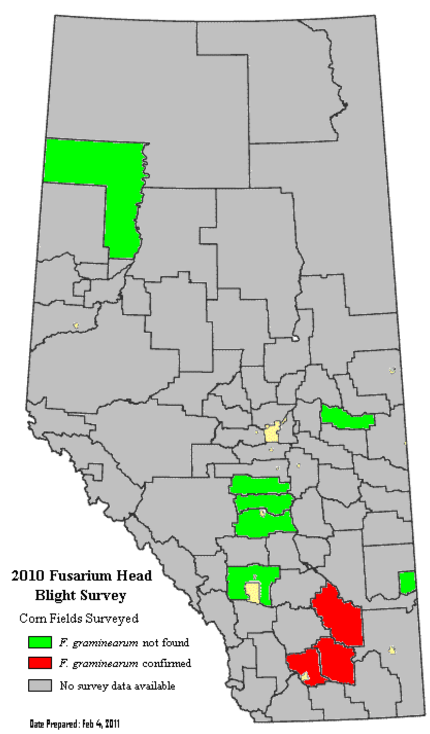


**Figure 8. Map of Alberta municipalities in which *Fusarium graminearum* was detected in corn samples in 2010**

**Table 1. Provincial survey targets for Alberta counties, municipal districts and special areas.**

| Municipal District / County | Crop District | Targeted Fields | | Optional Fields | | |
|---|---|---|---|---|---|---|
| | | Wheat | Durum | Barley | Oats | Corn |
| **Southern Region** | | | | | | |
| Acadia / Special Area No.3 | 1 | 33 | 0 | 5 | 4 | 0 |
| Cardston | 3 | 15 | 3 | 13 | 0 | 0 |
| Cypress | 1 | 19 | 8 | 5 | 2 | 0 |
| Forty mile | 1 | 30 | 34 | 7 | 1 | 0 |
| Lethbridge | 2 | 16 | 8 | 21 | 1 | 2 |
| Newell | 1 | 11 | 1 | 8 | 1 | 1 |
| Pincher Creek | 3 | 2 | 0 | 6 | 1 | 0 |
| Special area No.2 | 1 | 13 | 0 | 5 | 6 | 0 |
| Taber | 2 | 14 | 13 | 8 | 1 | 1 |
| Vulcan | 2 | 32 | 12 | 22 | 2 | 4 |
| Warner | 2 | 14 | 22 | 15 | 1 | 0 |
| Wheatland | 2 | 40 | 2 | 26 | 1 | 0 |
| Willow Creek | 3 | 20 | 0 | 10 | 1 | 0 |
| **Regional Total** | | 259 | 103 | 151 | 22 | 8 |
| **Central/Northern Region** | | | | | | |
| Athabasca | 6 | 5 | 0 | 2 | 2 | 0 |
| Barrhead | 6 | 4 | 0 | 5 | 1 | 0 |
| Beaver | 4b | 18 | 0 | 5 | 2 | 0 |
| Bonnyville | 6 | 1 | 0 | 3 | 2 | 0 |
| Brazeau | 6 | 0 | 0 | 0 | 1 | 0 |
| Camrose | 4b | 22 | 0 | 8 | 1 | 0 |
| Clearwater | 5 | 0 | 0 | 1 | 1 | 0 |
| Flagstaff | 4a | 33 | 0 | 9 | 2 | 0 |
| Kneehill | 2 | 27 | 2 | 21 | 1 | 0 |
| Lac La Biche | 6 | 0 | 0 | 1 | 1 | 0 |
| Lac Ste. Anne | 6 | 1 | 0 | 1 | 2 | 0 |
| Lacombe | 5 | 9 | 0 | 9 | 1 | 0 |
| Lamont | 4b | 13 | 0 | 4 | 2 | 0 |
| Leduc | 5 | 7 | 0 | 4 | 2 | 0 |
| Minburn | 4b | 18 | 0 | 5 | 2 | 0 |
| Mountain View | 3 | 5 | 0 | 11 | 1 | 0 |
| Paintearth | 4a | 12 | 0 | 4 | 4 | 0 |
| Parkland | 5 | 3 | 0 | 2 | 1 | 0 |
| Ponoka | 5 | 3 | 0 | 7 | 1 | 0 |
| Provost | 4a | 13 | 1 | 4 | 0 | 0 |
| Red Deer | 5 | 10 | 0 | 13 | 1 | 0 |

| Municipal District / County | Crop District | Targeted Fields: Wheat | Targeted Fields: Durum | Optional Fields: Barley | Optional Fields: Oats | Optional Fields: Corn |
|---|---|---|---|---|---|---|
| **Central/Northern Cont.** | | | | | | |
| Rockyview | 3 | 18 | 0 | 13 | 2 | 0 |
| Smoky Lake | 6 | 5 | 0 | 2 | 1 | 0 |
| Special area No.4 | 1 | 12 | 1 | 5 | 5 | 0 |
| St. Paul | 6 | 3 | 0 | 4 | 2 | 0 |
| Starland | 2 | 18 | 1 | 12 | 1 | 0 |
| Stettler | 4a | 14 | 0 | 6 | 2 | 0 |
| Strathcona | 5 | 5 | 0 | 1 | 0 | 0 |
| Sturgeon | 5 | 12 | 0 | 5 | 1 | 0 |
| Thorhild | 6 | 4 | 0 | 3 | 1 | 0 |
| Two Hills | 4b | 11 | 0 | 5 | 2 | 0 |
| Vermillion River | 4b | 22 | 0 | 11 | 3 | 0 |
| Wainwright | 4a | 18 | 0 | 6 | 3 | 0 |
| Westlock | 6 | 10 | 0 | 7 | 2 | 0 |
| Wetaskiwin | 5 | 6 | 0 | 4 | 1 | 0 |
| Woodlands | 6 | 1 | 0 | 1 | 0 | 0 |
| Yellowhead | 6 | 0 | 0 | 1 | 1 | 0 |
| **Regional Total** | | 363 | 5 | 205 | 58 | 0 |
| **Peace Region** | | | | | | |
| Big Lakes | 7 | 2 | 0 | 1 | 1 | 0 |
| Birch Hills | 7 | 12 | 0 | 2 | 0 | 0 |
| Clear Hills | 7 | 6 | 0 | 2 | 2 | 0 |
| Fairview | 7 | 8 | 0 | 1 | 1 | 0 |
| Grande Prairie | 7 | 16 | 0 | 6 | 2 | 0 |
| Greenview | 7 | 6 | 0 | 1 | 2 | 0 |
| Mackenzie | 7 | 12 | 0 | 2 | 1 | 0 |
| Northern Lights | 7 | 12 | 0 | 4 | 1 | 0 |
| Northern Sunrise | 7 | 7 | 0 | 1 | 0 | 0 |
| Peace | 7 | 5 | 0 | 1 | 0 | 0 |
| Saddle Hills | 7 | 10 | 0 | 2 | 2 | 0 |
| Smoky River | 7 | 21 | 0 | 2 | 1 | 0 |
| Spirit River | 7 | 6 | 0 | 1 | 0 | 0 |
| **Regional Total** | | 123 | 0 | 26 | 13 | 0 |
| **Provincial Target** | | 745 | 108 | 382 | 93 | 8 |
| **Provincial Survey** | | 705 | 30 | 111 | 16 | 45 |

**Table 2. Percentage of fields infected with *Fusarium graminearum* in Alberta by region.**

| Region | Sample Type | Total Fields Surveyed | Confirmed Positive Fields | Percent Infected Fields % |
|---|---|---|---|---|
| **Southern** | Cereal stubble | 182 | 24 | 13.2 |
| | Cereal seed | 230 | 54 | 23.5 |
| | Corn | 22 | 19 | 86.4 |
| | All crop types | 434 | 97 | 22.3 |
| **Central/Northern** | Cereal stubble | 200 | 4 | 2.0 |
| | Cereal seed | 148 | 0 | 0 |
| | Corn | 22 | 0 | 0 |
| | All crop types | 370 | 4 | 1.1 |
| **Peace** | Cereal stubble | 82 | 0 | 0 |
| | Cereal seed | 20 | 0 | 0 |
| | Corn | 1 | 0 | 0 |
| | All crop types | 103 | 0 | 0 |
| **Total for Province** | Cereal stubble | 464 | 28 | 6.0 |
| | Cereal seed | 398 | 54 | 13.6 |
| | Corn | 45 | 19 | 42.2 |
| **Grand Total** | All crop types | 907 | 101 | 11.1 |

**Table 3. Percentage of isolates identified to *Fusarium* species by region.**

| Region | Sample type | Presumptive Positive Fields | Isolates tested | *F.graminearum* (%) | *F. pseudo-graminearum* (%) | *F. culmorum* (%) |
|---|---|---|---|---|---|---|
| **Southern** | cereal stubble | 38 | 103 | 57.3 | 41.7 | 1.0 |
| | cereal seed | 56 | 195 | 99.0 | 1.0 | 0 |
| | corn | 20 | 89 | 100 | 0.0 | 0 |
| | All crop types | 114 | 387 | 88.1 | 11.6 | 0.26 |
| **Central/Northern** | cereal stubble | 4 | 4 | 100 | 0 | 0 |
| | cereal seed | 1 | 5 | 0 | 100 | 0 |
| | corn | 0 | - | - | - | - |
| | All crop types | 5 | 9 | 44.4 | 55.5 | 0 |
| **Peace** | cereal stubble | 0 | - | - | - | - |
| | cereal seed | 0 | - | - | - | - |
| | corn | 0 | - | - | - | - |
| | All crop types | 0 | - | - | - | - |
| **Total for Province** | Cereal stubble | 42 | 107 | 58.9 | 40.1 | 0.93 |
| | Cereal seed | 57 | 200 | 96.5 | 3.5 | 0 |
| | Corn | 20 | 89 | 100 | 0 | 0 |
| **Grand Total** | **All crop types** | **119** | **396** | **87.1** | **12.6** | **0.25** |

**Table 4. Chemotype results for confirmed *Fusarium graminearum* isolates in Alberta by region.**

| Region | Crop | Confirmed Positive Fields | *F.graminearum* Isolates | Percentage of isolates 15ADON | Percentage of isolates 3ADON | Percentage of isolates NIV |
|---|---|---|---|---|---|---|
| **Southern** | cereal stubble | 24 | 33 | 87.9 | 12.1 | 0 |
| | cereal seed | 54 | 187 | 91.4 | 8.6 | 0 |
| | corn | 19 | 66 | 86.4 | 12.1 | 1.5 |
| | All crop types | 97 | 286 | 89.9 | 9.8 | 0.35 |
| **Central/Northern** | cereal stubble | 4 | 3 | 100.0 | 0 | 0 |
| | cereal seed | 0 | 0 | - | - | - |
| | corn | 0 | 0 | - | - | - |
| | All crop types | 4 | 3 | 100 | 0 | 0 |
| **Peace** | cereal stubble | 0 | - | - | - | - |
| | cereal seed | 0 | - | - | - | - |
| | corn | 0 | - | - | - | - |
| | All crop types | 0 | - | - | - | - |
| **Total for Province** | Cereal stubble | 28 | 36 | 88.9 | 2.8 | 0 |
| | Cereal seed | 54 | 187 | 91.4 | 8.6 | 0 |
| | Corn | 19 | 66 | 86.4 | 12.1 | 1.5 |
| **Grand Total** | All crop types | 101 | 289 | 90.0 | 9.7 | 0.34 |

**Table 5. Percentage of fields confirmed with *Fusarium graminearum* by crop type.**

| | Seed samples | | | Stubble / Stalk samples | | | Total | | |
|---|---|---|---|---|---|---|---|---|---|
| **Crop sampled** | **Surveyed Fields** | **Positive Fields** | **Disease presence (%)** | **Surveyed Fields** | **Positive Fields** | **Disease presence (%)** | **Surveyed Fields** | **Positive Fields** | **Disease presence (%)** |
| **Southern Region** | | | | | | | | | |
| Wheat | 196 | 47 | 24.0 | 132 | 17 | 12.9 | 328 | 64 | 19.5 |
| Durum | 15 | 6 | 40.0 | 13 | 2 | 15 | 28 | 8 | 28.6 |
| Barley | 18 | 1 | 5.6 | 35 | 5 | 14 | 53 | 6 | 11.3 |
| Oats | 1 | 0 | 0 | 2 | 0 | 0 | 3 | 0 | 0 |
| Corn | - | - | - | 22 | 19 | 86.4 | 22 | 19 | 86.4 |
| Total | 230 | 54 | 23.5 | 204 | 43 | 21.7 | 434 | 97 | 22.3 |
| **Central/ Northern Region** | | | | | | | | | |
| Wheat | 131 | 0 | 0 | 158 | 4 | 2.5 | 289 | 4 | 1.4 |
| Durum | - | - | - | 2 | 0 | 0 | 2 | 0 | 0 |
| Barley | 12 | 0 | 0 | 39 | 0 | 0 | 51 | 0 | 0 |
| Oats | 5 | 0 | 0 | 1 | 0 | 0 | 6 | 0 | 0 |
| Corn | - | - | - | 22 | 0 | 0 | 22 | 0 | 0 |
| Total | 148 | 0 | 0 | 222 | 4 | 1.8 | 370 | 4 | 1.1 |
| **Peace Region** | | | | | | | | | |
| Wheat | 20 | 0 | 0 | 68 | 0 | 0 | 88 | 0 | 0 |
| Durum | - | - | - | - | - | - | - | - | - |
| Barley | - | - | - | 7 | 0 | 0 | 7 | 0 | 0 |
| Oats | - | - | - | 7 | 0 | 0 | 7 | 0 | 0 |
| Corn | - | - | - | 1 | 0 | 0 | 1 | 0 | 0 |
| Total | 20 | 0 | 0 | 83 | 0 | 0 | 103 | 0 | 0 |
| **Provincial Totals** | | | | | | | | | |
| Wheat | 347 | 47 | 13.5 | 358 | 21 | 5.9 | 705 | 68 | 9.6 |
| Durum | 15 | 6 | 40.0 | 15 | 2 | 13 | 30 | 8 | 27 |
| Barley | 30 | 1 | 3.3 | 81 | 5 | 6 | 111 | 6 | 5.4 |
| Oats | 6 | 0 | 0 | 10 | 0 | 0 | 16 | 0 | 0 |
| Corn | - | - | - | 45 | 19 | 42.2 | 45 | 19 | 42.2 |
| Grand Total | 398 | 54 | 13.6 | 509 | 47 | 9.2 | 907 | 101 | 11.1 |

## Table 6. Percentage of fields confirmed with *Fusarium graminearum* in Alberta by County / Municipal District.

| | Cereal Seed Samples | | | Cereal Stubble Samples | | | Corn Stalk Samples | | |
|---|---|---|---|---|---|---|---|---|---|
| **Municipal District / County** | **Surveyed Fields** | **Confirmed Positive Fields** | **Positive Fields (%)** | **Surveyed Fields** | **Confirmed Positive Fields** | **Positive Fields (%)** | **Surveyed Fields** | **Confirmed Positive Fields** | **Positive Fields (%)** |
| **Southern Region** | | | | | | | | | |
| Acadia | 2 | 0 | 0 | 24 | 0 | 0 | 2 | 0 | 0 |
| Cardston | - | - | - | 18 | 1 | 5.6 | - | - | - |
| Cypress | 9 | 1 | 11.1 | 18 | 3 | 16.7 | - | - | - |
| Forty mile | 35 | 16 | 45.7 | 24 | 6 | 25.0 | - | - | - |
| Lethbridge | 21 | 5 | 23.8 | 30 | 11 | 36.7 | 9 | 9 | 100 |
| Newell | 21 | 6 | 28.6 | - | - | - | 7 | 6 | 86 |
| Pincher Creek | - | - | - | - | - | - | - | - | - |
| Special area No.2 | 7 | 0 | 0 | - | - | - | - | - | - |
| Special area No.3 | - | - | - | - | - | - | - | - | - |
| Taber | 35 | 17 | 48.6 | - | - | - | 4 | 4 | 100 |
| Vulcan | 42 | 5 | 11.9 | - | - | - | - | - | - |
| Warner | 23 | 4 | 17.4 | - | - | - | - | - | - |
| Wheatland | - | - | - | 46 | 1 | 2.2 | - | - | - |
| Willow Creek | 35 | 0 | 0 | 22 | 2 | 9.1 | - | - | - |
| **Regional Total** | **230** | **54** | **23.5** | **182** | **24** | **13.2** | **22** | **19** | **86.4** |
| **Central / Northern Region** | | | | | | | | | |
| Athabasca | - | - | - | 6 | 0 | 0 | - | - | - |
| Barrhead | 7 | 0 | 0 | - | - | - | - | - | - |
| Beaver | - | - | - | 10 | 0 | 0 | - | - | - |
| Bonnyville | - | - | - | - | - | - | - | - | - |
| Brazeau | - | - | - | - | - | - | - | - | - |
| Camrose | 25 | 0 | 0 | - | - | - | - | - | - |
| Clearwater | - | - | - | 5 | 0 | 0 | - | - | - |
| Flagstaff | 10 | 0 | 0 | - | - | - | - | - | - |
| Kneehill | 15 | 0 | 0.0 | - | - | - | - | - | - |
| Lac La Biche | - | - | - | 5 | 0 | 0 | - | - | - |
| Lac Ste. Anne | - | - | - | - | - | - | - | - | - |
| Lacombe | - | - | - | 9 | 0 | 0 | 5 | 0 | 0 |
| Lamont | - | - | - | 25 | 0 | 0 | - | - | - |
| Leduc | - | - | - | - | - | - | - | - | - |

| | Cereal Seed Samples | | | Cereal Stubble Samples | | | Corn Stalk Samples | | |
|---|---|---|---|---|---|---|---|---|---|
| **Municipal District / County** | **Surveyed Fields** | **Confirmed Positive Fields** | **Positive Fields (%)** | **Surveyed Fields** | **Confirmed Positive Fields** | **Positive Fields (%)** | **Surveyed Fields** | **Confirmed Positive Fields** | **Positive Fields (%)** |
| **Central/Northern Region (cont.)** | | | | | | | | | |
| Minburn | - | - | - | 28 | 0 | 0 | - | - | - |
| Mountain View | 10 | 0 | 0 | - | - | - | - | - | - |
| Paintearth | 12 | 0 | 0 | - | - | - | - | - | - |
| Parkland | - | - | - | 6 | 0 | 0 | - | - | - |
| Ponoka | - | - | - | 6 | 2 | 33.3 | 3 | 0 | 0 |
| Provost | - | - | - | 13 | 0 | 0 | - | - | - |
| Red Deer | - | - | - | 15 | 0 | 0 | 9 | 0 | 0 |
| Rockyview | - | - | - | 14 | 0 | 0 | 3 | 0 | 0 |
| Smoky Lake | - | - | - | 2 | 0 | 0 | - | - | - |
| Special area No.4 | 22 | 0 | 0 | - | - | - | - | - | - |
| St. Paul | 15 | 0 | 0 | - | - | - | - | - | - |
| Starland | 5 | 0 | 0 | - | - | - | - | - | - |
| Stettler | 16 | 0 | 0 | - | - | - | - | - | - |
| Strathcona | - | - | - | 5 | 0 | 0 | - | - | - |
| Sturgeon | - | - | - | 4 | 0 | 0 | - | - | - |
| Thorhild | - | - | - | 10 | 0 | 0 | - | - | - |
| Two Hills | - | - | - | 10 | 1 | 10.0 | 2 | 0 | 0 |
| Vermillion River | 11 | 0 | 0 | - | - | - | - | - | - |
| Wainwright | - | - | - | 18 | 1 | 5.6 | - | - | - |
| Westlock | - | - | - | 9 | 0 | 0 | - | - | - |
| Wetaskiwin | - | - | - | - | - | - | - | - | - |
| Woodlands | - | - | - | - | - | - | - | - | - |
| Yellowhead | - | - | - | - | - | - | - | - | - |
| **Regional Total** | 148 | 0 | 0.0 | 200 | 4 | 2.0 | 22 | 0 | 0.0 |

| | Cereal Seed Samples | | | Cereal Stubble Samples | | | Corn Stalk Samples | | |
|---|---|---|---|---|---|---|---|---|---|
| **Municipal District / County** | **Surveyed Fields** | **Confirmed Positive Fields** | **Positive Fields (%)** | **Surveyed Fields** | **Confirmed Positive Fields** | **Positive Fields (%)** | **Surveyed Fields** | **Confirmed Positive Fields** | **Positive Fields (%)** |
| **Peace Region** | | | | | | | | | |
| Big Lakes | - | - | - | 8 | 0 | 0 | - | - | - |
| Birch Hills | - | - | - | - | - | - | - | - | - |
| Clear Hills | - | - | - | - | - | - | - | - | - |
| Fairview | - | - | - | 8 | 0 | 0 | - | - | - |
| Grande Prairie | 20 | 0 | 0 | - | - | - | - | - | - |
| Greenview | - | - | - | 9 | 0 | 0 | - | - | - |
| Mackenzie | - | - | - | - | - | - | - | - | - |
| Northern Lights | - | - | - | 15 | 0 | 0 | 1 | 0 | 0 |
| Northern Sunrise | - | - | - | 14 | 0 | 0 | - | - | - |
| Peace | - | - | - | - | - | - | - | - | - |
| Saddle Hills | - | - | - | - | - | - | - | - | - |
| Smoky River | - | - | - | 28 | 0 | 0 | - | - | - |
| Spirit River | - | - | - | - | - | - | - | - | - |
| **Regional Total** | 20 | 0 | 0.0 | 82 | 0 | 0.0 | 1 | 0 | 0.0 |
| **Total for Province** | **398** | **54** | **13.6** | **464** | **28** | **6.0** | **45** | **19** | **42.2** |