Occurrence and Fate of Toxigenic Fungi and Associated Mycotoxins in Oats

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Canada
Fungal Diseases and other Microbial Degrading Factors of Oats

- Fusarium Head Blight
- Smuts (*Ustilago* spp.)
- Mildew (mainly *Alternaria* spp.)
- Storage moulds
- Impact on yield, grain quality and safety
- Range of different mycotoxins (DON, OTA, …)
Storage Moulds on Cereal Grains

- Aspergillus, Penicillium
- Spoilage
- Degradation of nutrients
- Odour
- Grain properties
- Contamination with mycotoxins
Project material: 2013-14 oat samples

- Total of 39 composite samples (SK=17, AB=3, MB=19)
- Contributions from Emerson Milling, Cargill, Paterson
- Loading/sampling dates: May 19 – Oct 24, 2014
- 2014 Harvest Sample Program: 42 producer samples (not yet analyzed)
- Sample size 500–2000 g
Mould Load (ergosterol) in Oats 2013-14

- Total fungal biomass on kernels
- Depends on precipitation during the season
- Indicate origin of grain

- Alberta: ~6.5 ppm
- Saskatchewan: 2.8-4.9 ppm, 3.6-5.8 ppm, 8-12.4 ppm
- Manitoba: 6.7-17 ppm, 8-12.4 ppm, 9.3-35 ppm
Fungal pathogens in Oats 2013-14

- Mildew-causing fungi predominant
- Fusarium species less frequently detected
  (mainly in the eastern Prairies)
Deoxynivalenol (DON)

- relatively stable
- Symptoms of toxicity for livestock: Reduced feed intake, decrease in performance
- Maximum allowable limits in the EU for raw grains including oats = 1.75 ppm
- Processed cereal based foods for infants and young children = 0.2 ppm
Deoxynivalenol (DON) in Oats 2013-14

- 21 of 39 samples contained free of DON
- 18 samples with <0.26 ppm DON
Ochratoxin A (OTA)

- relatively stable
- bioaccumulative
  - detected in human milk and serum
- potentially carcinogenic to humans, neurotoxicity, immunotoxicity
- Proposed Value by HC (under consideration as a guideline)
  → Raw cereal grains (i.e., wheat, barley, oats, rice) 5 ng/g (ppb)
Production of OTA during Grain Storage

- Not a disease of field crops
- Different from DON issue
- *Penicillium verrucosum* growth and OTA production is driven by
  - moisture content / water availability
  - temperature

(Abramson et al. 1990)
Ochratoxin A (OTA) in Oats 2013-14

- 36 of 39 samples contained no OTA
- 3 samples with <2.6 ng/g (ppb) OTA
Occurrence of OTA in Canadian Grain Cargoes

- Cereals:
  - < LOQ
  - 1 – 5 µg/kg
  - > 5 µg/kg

- Oilseeds and pulses:
  - < LOQ
  - 1 – 5 µg/kg
  - > 5 µg/kg
OTA in wheat shipments vary throughout the year.
Outlook for 2015

- Mildew and Fusarium damage main degrading factors in wheat across western Canada in 2014
- Total mould load (fungal biomass) on oats higher in 2014 producer samples
- Frequency of Alternaria and Fusarium pathogens increased
- DON levels may be higher in 2014 harvest samples
- First results of processing study
Fusarium incidence on CWRS in 2014

- 100% samples with FDK
- 50% samples with FDK
- 0% samples with FDK
- no samples received
Fusarium severity on CWRS in 2014

Alberta

Saskatchewan

Manitoba

- 4% FDK (weight)
- 2% FDK (weight)
- 0% FDK (weight)

no samples received
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