

Mycotoxin Contamination in Western Canada

Background

Mycotoxins are secondary fungal metabolites produced by a variety of molds. Worldwide, many different types of mycotoxins are produced. Specific mycotoxins produced vary from region to region. This variability is related to temperature, moisture, type of crop and agricultural practices such as crop rotation, fungicide application, roadside plant control, and no till management.

Most mycotoxins are extremely potent and produce clinical disease at very low concentrations. Analytical detection is a challenge. Rapid metabolism and elimination from tissues further compromise analytical options. Mycotoxins are a feed-related problem and are not typically associated with water or air contamination in livestock.

Characteristics of Mycotoxin Poisoning in Livestock:

1. Often a vague problem. Molds don't grow uniformly in feed and mycotoxin production is highly variable. Intermittent low-concentration exposure is common
2. Sick animals do not respond to antibiotics
3. Outbreaks are often seasonal, primarily winter
4. Geography and climate are important
5. Problems are often associated with feed or a change in feed (feed refusal is common)
6. Fungal growth or mold in the feed is not a reliable indicator of mycotoxin content
7. Usually it is a herd problem

Analytical Assessment

Mycotoxins or groups of mycotoxins affect specific systems. Therefore, it is important to characterize the clinical disease and evaluate all mycotoxins that could produce the disease. Consequently, it is important to test for a variety of mycotoxins in the feed as effects may be additive. Many mycotoxin-related disease problems are both time (of exposure) and dose dependent. Exposure over a long period of time at a low dose may produce similar effects as a higher dose over a shorter period of exposure.

Since each mycotoxin or group of mycotoxins may produce different effects, the highlights for each mycotoxin will be briefly summarized:

Aflatoxin

Associated with *Aspergillus flavus* typically

- Several mycotoxins are in the group B. This is most common
- Clinical features
 - Liver disease
 - Carcinogenic
 - Poor performance

Aflatoxin is rarely observed in most parts of Western Canada unless the feed has been imported from the USA.

Zearalenone

Associated with *Fusarium* species

- Clinical features:
 - Estrogenic properties
 - Infertility, anestrus

Zearalenone is not frequently encountered in Western Canada. In the USA, this is a common problem in corn crops.

Trichothecene Mycotoxins

Associated *Fusarium* fungi

- There are several mycotoxins in the group with varied potencies:
 - HT-2 toxin, T-2 toxin, deoxynivalenol (vomitoxin, DON) plus 3 and 15-acetyldeoxynivalenol, nivalenol (NIV), diacetoxyscirpenol (DAS)
- Relative potencies:
 - HT-2 toxin = 50-fold more potent than DON and others
 - T-2 toxin = 5-fold more potent than DON and others
- During assessment of feed quality, differences in potency must be considered.
- Clinical features:
 - Feed refusal
 - Dermal necrosis
 - GIT irritation
 - Immunosuppression
 - Embryo toxicity, possible abortion

Tricothecenes are a common problem in Western Canada

Ergot

Associated with *Claviceps* species and *fescue* species

- A common problem in Western Canada
- Marked species susceptibility
- Clinical features:
 - Gangrene
 - Feed refusal
 - Convulsions (not common in Western Canada)
 - Abortion (not common in Western Canada)
 - Agalactia (reduced prolactin)
- Horses and sheep are highly susceptible to milk production losses
- Effects often observed during winter months
- Livestock standards in feed vary widely from country to country
- Clinical disease in livestock has been observed at concentrations below **current** CFIA regulatory standards

Ergot mycotoxins (alkaloids and epimers) vary widely in feeds. The current standards in most countries are based exclusively on the ergot alkaloid total concentration. However, the epimers may also have

pharmacological activity. The total ergot alkaloid **and** epimer concentration must therefore be considered when evaluating feed quality.

Ergot contamination of crops is highly variable from region to region and is dependent upon crop type (cereal and grass crops are susceptible) and level of rainfall in the spring months.

Ochratoxin

Associated with *Aspergillus* and *Penicillium* mold

- There are several ochratoxin mycotoxins such as Ochratoxin A
- Clinical disease
 - Kidney damage

The clinical significance in Western Canada is variable

Fumonisin

Associated with *Fusarium* species

- Clinical disease associated with Fumonisin B1 or B2 has not been confirmed in Western Canada

There is marked species differences and susceptibility. In horses, it produces a neurological problem, whereas in swine, it produces a respiratory syndrome. Cattle and poultry are more resistant to clinical disease.

Species Differences

Susceptibility to various mycotoxins is highly variable species to species. Consequently, the clinical manifestations may also vary. In cattle, dairy breeds may present a special concern. In general, dairy breeds may be four-fold more susceptible compared to beef breeds. In some instances, monogastric species may be more susceptible compared to ruminal species. There are exceptions to this statement, it is therefore important to contact a nutritional specialist or consult species-specific guidelines.

Sampling Concerns/Tips:

Proper representative sampling of feedstuffs is vital for obtaining accurate analytical results. A few infected grains can lead to heavy contamination of the sample which may not reflect the overall suitability of the feed. As well, a sample that does not adequately represent the feed may give a “cleaner” result than is actually the case. Approximately 90% of the variability observed in analysis is related to sample collection.

Corn: Grazing standing corn presents a unique problem. The contamination is almost exclusively in the cob. Since cattle graze the entire plant, submission of chipped plants including the cob is recommended. Animals that preferentially graze the less palatable stems and leaves may suggest the cobs are heavily contaminated. The extent of visual mold growth is usually a poor indicator of mycotoxin contamination. Analysis is, therefore, critical.

Swath-grazing Crops: Generally, mold growth on swathed crops occurs after swathing. This late season mold growth does reduce feed quality, but mycotoxin production is typically limited, although some risk is possible.

Blended Grain/Pellets: it is important to check that blended grains/pellets are safe for consumption. Testing is critical to ensure that these blends are below toxic levels, especially when sources for the blends/pellets are not known.

Sample Analysis:

Prairie Diagnostic Services (PDS), through the purchase of two brand new Ultra High Performance Liquid Chromatography- Tandem Mass Spectrometers (UHPLC-MS/MS), is now able to offer clients comprehensive panels for mycotoxin and ergot analysis.

Mycotoxin Panel: evaluates 11 analytes:



Deoxynivalenol (Vomitoxin)	Aflatoxin B1	Zearalenone
3+15 –acetyldeoxynivalenol	Ochratoxin	T-2 Toxin
Nivalenol	Fumonison B1	HT-2 Toxin
Diacetoxyscirpenol	Fumonison B2	

Ergot Alkaloid Panel: evaluates 6 alkaloids as well as their corresponding epimers:

Ergocornine + Ergocorninine	Ergocristine + Ergocristinine
Ergocryptine + Ergocryptinine	Ergometrine + Ergometrinine
Ergosine + Ergosinine	Ergotamine + Ergotaminine



Interpretation of Feed Analysis

The evaluation of mycotoxin analysis in feed samples is complex. Species differences, mycotoxin interactions, duration of exposure, climatic conditions, etc. make interpretation a challenge. Following consultation with various websites, it is recommended that you contact the feed specialist in the laboratory. Proper interpretation of results depends on many factors such as species for which feed is intended, age of animals, amount of feed provided to animals, and if sample is a proper representation of feed being tested.

Further Information:

General guidelines and information with regards to maximum allowable concentrations in feed as well as species/age/mycotoxin specific considerations can be found on the CFIA website: <https://www.inspection.gc.ca/> (search “RG-8”).

For further information regarding sample analysis, please go to <https://pdsinc.ca/services/toxicology>.

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