



# **NUTRIFAX**

**Nutrition News and Information Update**



# **MOLDS**



# **&**

# **MYCOTOXINS**



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# MOLDS AND MYCOTOXINS

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The effects of molds and mycotoxins on cattle are highly variable although, in general, ruminants are less sensitive to the effects of mycotoxins than swine. The rumen micro flora has the ability to detoxify many mycotoxins. However, today's high producing cattle have a higher passage rate of rumen digesta and this reduces the microbes' ability to denature mycotoxins. There are also some mycotoxins that the rumen bacteria have only a limited ability to detoxify. This leaves ruminants susceptible to the effects of mycotoxins. Lower milk production, reduced feed intake, a compromised immune system and reduced reproductive efficiency can result. Moldy feeds may also cause human health problems such as Farmers' lung, which can develop if a person inhales mold spores from moldy feeds. The management of molds and mycotoxins starts in the field and continues through the harvest and storage process ending with feeding management. This is essential to maximizing animal health and performance.

## Types of Mycotoxins:

There are several hundred known mycotoxins. However, the impact of only a few on animal health and production is known and it is thought that some may act synergistically such that the effects on animal performance can be greater than would be expected from the additive effect of each alone. The most common mycotoxins found in Ontario include:

**DON (Deoxynivalenol or Vomitoxin):** DON is the most common mycotoxin found in Ontario. The effects of DON on cattle include reduced feed intake and milk production, diarrhea and reduced reproductive performance. DON can also lead to an increase in health problems such as ketosis, displaced abomasum and reduced immune function.

**Zearalenone:** Zearalenones are estrogenic metabolites of several species of *Fusarium* molds. They cause reproduction problems in ruminants. Symptoms of Zearalenone exposure include abortions, enlarged vulva, decreased fertility and prolonged estrus. Other symptoms may include reduced dry matter intake and milk production.

There are many problems with identifying mycotoxin problems in cattle. In controlled situations, the problems associated with mycotoxins in the field have not been replicated. Examples include:

DON levels at 0.1 ppm have been linked with lower dry matter intake and lower milk production but research on dairy cows 13-22 weeks in lactation with 0, 6 and 12 ppm DON did not show significant differences in milk yield.

Studies at the University of Wisconsin noted abortions associated with 1 ppm Zearalenone. Similar reproductive disorders could not be demonstrated in cattle fed 200 – 300 ppm Zearalenone contaminated feed.

DON/Zearalenone may not be the actual problem. They may only be indicators of other harmful toxins or metabolites present in the feed. There could be cumulative or synergistic effects of other toxins present in the feed that are unknown. Many trials use a “pure” source of DON/Zearalenone. There could be other toxins present in the feed in field situations that are causing production and health problems. This could be one reason why “pure” sources do not show any effect on cattle in controlled experiments. Additionally, many trials lasted for only a relatively short period of time (1 to 10 days) and this could be too short a time to determine the long-term effects of mycotoxin exposure. Other trials use animals that are less sensitive to mycotoxins (mid to late gestation animals, low producing cows). This makes it difficult to interpret results.

### **Field Conditions:**

The majority of molds are produced in the field prior to harvesting. *Fusarium* molds are most often associated with mycotoxin problems in cattle (*Fusarium* are responsible for DON and Zearalenone). *Fusarium* molds flourish in high humidity (> 70%), the presence of oxygen and temperatures that fluctuate between hot days and cool nights. These molds are responsible for a wide range of plant diseases including stalk and ear rot in corn. They also cause head scab in wheat and other small grains. Not all molds that are produced in the field result in animal problems. Molds that cause corn smut (*Ustilage maydis*) are harmless. Key areas to address in reducing field molds include:

- **Soil fertility** –A well-balanced soil fertility program reduces plant stress and the likelihood of diseases. An imbalance of nitrogen and potassium have been directly associated with stalk rot in field corn.
- **Hybrid selection** –Selecting varieties for disease resistance, plant maturity and insect resistance can all play a role in reducing field mold.
- **Tillage and crop residue** - Crop residue can increase the risk for a number of plant diseases, which, in turn, increases the risk for mold development. Some researchers theorize that growing the same crop year after year on the same ground creates the opportunity for mold growth. Crop rotation could help “break the cycle” of mold development.
- **Reduce leaf diseases** – Reducing the incidence of leaf diseases will result in maximized plant photosynthesis and less of the nutrient requirements being supplied from the stalk. This results in the plant becoming less susceptible to the development of diseases and the formation of molds.

## Harvesting and Storage of Crops

Proper harvesting and storage of feed on farm is essential in reducing molds and mycotoxins. The inherent low pH of haylage and corn silage will prevent *Fusarium* field mold from proliferating even further. However, when making haylage and corn silage minimizing oxygen exposure is essential. If oxygen is present during the fermentation process molds will develop. Proper storage of grains is critical. Grains stored in poor conditions have an increased risk for mold development. There are many factors in harvesting and storing crops to reduce mold development. These include:

- **Timing of Harvest:** Harvesting crops at the right time will reduce the incidence of molds. Optimal conditions for mold formation occur in the Fall. The longer a crop remains in the field, the more opportunity for mold development.
- **Harvest crop at proper moisture:** Haylage and corn silage harvested too dry does not pack well. This results in more oxygen and subsequent mold development during the fermentation process. Store dry grains at the proper moisture. *Fusarium* mold will not proliferate when moisture levels are below 12-14%. Grain harvested too wet, not dried down quickly or stored under poor conditions are at greater risk of mold growth. Temperature also plays a role in reducing molds. A temperature difference greater than 5°C between the stored grain/fermented forage and ambient temperature can result in mold growth.
- **Rapid fill silos** – Silos that are filled too slowly will allow for more oxygen exposure. This will result in spoilage and mold formation.
- **Proper chop length:** Haylage/corn silage cut too long will not pack well resulting in oxygen present during the fermentation process. Corn Silage should be cut at 3/8 –1/2 inch (kernel processed 1/2- 3/4) and haylage at 1/4-3/8 inch. Screening dry grains will also help reduce mycotoxin levels. The small, light kernels are generally the most contaminated part of the crop.
- **Proper packing of forages:** Forages stored in a bunker that are not adequately packed allows for more oxygen and mold development. Ensure enough tractor weight and time is used when packing a bunk. Pack forages in thin layers (15-30 cm). This will improve packing density.
- **Covering the bunker** – Cover the top of the bunker with plastic and tires. This will help reduce the incidence of spoilage in the top layer.
- **Use silage inoculants** – The use of inoculants can help improve the fermentation process of forages and reduce the growth of molds.

## Symptoms of Cattle effected by Mycotoxins

Mycotoxins can have a wide range of effects on cattle. The main effects include:

1. Lowered nutrient levels and digestibility value of the feed
2. Hormonal effects in the cow
3. Immune suppression

The protein and energy content of the feed is reduced by about 5% when mycotoxins are present. Dietary fat is reduced by 5-10%. Molds use protein and energy from the feed to proliferate and grow. Vitamin losses are also accelerated in spoiled forages. Mycotoxins can cause estrogenic effects affecting reproductive performance. Health problems can occur due to immune suppression.

There are many symptoms that cattle will display as a result of the consumption of mycotoxins. The most common symptoms include:

- Slightly reduced feed intake – in severe cases feed refusal can occur
- Rough hair coat
- Higher incidence of health problems – especially ketosis, displaced abomasums, retained placenta and metritis
- Intermittent diarrhea, occasionally bloody and dark
- Increased incidence of abortions
- Silent heats
- Pregnant cows showing heats
- Swollen vulvas and nipples and vaginal or rectal prolapses
- Decreased conception rates
- A general unthrifty, undernourished appearance

These symptoms are not unique to mold and mycotoxins. Herd problems need very careful evaluation and the help of a veterinarian is generally recommended.

## Dietary Strategies to Reduce Mycotoxin Effects

Due to a number of circumstances many producers will at some point use feeds that are contaminated with mycotoxins. While this is not desirable there are a number of things that can be done to minimize the risk. Key points in using feeds containing mycotoxins include:

- **Bunk Face Management:** Proper bunk face management can help reduce mold problems. Ensure enough feed is removed each day to minimize mold growth. An average of 7-10 cm (3-4 inches) from the face of the bunk should be removed and fed each day. During warmer weather 10-15 cm (4-6 inches) should be removed for feeding.

- **Dilution of Contaminated Feed:** Reduce the amount of contaminated feed and replace with better quality feed. This will reduce the amount of mycotoxins present in the diet. Slowly introduce contaminated feed to cattle. This will help get cattle adjusted to feed. For example if an ingredient contains 2 ppm of DON it should be fed at no more than 25-28% of the diet ( $0.56/2$  as per appendix one). This would be if no other feeds contain mycotoxins. Start cattle at a low level of the ingredient (i.e. 5%) and slowly increase the amount being fed. Watch for symptoms of mycotoxin problems. If feed is severely contaminated with mycotoxins it should be discarded.
- **Feed a mycotoxin binder:** Feed 20 g/head/day of Integral. It can reduce the effect of mycotoxins and improve animal performance. Another option is to feed sodium bentonite at 120-240 g/head/day. The addition of Mold Inhibitor (1-2 kg/mt of ration) will reduce the incidence of feed heating in the bunk and help prevent mold development.
- **Feed contaminated feeds to low risk animals** – High producing cows and young pre-ruminants are most susceptible to mycotoxins. Do not feed to pregnant animals, especially dry and close-up cows. Low producing and mid-late gestation animals are less susceptible to mycotoxins.
- **Test forages and grains** – Sending a feed sample to a lab can help determine mycotoxin levels. Mycotoxins can occur in “pockets”. One area may contain no mycotoxins while another area may be severely contaminated. This can make it difficult to sample and interpret results. Take a representative TMR sample when testing for mycotoxins. This will give a basic background to identify if a problem exists. More thorough testing on specific ingredients can then be done to determine the problem.
- **Ration changes** - Increase ration protein level by 5%. If the original diet is at 17% protein, increase it to 17.85%. Increase vitamin A&E levels (by 20%). Increase trace mineral levels, use 1/3 from organic sources. Feed sodium bicarbonate and yeast. All of these can help animals cope better with mycotoxins.

Molds and mycotoxins can be a difficult problem to identify and deal with on farm. Field conditions, harvesting and storage management and proper feeding strategies all play an important role in reducing mold and mycotoxin problems. If mycotoxins are not handled properly animal health and performance will suffer.

Appendix 1.

**Guidelines for Interpretation of mycotoxin tests in dairy feeds**

Mycotoxin	Concern Level	Potentially Harmful
Aflatoxin		
Major Ingredient	20 ppb	20-300 ppb
TRDM	20-40 ppb	20-132 ppb
Zearalenone		
Major Ingredient	0.56 ppm	5.6-10.0 ppm
TRDM	3.9-7.0 ppm	0.6-3.9 ppm
DON/Deoxynivalenol		
Major Ingredient	0.56 ppm	5.0-12.0 ppm
TRDM	0.56 ppm	2.5-6.0 ppm
T-2		
TRDM	0.25 ppm	0.7-1.5 ppm
HT-2		
TRDM	0.25 ppm	1.5-3.0 ppm
Fumonisin		
Major Ingredient	1.1-3.3 ppm	6.7-11.1 ppm

From Penn State University Mold and Mycotoxin problems in livestock feeding paper

All values based on a dry matter basis

TRDM – Total ration dry matter