Mycotoxins: A Veterinary Perspective

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Mycotoxins are a toxic substance that can produce undesirable health, milk production and reproduction effects when consumed by livestock (1, 2, 3). They are produced by molds that can grow in grains and forages under the right environmental conditions during the growing or harvest season (1,2, 4). Not all molds produce mycotoxins (1), however, mold in feed ingredients can change the palatability and digestibility of a ration leading to a decrease in feed intake (1,5). Mold does not have to be visibly present in feed ingredients for toxic levels of mycotoxin to be present (5).

In this article I will discuss the signs and symptoms to look for in individual cows and your herd indicating you should investigate mold or mycotoxin levels in your feed ingredients and TMR. However, I will caution that the negative effects on health and production can be subtle and therefore go unnoticed. By the time you observe clinical signs, the subclinical effects will have already caused significant economic losses. The losses can result from decreased production, increased disease incidence and decreased reproductive performance (1,5). Details on the growing conditions for each type of mold in the field, at harvest and in storage bunks as well as prevention strategies for mold and mycotoxin production can best be addressed by your crop consultant and nutritionist.

Individual animals may respond differently to contaminated feed due to dose variation (molds/mycotoxins are not evenly distributed in contaminated feed ingredients), stage of production (high producing animals are often more sensitive to the effects), and duration of exposure (longer exposure can lead to more severe signs) (1, 2). Herds experiencing mycotoxicoses can show generalized signs of digestive disorders, reduced feed consumption, un-thriftiness, rough hair coat, poor growth, low milk production, impaired reproduction and impaired immune function (1,3, 5). Even when fed at a low rate, mycotoxins can interact with other stressors, such as heat stress or the stress of early lactation, to produce subclinical production losses, decreased reproductive performance and an increase in disease incidence (1). These signs are not unique to mycotoxicosis and a thorough investigation should be performed with the help of your veterinarian to rule out other causes before a diagnosis of mycotoxicosis is made.

Every growing season is slightly different and may result in favourable conditions for different combinations of molds and mycotoxins. There are many different types of molds and mycotoxins that can be found in harvested and stored grains and forages (1,2). Often more than one mold or mycotoxin can be identified in a contaminated feed sample. I will not discuss the exhaustive list here but will mention the two most commonly tested mycotoxins in 2015 and 2016 at the SGS Agriculture and Food lab in Guelph. These mycotoxins were Vomitoxin (Table 1) and Zearalenone (Table 2) both of which are produced by different species of *Fusarium* molds. Different mycotoxins can exert different effects when ingested by cattle. For instance, Zearalenone is known to have estrogenic effects that can cause reproductive problems (1, 2, 3). Vomitoxin has been found to effect digestion (reduced feed consumption and reduced nutritional efficiency), immune function

and reproduction (1, 2, 3). Mycotoxins work in a dose dependent manner with the severity of signs depending on the amount and duration that the contaminated feed is being offered. There are guidelines for the amount of each type of toxin that can be fed safely to cattle. Vomitoxin can safely be fed at a rate of no more than 1 part per million (ppm) in the diet of calves and lactating cows, with 0.56 ppm as the initial concern level and anything above 2.0 being considered as potentially harmful (5). Zearalenone can be fed at a level below 0.56 ppm before reaching an initial concern level in the diet but is considered potentially harmful at levels of about 5.6 ppm (5).

Table 1: Comparative summary of Vomitoxin found in different feed ingredients submitted to SGS Agriculture and Food Lab (Guelph) in 2015 and 2016. Starred values (*) are above the potentially harmful level if fed in the ration at that rate without dilution. This table has been modified to include both 2015 and 2016 as well as annotated with starred values from communications with SGS (Narvaez, N., SGS Agriculture and Food, Guelph, Ontario, Personal Communication).

Feed Type (# tests 2015/ # tests 2016)	Vomitoxin (ppm)											
	< 0.2		0.2 – 1.0		1.0 – 2.0		2.0 – 4.0		4.0 – 6.0		> 6.0	
	% 2015	% 2016	% 2015	% 2016	% 2015	% 2016	% 2015	% 2016	% 2015	% 2016	% 2015	% 2016
Wheat (257 / 168)	7.4	76.6	23.3	13.3	31.1	3.8	24.5*	3.2*	13.6*	3.2*	-	-
Barley (82 / 34)	24.4	58.8	18.3	20.6	24.2	5.9	22*	14.7*	11*	-	-	-
Grain Corn (578 / 640)	37.4	15	44.3	22	11.8	19.5	5.7*	22.3*	0.9*	21.1*	-	-
High Moisture Corn (38 / 37)	39.5	5.4	44.7	13.5	15.8	27	-	40.5*	-	13.5*	-	-
Distiller grains (189 / 170)	1.1	0.6	6.3	25.3	11.6	8.8	38.6*	29.4*	42.3*	35.9*	-	-

Table 2: Comparative summary of Zearalenone found in different feed ingredients submitted to SGS Agriculture and Food Lab (Guelph) in 2015 and 2016. Starred values (*) are above the potentially harmful level if fed in the ration at that rate without dilution. This table has been modified to include both 2015 and 2016 as well as annotated with starred values from communications with SGS (Narvaez, N., SGS Agriculture and Food, Guelph, Ontario, Personal Communication).

Feed Type (# tests 2015/ # tests 2016)	Zearalenone (ppm)									
	< 0.05		0.05 – 0.1		0.1 – 0.2		0.2 – 0.4		> 0.4	
	% 2015	% 2016	% 2015	% 2016	% 2015	% 2016	% 2015	% 2016	% 2015	% 2016
Wheat (29 / 1)	86.6	100	2.6	-	5.3	-	5.3	-	-	-
Barley (4 / 5)	100	100	-	-	-	-	-	-	-	-
Grain Corn (98 / 87)	83.6	10.3	9.2	8	3.6	11.5	2.6	55.2	1*	14.9*
High Moisture Corn (22 / 10)	81.8	20	9.1	10	-	40	9.1	-	-	30*
Distiller grains (19 / 3)	10.5	-	10.5	-	15.8	38.3	42.1	-	21.1*	66.7*

Diagnosing mycotoxicosis can be difficult as clinical signs can be subtle and be confounded with those exhibited by other diseases (1,3). An investigation into mycotoxicosis should be started after other disease causes are ruled out or if cattle are not responding as expected to disease treatment (1,3,5). My best recommendation is that you work together with both your nutritionist and your veterinarian when investigating the cause of poor milk production or reproduction in your herd. This could be as simple as planning a brief meeting with both your veterinarian and nutritionist after your regular scheduled herd health.

If molds or mycotoxins are identified at concerning levels in your feed ingredients and TMR, steps should be taken as soon as possible to address the problem (5). No matter what actions are taken to correct the problem the goal remains the same, reduce the amount of mold/mycotoxin to a level that can be safely fed to cattle. These steps can include: disposal or dilution of the contaminated feed source so that the TMR is fed with mold/mycotoxin below the level of concern; or, inclusion of feed additives such as toxin binders to reduce the dose of active mycotoxin in the TMR below the level of concern (1,3,5). Work with your nutritionist to reformulate your ration appropriately for your operation and keep your veterinarian informed of the action taken. Improvements in production or health should be noticed within a few weeks to several months depending on the length of exposure.

In summary, the effects of mold and mycotoxins in a herd can often be very subtle, making it difficult to diagnose. The signs and symptoms are not unique to mycotoxicosis so work with your herd veterinarian to rule out other causes of poor herd performance. Involving both your nutritionist and your veterinarian and creating a unified health team can keep your operation running at peak performance.

References:

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