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Newsletter

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> EDITORIAL

In the past our newsletters focused on the effects of mycotoxins in pigs and poultry. Ruminants are less susceptible to the effects of mycotoxins. However, we are finding more and more evidence of adverse effects for mycotoxins in dairy cows and Mycofix® Plus is already being used in several countries to overcome mycotoxin problems in dairy cows successfully, particularly in the USA. The most recent news on adverse effects of mycotoxins in dairy cows were received from Canada and the UK. In Canada last year's harvest was highly contaminated with deoxynivalenol and zearalenone and some dairy herds reported a drop in milk production of up to 50%! Furthermore they observed a higher incidence of diarrhea, decreased feed intake and longer calving intervals. Fresh cows seemed to be most affected. The return on investment from using Mycofix® Plus in dairy cows under those circumstances proved to be very high and helped to regain health status and performance levels in affected herds. A case in UK was reported with not only lower milk production, but also fertility problems and ovarian cysts in response to feed contaminated with increased levels of deoxynivalenol and zearalenone. Again the investment of 30g of Mycofix® Plus per cow per day proved to be well worth it with significant increases in milk production and continued improvement of fertility in the cows of this herd. As a result of the increased interest in the use of Mycofix® Plus in dairy cows, we invited our ruminant specialist Matthias Lins to share his knowledge on dairy cows with us and tell us why despite being less susceptible to mycotoxins than e.g. pigs, the dairy cow should be protected from mycotoxin contamination in the feed.



Verena Starkl

Mycofix® Plus product line –
 always a step ahead in
 mycotoxin deactivation!



Mycofix® Plus product line

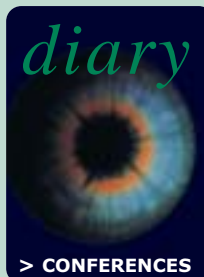
Mycotoxins are a widely accepted issue in monogastric nutrition. On a scientific basis the general agreement in ruminant nutrition over years was that due to the detoxification ability of the rumen microbes ruminants are not susceptible to mycotoxins at all. On the other hand extensive field studies showed significant production losses and increased incidence of health disorders in early lactating dairy cows when mycotoxin contaminated rations were fed.

Mycotoxins cut Dairy Profitability

by Matthias Lins

Mycotoxins are secondary metabolites of *Fusarium sp.*, *Aspergillus sp.* and *Penicillium sp.*. Mycotoxins produced by field fungi (*Fusarium sp.*) are trichothecenes [e. g. T-2 toxin, deoxynivalenol (DON)], fumonisin and zearalenone (ZON). Crop rotation, soil management and weather conditions at flowering affect trichothecene and ZON formation. By switching from an intensive crop rotation to monoculture (e. g. corn after corn for several years) *Fusarium* infected plant residues might accumulate in the soil. By choosing "minimum tillage" (crop residues stay on the soil surface) the crop has to grow through crop residues of the previous year. Thus the plant gets infected by *Fusarium* at a very early stage of growth. Feeds in dairy nutrition that might be contaminated by DON and ZON are cereals, concentrates and silages (grass, alfalfa, corn). Under hot and humid climates also aflatoxins can be formed in the field. Storage fungi (*Aspergillus*, *Penicillium*) mainly produce ochratoxin A (OTA) and aflatoxins. Proper storage conditions

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> CONFERENCES

AVE EXPO AMERICAS Forum Int. de AviculturaFoz do Iguacu, Brazil
August 17 - 19, 2005**Agrocomplex**Nitra, Slovakia
August 18 - 23, 2005**14th World Veterinary Poultry Congress 2005**Istanbul, Turkey
August 22 - 26, 2005**Euro-Maghrebin Symposium on biological, chemical contaminants and safety in food**Fes, Morocco
September 7 - 9, 2005**UK Dairy Event**Warwickshire (UK)
September 21 - September 22, 2005**SPACE**Rennes, France
September 13 - 16, 2005**World Dairy Expo 2005**Alliant Energy Center, Madison WI, USA
October 4 - 8, 2005**Fusarium Head Blight Workshop**Ottawa, Canada
November 1 - 3, 2005**3rd World Mycotoxin Forum**Nordwijk, Netherlands
November 10 - 11, 2005**Mold Meeting 2005**Gars/Kamp, Austria
November 17 - 18, 2005

> LITERATURE

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> IMPRESSUM

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(dry and cool) reduce the risk of mycotoxin formation. In silage (grass, alfalfa and corn silage) the mycotoxins might be produced on the field before harvest (e. g. DON, ZON) and after opening the silo (e. g. OTA). When farmers do not remove enough silage each day, yeast and mold growth occurs. This leads to nutrient losses, heat production in the silo, and it also impairs rumen fermentation and can induce diarrhea. Besides this “yeast and mold contamination” there is a possibility for mycotoxin contamination. Mycotoxin production is initiated when essential growth factors for fungi reproduction get short. Fungi produce these toxic metabolites to inhibit growth of competitive fungi and so improve the access to limited nutrients and minimize its availability for competitive fungi species.

How is ruminal detoxification affected?

Ruminants can detoxify mycotoxins to a certain but not complete extent. Once they have passed the rumen without any modification they enter the bloodstream and affect immunity and liver metabolism. Experiments show that ruminal degradation is in the range of 0 to 90% depending on the level and type of mycotoxin. In a scientific investigation the aflatoxin load in the feed was detoxified up to 40% in the rumen. Even 90% of ZON can be degraded but the main metabolite is α -zearalenol which is several times more estrogenic than ZON itself. Degradation of OTA and DON in the rumen was investigated many times with various results. Experiments show that mycotoxin detoxification in the rumen varies. Different mycotoxins are degraded at a different rate. Their negative effects depend on the level of cow comfort (housing conditions) as well as the duration of the mycotoxin intake. Poor bedding management increases the risk of mastitis and heat stress reduces feed intake. In addition to stressful

Factors influencing the susceptibility of dairy cows to mycotoxins can be summarized as:

- Contamination level in the feed
- Duration of mycotoxin intake
- Level of cow comfort
- Level of concentrate intake
- Level of feed intake and passage rate

housing conditions even a low mycotoxin contamination might already cause health disorders (e. g. mastitis). Consumption of contaminated diets for only a few days might be without any effects. Feeding mycotoxin contaminated concentrates or corn silage for weeks or even months undoubtedly will lead to reduced herd health and production losses. The ability of rumen microbes to detoxify mycotoxins is enhanced when rumen pH is around 6-7. If it drops below 5,8 (rumen acidosis) rumen microbes are killed and thus ruminal mycotoxin detoxification is reduced. Rumen acidosis is induced by feeding high amounts of concentrates. The level of feed intake can also affect ruminal mycotoxin detoxification. Cows producing more than 40kg of milk per day or 10.000kg a year have to consume a lot of feed on a daily basis. To enable a high feed intake the feed has to pass the digestive tract quickly. So the rumen of a high producing cow has only little time to detoxify mycotoxins because the feed does not stay in the rumen as long as it does in a low producing cow with lower feed consumption.



Mycotoxins might be present in corn silage as an important forage source

Research and field data contradictory

In research trials often mycotoxin consumption had no effects. On the other hand mycotoxin contamination even at a low level showed dramatic effects in large field studies (up to 20.000 cows per field study). In contrast to scientific experiments where mainly purified mycotoxins are used, cows in field studies consume naturally contaminated feeds in which due to co-occurrence of different mycotoxins toxicity of the single mycotoxin is enhanced (synergistic effects). To minimize the high costs of a scientific trial, exposure periods are often reduced. Unfortunately exposure of cows to mycotoxins for only 10 or 20 days is too short to express negative effects. In field studies dairy herds consumed contaminated rations for several weeks or even months before the investigation started. Mainly early lactating, high producing dairy cows showed negative effects in the field whereas low producing, mid to late lactation cows being used in research trials did not show any symptoms of mycotoxicosis. Table 1 illustrates the main causes of varying results in research and field data.

Table 1: Explanation for varying results of research and field data

Research	Field data
"Purified" mycotoxins	Natural contamination and synergistic effects of mycotoxins
Short trial periods	Most symptoms occur after weeks
Mid to late lactation cows (low susceptibility)	Problems in early lactating cows
High level of hygiene in the research facility	Compromised housing conditions

Consequences of feeding mycotoxins to dairy cows

Like in monogastric nutrition in dairy the most important mycotoxins are DON (and other trichothecenes), ZON and aflatoxins. DON and ZON are widespread in feeds grown under moderate climate conditions. Aflatoxins decrease milk



Mainly ZON impairs fertility and causes economical losses

In general mycotoxins act by 3 mechanisms in the animal:

- Altering nutrient absorption and utilization (feed efficiency)
- Effect on the endocrine system
- Suppression of the immune system

production and induce metabolic disorders in the first weeks after calving. A field study showed that production rose by 30% after the removal of aflatoxin contaminated corn silage (120ppb). Even though the physiological “mode of action” of ZON in ruminants is absolutely comparable with the one in pigs, the visible effects are different. As a result of mimicking estrogene in the organism ZON causes irregularities in heat expression. Heats occur in abnormal intervals or are even skipped. Conception rates drop to an unacceptable level (<30%) as a consequence of a high breeding index (number of servings until the cow gets pregnant) and incidence of ovarian cysts in cows and heifers increase. At a very high contamination level abortions might appear more frequently. Feminization in bulls is often associated with ZON contaminated feed.

A field study which was coordinated by the University of North Carolina in the USA investigated the effect of a natural DON contamination on dairy productivity. Whitlow and co-workers summarized that beginning at a contamination of 100ppb DON up to 800ppb in the total ration, milk production declined by almost 2kg/cow/day. In addition to the production losses a higher incidence of metabolic disorders like ketosis and fatty liver syndrome as well as mastitis, metritis, retained placenta, diarrhea and displaced abomasums (digestive disorder) was observed.

Experiences using Mycofix® Plus in dairy cows

Biomin started evaluating Mycofix® Plus in dairy cattle already in 1998 on a scientific basis. A trial was run by a research station in Austria (Wieselburg) in cooperation with the University of Veterinary Medicine Vienna. The contamination in the ration was 620, 705, 714ppb DON and 47, 33, 34ppb



Mycotoxins decrease feed efficiency and lower milk production

ZON in the control, toxin and Mycofix® Plus group. The conclusion of the long term trial (6 months) with 27 Simmental cows (dual purpose breed) was:

- Mycotoxins decrease rumen microbe population
- Mycofix® Plus increases milk production even in low producing dairy cows
- Mycofix® Plus lowers Somatic Cell Count by 60 %

The above promising results led to another dairy trial 2003 in the United States with 1200 Holstein cows. The contamination in the TMR (total mixed ration) was 400 and 600ppb DON and 78 and 70ppb ZON in the control and the Mycofix® Plus group. Inactivating the mycotoxin load in the TMR increased milk production by more than 2kg/cow/day, feed intake by 0,4kg and feed efficiency from 1,39 to 1,47kg milk per kg feed. Increasing feed efficiency improves dairy profitability and reduces manure production which gets extremely important on large dairy operations.

The economical evaluation of the trial showed that the Return on Investment (ROI) of Mycofix® Plus was 5:1. For every cent the farmer invested he got 5 cent back. In addition to results from trials in the past we did and planned in the near future we receive feed back from the area managers working with Mycofix® Plus in the dairy industry. Mycofix® Plus has been confirmed to reduce mycotoxin related fertility problems, such as ovarian cysts and poor conception rates. Furthermore there is positive feedback on Mycofix® Plus eliminating aflatoxin contamination in the milk and compensating negative effects of mycotoxins in feed intake, milk yield and metabolic disorders.

Conclusion

Mycotoxins can be present in dairy concentrates and silages. Especially dairy cows producing 40kg of milk a day are very susceptible to mycotoxins due to their limited ruminal detoxification. Trials with Mycofix® Plus in dairy cows showed promising results which are confirmed from the field (farmers, veterinarians, nutritionists). Mycofix® Plus unlocks the cows' potential and increases profitability in dairy production.