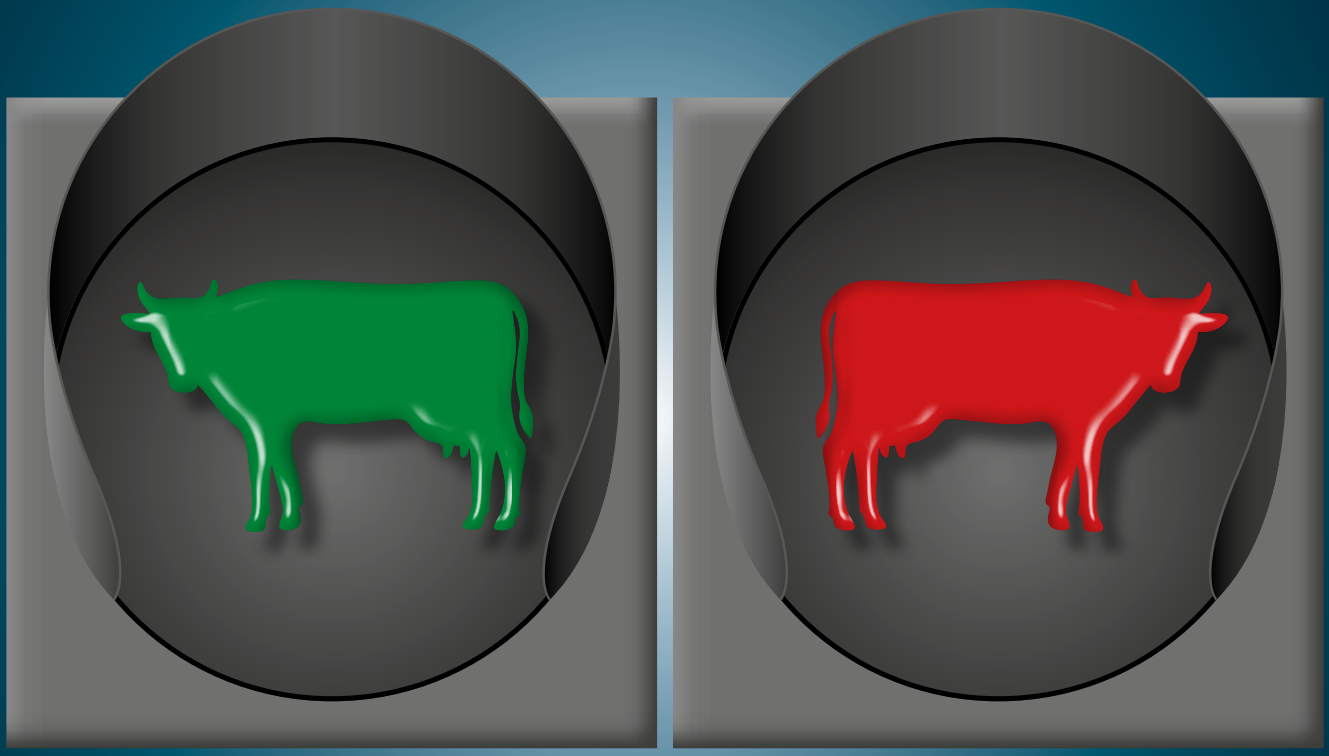
Issue 25 • Ruminants
A magazine of Biomin®

Science & Solutions



Trouble with On/Off Mycotoxin Risk Management

Illustration: ET-ART/ Balakovo

Case study

Dairy farm in China

Photo: visual7

Tackling acidosis

The dangers of SARA

Photo: Nenadpress

Editorial

The Race Continues

In April we noted that, in the absence of the EU milk quota system, competition to produce milk efficiently would mount considerably. Few anticipated that increased production by major markets would be met by a slowdown in demand from China and elsewhere, wreaking havoc on milk prices.

A common response from farmers facing low prices is to cut costs. In this issue of **Science & Solutions** we explore the case of a dairy farmer in China who, in an effort to reduce production costs, suspended the farm's mycotoxin risk management program. While initially put in place to counteract aflatoxins, the program's removal revealed a whole new set of challenges caused by other mycotoxins and reinforced the need for consistent application of mycotoxin risk management.

We then turn to subacute ruminal acidosis, or SARA, a difficult to perceive challenge that a dairy cow can face during her lactation that affects milk production, general health and longevity. We look at a number of steps farmers can take to maintain a more stable rumen pH and keep cows healthy.

Worldwide dairy production is expected to increase by nearly a quarter in the coming decade while prices are expected to decline slightly in real terms (e.g. after inflation). This suggests that the race towards greater efficiency and maintaining healthy herds will continue to define the industry in the years to come.

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Contents

Science & Solutions is a monthly publication of BIOMIN Holding GmbH, distributed free-of-charge to our customers and partners. Each issue of **Science & Solutions** presents topics on the most current scientific insights in animal nutrition and health with a focus on one species (aquaculture, poultry, swine or ruminant) per issue.
ISSN: 2309-5954

For a digital copy and details, visit: http://magazine.biomin.net
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The Perils of On/Off Mycotoxin Risk Management

By **Simone SCHAUMBERGER**, Product Manager Mycotoxin Risk Management

A dairy owner's recent experience demonstrates the risk of occasional application and highlights how mycotoxins can affect dairy herds and profits.

Like most dairy farmers, the owner of a 1000-head dairy operation located northwest of Beijing, China, was well aware of the dangers posed to cows by aflatoxin-contaminated feed. He was also conscious of the risk of carryover of ingested aflatoxins into milk at a rate ranging from one to six percent that could endanger human consumers.

With this information at hand, he decided to implement a mycotoxin deactivating feed additive at 20 to 25 grams per day per cow. A few months passed without issue. Plans to construct a new barn faced headwinds when the price of milk dropped and production cost pressures mounted—leading the dairy owner to cease the mycotoxin risk management program. In just a few days, the herd's abortion rate climbed significantly. The total mixed ration (TMR) had only trace amounts of mycotoxins, indicating that the alfalfa silage was the likely source of mycotoxin contamination. The owner reintroduced application of Mycofix® at a similar dosage as before, and within a few days everything had returned to normal. This case reveals a number of important facts about how mycotoxins affect dairy production.

Aflatoxin not the only danger

The reproductive issues observed in this case were likely the results of zearalenone, a potent estrogenic mycotoxin linked to a number of reproductive issues. The most well-known mycotoxins, recommended risk thresholds and effects are listed in *Table 1*. According to the annual BIOMIN Mycotoxin Survey, several major

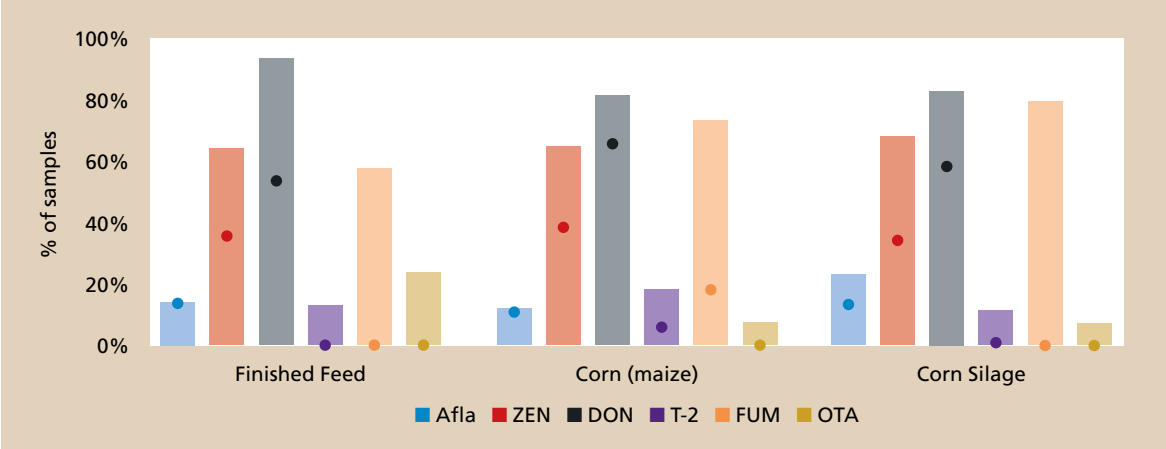
Table 1. Major mycotoxins and the dangers for cows.

Mycotoxin	Recommended risk threshold (ppb)	Effects
Aflatoxin	2	• Weight loss and reduced weight gain (cattle) • Impaired rumen function • Impaired udder health, increased somatic cell count • Decreased resistance to environmental and microbial stressors; increased susceptibility to diseases
Zearalenone	100	• Infertility, decreased conception rates • Teat enlargement • Enlargement of mammary glands in virgin heifers • Reproductive tract infections
Deoxynivalenol	300	• Impaired rumen function • Diarrhea • Metabolic disorders, mastitis, metritis • Lameness
T-2	100	• Loss of appetite • Gastroenteritis • Lowered milk production • Reduced immune response
Fumonisins	2000	• Decreased milk production and increased levels of liver enzymes
Ochratoxin A	80	• Ochratoxin A (OTA) is a nephrotoxic mycotoxin and ruminants are much less sensitive to ochratoxin A compared to non-ruminants

Source: BIOMIN

A common misconception is that mycotoxin risk management is optional or only necessary in response to

Figure 1. BIOMIN Mycotoxin Survey results, January to June 2015
Bars represent percentage of contaminated samples. Dots display occurrence of mycotoxins above risk threshold levels.



Source: BIOMIN

mycotoxins display high prevalence in common dairy cow feed components. *Figure 1* shows the incidence and concentrations of aflatoxins (Afla), zearalenone (ZEN), deoxynivalenol (DON), T-2 toxin (T-2), fumonisins (FUM) and ochratoxin A (OTA) in corn (maize), corn silage and finished feed samples analyzed worldwide between January and June 2015.

The most prevalent mycotoxin in dairy cow feed components was deoxynivalenol, present in 81% of corn and corn silage samples, as well as in 93% of the finished feed samples. Although the average levels of deoxynivalenol in corn and corn silage were above 2,000 ppb, single samples showed levels above 16,000 ppb which clearly exceed guidance and advisory levels imposed by both the US FDA and the EU for dairy cattle.

The average levels of zearalenone detected in corn, corn silage and finished feed (all above 300 ppb) pose a potential health threat to dairy cows due to its estrogenic effects.

On again, off again

A common misconception is that because cows are less sensitive to the effects of mycotoxins than other livestock species that mycotoxin risk management is optional or only necessary in response to a severe mycotoxin challenge. As the case study in China and *Table 1* demonstrate, the reality shatters this myth. Many dairy producers across the world have had similar experiences, forgoing a mycotoxin risk management program when faced with low milk prices or cost pressures, only to have sudden problems relating to insemination rates, lower milk production, diarrhea, elevated somatic cell counts, higher incidence of diseases such as hoof disease or mastitis, and reproductive failure. (See "Mycotoxins in Dairy" in **Science & Solutions**, Issue 13 for further case studies).

A number of factors that can lead to decreased mycotoxin deactivation in the rumen are shown in *Table 2.*

Degradation is not protection

Cows' lower sensitivity to mycotoxins (compared to other species) is due to their degradation in the rumen. Rumen biodegradation of various mycotoxins happens via certain microorganisms (e.g. protozoa) which have some capacity to metabolize particular mycotoxins.

Simone Schaumberger
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a severe mycotoxin challenge.

While some researchers have postulated that toxin degradation can reach up to 90% for some mycotoxins, estimates vary widely and differ for each mycotoxin. Several studies have shown that in the presence of some mycotoxins, rumen microorganisms are altered and do not have the expected detoxification capacity.

High production, unintended consequences

Ruminal transformation does not always render mycotoxins harmless. In the case of zearalenone, which is metabolized via protozoa to α- and β-zearalenol, the beta form has been shown to be a less-toxic metabolite, whereas the alpha metabolite results in an even more estrogenic compound compared to zearalenone itself (Jouary *et al.*, 2009, Dänicke *et al.*, 2005). The level of zearalenone degradation in the rumen seems to be strongly connected to the level of feed intake and the resulting retention time of the feed. High-producing dairy cows with a daily feed intake of 26 kg dry matter, for example, have higher throughput which reduces the time allotted for detoxification.

Undetected invaders

Masked mycotoxins (conjugated forms bound to proteins or sugars) cannot be detected by conventional analytical methods (HPLC, ELISA). During digestion, the intestinal enzymes may cleave the masked mycotoxins and the parent mycotoxins are released. After release, the mycotoxins can again become toxic for the animal.

Acidosis

A well-known problem within ruminants is subclinical or acute ruminal acidosis (SARA/ARA). This syndrome of low rumen pH often occurs in high-producing dairy farms, especially when the feeding regime is impaired or stress situations impair the ruminal flora and lead to dysbiosis.

It is assumed that during acidosis the numbers of protozoa decline and, as one of the most important mycotoxin-degrading agents, this leads to decreased degradation. Therefore, higher levels of mycotoxin can pass to the intestine and exert toxic effects.

Table 2. Factors impeding mycotoxin deactivation in the rumen

Factor	Description
High productivity	Higher throughput reduces time for detoxification
Partial/unfavorable degradation	Higher toxicity metabolites released in the rumen
Masked mycotoxins	Increased bioavailability of the parental mycotoxin
Multiple mycotoxins in rumen	Microorganisms have lower degradation capacity
Acidosis	Dysbiosis results in lower degradation capacity

Source: BIOMIN

Multiple threats

A number of common molds found in the field produce a variety of harmful mycotoxins that impair dairy cow health and performance. The most advanced, commercially available mycotoxin detection methods can identify over 380 different mycotoxins and metabolites (Spectrum 380®). Different groups of mycotoxins differ structurally from one another. While the dairy owner in this case initially implemented a mycotoxin risk management program to counteract aflatoxins, a robust program will combine several strategies, or modes of action, to counteract a broad range of different mycotoxins.

Comprehensive solution

Robust mycotoxin risk management comprises several steps: detection, prevention and mitigation. Regular analysis of feed components and silage can help to uncover potential threats to animals. Good silage management is essential to avoid further growth of molds and thereby prevent the production of mycotoxins. Regular application of a mycotoxin deactivator cannot be overlooked. Proper mycotoxin risk management is essential to avoid unpredictable losses and maintain a high producing dairy herd.