From science to practice 7

Laminitis: preventable pain?

One of the main causes for economic losses in dairy production after mastitis and fertility problems is lameness. In cows, the diagnosis of laminitis is difficult and its economic relevance is therefore related to all types of lame cows. The fact that about 90% of lameness is caused by claw-related diseases accentuates the impact of laminitis.

The average percentage of lame cows in herds differs, depending on country and stable management. Financial losses are high, because one lame cow can cost between €200-300/lactation. This means a financial loss of €4,000-6,000 Euros in a herd with 100 cows and an average lameness prevalence of 20%.

Endotoxins are parts of the cell wall of Gram-negative bacteria, and are released when bacteria multiply, lyse and die.

Excessive feeding of carbohydrates leads to an imbalance in bacteria population in the gut. Gram-positive bacteria proliferate rapidly, which consequently results in the death of Gram-negative bacteria.

As endotoxins are released when bacteria die, the amount of endotoxins can dramatically increase during carbohydrate overload. In addition to the release of endotoxins, acidity is increased and affects the gut permeability.

Endotoxins are absorbed into the bloodstream, together with other toxins, such as mycotoxins and exotoxins as well as histamine. This worsens the blood supply of the lamella tissue, and increases the blood pressure in the feet.

If toxins reach the hoof/claw tissue, an inflammation process starts. In the worst cases, the connective tissue of the pedal bone completely separates from the lamellar tissue, which causes the rotating, and eventually, the sinking of the pedal bone. This process causes a lot of pain, and is irreversible.

Application of proper mycotoxins and endotoxins risk management might remove two of the most important trigger factors for this disease, and therefore reduce the risk of laminitis. ■

From science to practice 8

The negative effects of mycotoxins in ruminants: A matter-of-fact or misperceptions?

by Carina Schieder, technical manager for ruminants, Biomin Holding GmbH

The consumption of mycotoxin-contaminated feedstuffs by animals leads to adverse effects on animal health. Ruminants are generally considered quite resistant to the adverse effects of mycotoxins as the presence of numerous bacteria in the rumen aid in the microbial degradation of various mycotoxins.

However, while on the subject of degradation ability, increased milk performance, especially in fresh lactating cows, and a consequently higher feed intake are parameters that have to be considered. Cows ingesting about 15 to 16kg of dry matter have about 120 minutes kg^{-1} feed to deactivate mycotoxins, whereas cows consuming 26kg of dry matter have only 55 minutes kg^{-1} for degradation due to a higher passage rate. Therefore, a greater number of undegraded mycotoxins are able to reach the small intestine, where they are absorbed.

Furthermore, negative effects depend on the level of microbial contamination. The higher the level of mycotoxins, the greater the negative impact on the microbial population in the rumen. Generally, mycotoxins have anti-microbial, anti-protozoal and anti-fungal activity. These properties lead to a decreased feed degradation with lower production of volatile fatty acids (acetic, propionic and butyric acid), which further decreases milk yield and milk components. Besides affecting the quality of milk performance, mycotoxins also inflict negative effects on the physiology of dairy cows, such as reduced fertility as well as decreased claw and udder health.

The mycotoxin challenge among cattle is an issue of high agro-economic importance to farmers. Hence accurate feeding in combination with continual and effective mycotoxin risk management are the key factors to maintaining animal health and increasing economic profit. ■

From science to practice 9

**Looking in the wrong direction?
Aflatoxins are just in front of us!**

by Dr Christina Schwab, Biomin Holding GmbH

The 2012 drought in the US raised worldwide awareness of the mycotoxin problem. Here in Europe, we are/were faced with a similar challenge: The aflatoxin scandal which started in Serbia and spread to Germany and the Netherlands.

The contaminated corn was found to originate mainly from countries in southeastern Europe like Bulgaria, Greece, Romania, Ukraine, Hungary, Serbia and Italy. Concentrations of aflatoxin B1 exceeding up to 40 times the regulatory limit of 5ppb in compound feed for dairy cattle were found in corn samples (for example 204ppb aflatoxin B1 in corn from Serbia).

Some 1-6% of the consumed aflatoxin B1 present in feedstuffs can be carried over as aflatoxin M1 into the milk of dairy cows. From last month's news, it was obvious the significant economic impact through loss of milk sales. The regulatory limit of 0.05ppb aflatoxin M1 in milk was set to protect children, elderly and the sick who consume milk.

Fungal growth and the ability to produce mycotoxins like aflatoxins are dependent on climatic conditions. Heat and drought stress are known to favour the growth of Aspergillus flavus and Aspergillus parasiticus, the fungi-producing aflatoxins.

Due to changing weather patterns, even well planned crops in usually aflatoxin-free areas may become exposed to conditions favourable for contamination.

With Serbia's harvest reduced by 45% due to the severe drought of 2012, an increased awareness of the expected mycotoxin occurrence could have helped dairy farmers. Monitoring aflatoxin B1 in feedstuffs and aflatoxin M1 in milk is an important part in correct mycotoxin risk management. ■

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From science to practice 10

Mycotoxins impact dairy fertility

by Inês Rodrigues MSc, Biomin Singapore Pte Ltd

Fertility and milk yield are directly related parameters; therefore the maintenance of productive animals plays a crucial role in dairy farming. All factors disrupting fertility will have a negative economic impact on herds. Zearalenone (ZEN) is an oestrogenic metabolite that has been reported to occur in silage, corn and other grains such as soybeans, wheat, barley, oats, sorghum, sesame seed and hay in many areas of the world. Chemically, ZEN shows a similar configuration to oestradiol, the female hormone, enabling it to connect to cell receptors, thus causing oestrogenic effects as well as abnormal oestrus cycles which ultimately impair fertility. More than 90% of ingested ZEN is known to be converted into α-zearalenol (about 10 times more oestrogenic) in the rumen and to a lesser extent to β-zearalenol (lower toxicity). Artificial insemination (AI) index rose from 1.2 to 4.0 in a dairy farm in England where poor quality hay was being used. In another case study, vulvar mucous discharge, repeated AI, increased culling due to infertility, difficult heat detection were also related with indoor season when animals were fed hay and silage which tested positive for Fusarium sp. contamination. Besides ZEN, other mycotoxins have shown to cause fertility problems in dairy animals. Low conception rate, cystic ovaries and uterine infection was observed in dairy animals consuming
naturally aflatoxin contaminated diets. Research proves there is no single method for effective mycotoxin control. Most grains and feedstuffs are afflicted by a wide variety of mycotoxin types, and not all varieties of mycotoxins can be destroyed with one deactivation agent. Research has proven that the best way to deactivate mycotoxins is with a triple assault: (1) adsorption of polar mycotoxins, (2) biological degradation of non-adsorbable mycotoxins and (3) protection of both the liver and the immune system. Combined, these three modes of action provide the most thorough means of deactivating the toxic effects of mycotoxins.■

From science to practice 11

Long-term mycotoxin analysis emphasises the need for careful mycotoxin risk management

Dairy cows are fed a complex diet to ensure sufficient roughage intake to maintain the rumen in a good condition. The complexity of these diets raises the issue of mycotoxins, as the risk of exposure to more than one mycotoxin increases.

As a pioneer in mycotoxin risk management, Biomin began in 2004 an extensive worldwide survey program analysing mycotoxin contamination of feed and feed raw materials. This comprehensive study was published in a recent scientific paper which evaluated the first eight years of the survey program (Streit et al. 2013).

From 2004 till 2011, 17,316 samples were analysed, out of which 72% contained detectable amounts of at least one mycotoxin – close to three times more than the frequently-cited FAO estimate of about 25 %. Deoxynivalenol was the most dominant with 55% of the samples tested positive, followed by fumonisins (54 %), zearalenone (36%), aflatoxins (27%) and ochratoxin A (25%).

Clear yearly variations were observed in mycotoxin prevalence and contamination levels. In 2010, there were a series of floods in Australia, mainly in the state of Queensland and Victoria. As a result, Australian samples displayed a five-fold increase in average zearalenone contamination and a six-fold increase in average deoxynivalenol contamination compared to the year before.

Average contamination of Asian maize with aflatoxins also increased from 45ppb to reach 183ppb in 2009. A possible reason for this development could be the increased frequency of droughts and extreme rainfalls over the past decade in South-East Asia. An interesting phenomenon was the increase in zearalenone-positive finished feed in North Asia which coincided with the rising import of US DDGS in this region. 81% of the DDGS samples in this survey tested positive for zearalenone.

Changing weather conditions and global trading of feed raw materials challenges the prediction of mycotoxin occurrence and emphasises once more the need for long term mycotoxin risk management. ■

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From science to practice 12

The risk of mycotoxins during the transition period

Dairy cows face a high risk of developing metabolic diseases during the transition period. A few days prior to calving, feed intake is reduced by up to 20% and stays low during the first days after parturition. But with the onset of lactation, the need for calcium and digestible energy increases. This combination may result in a negative energy balance. Cows are, therefore, fed high grain diets to compensate for the negative energy balance, which in turn increases the risk of ruminal acidosis. As a result of the mycotoxin detoxification ability of specific rumen microbes, ruminants are thought to be more resistant to mycotoxins. Dairy farmers have often overlooked the negative effects of these metabolites. Why is this a risky practice? In ruminants, high production levels and feed intake occur alongside increased passage rates. Subsequently, rumen microbes have had much less time to detoxify mycotoxins. The antibacterial properties of mycotoxins further reduce the detoxifying capability of rumen microbes. Hence, mycotoxin contaminated feed negatively affects the health of animals and may lead to reduced milk yield, lowered fertility rates and reduced farm profit overall. Moreover, the transition period is also the time when cows are more vulnerable to these secondary metabolites of fungi. Mould contaminations can lead to reduced feed intake. Ruminants dislike the mouldy odour in silage or stored feed, which can result in a reduced feed intake and prolonged feeding times. This, in turn, enhances the negative energy balance. Another problem with dry materials may be the inhalation of mould spores, which are known to induce a continuous pro-inflammatory challenge. The uncontrolled inflammation may be, among others, a trigger factor for secondary disorders such as metritis and mastitis. Another reason for an uncontrolled inflammatory challenge could also be the increase in endotoxins during an acidotic state in the rumen and the reduction in rumen wall permeability because of a disturbance in rumen metabolism. In addition, endotoxins and mycotoxins support an uncontrolled inflammatory challenge, which may lead to secondary disorders. Therefore, a continuous mycotoxin and endotoxin risk management can help improve the health of your dairy cows. ■

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