

Science & Solutions



Take a closer look

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**Adding a Phytogetic
Feed Additive to
Deliver More from
your Feed**



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**What is Hiding in
your Feed?**

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Editorial

Successful Farming is the Art of Looking Inside and Beyond

Having grown up on a farm, I learnt that success is the result of patience and proper investment. Seeds planted today will provide rich fruits at the proper time.

In this issue of **Science & Solutions**, we provide examples of this basic but economically sound attitude, which will keep you naturally ahead.

Every calf born today is an opportunity for increasing milk production, and reducing the overall cost of tomorrow's herd. Better intestinal health and feed intake are the basis for successful growth in young ruminants. In her article, Carina Schieder describes how phytochemicals can help in this task; a good example of strategic investment.

Mycotoxins are recognized as the main category of natural toxic substances due to their prevalence and specific effects. Only a few micrograms of mycotoxins can greatly damage health and productivity in ruminants. However, such small quantities can only be detected using appropriate analyses. When animals are showing clinical signs, it is always too late. Paige Gott focuses in on the hidden challenge of mycotoxins and on the risks of overlooking them.

Energy is the main driver of production and fertility in dairy cows and this is the reason why ketosis remains the main metabolic disease in the modern herd. Bryan Miller outlines the importance of supporting liver health during excessive fat mobilization, mycotoxin and endotoxin challenges.

Nowadays, making profits in the ruminant sector is not easy. However, the extensive experience of the BIOMIN ruminant experts are combined in this issue to highlight how reasonable investments at strategic times, and protecting animals against hidden threats, do pay back big dividends.

Enjoy reading this issue of **Science & Solutions**, keeping you naturally informed.



Paolo Fantinati

Technical Sales Manager Ruminant



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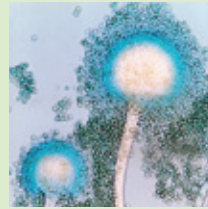


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Achieving and maintaining high feed intakes in calves, followed by good muscle and skeletal growth in young stock, are the targets for successful dairy producers. Phytogetic feed additives can help achieve these targets by improving the palatability and digestibility of starter feeds.

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A handy diagnostic checklist of symptoms, causes and remedies.

ISSN: 2309-5954

For a digital copy and details, visit: <http://magazine.biomin.net>

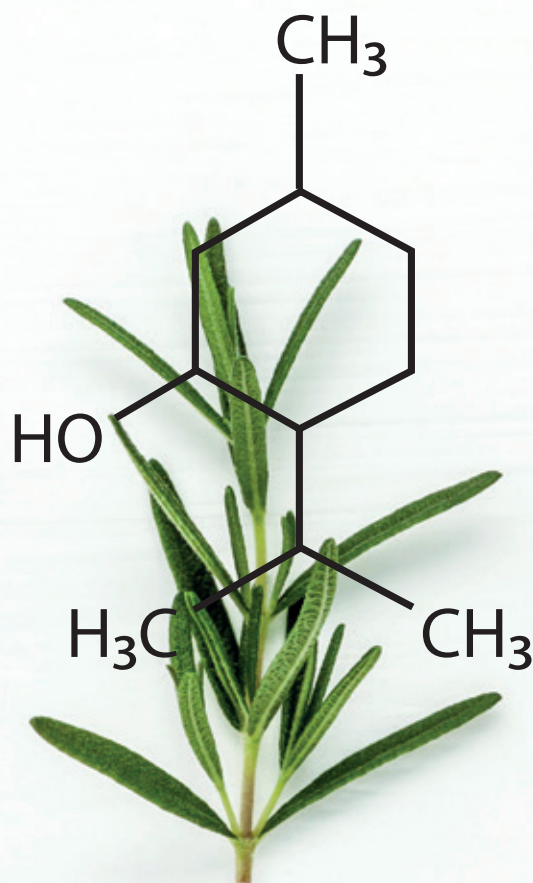
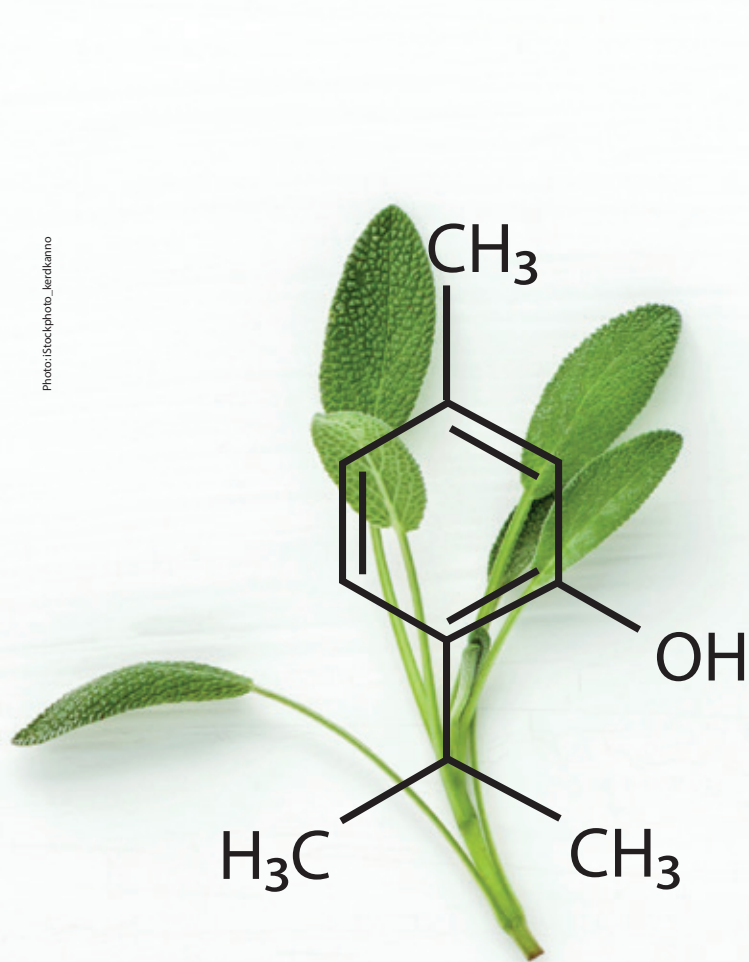
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Research: Franz Waxenecker, Ursula Hofstetter
Publisher: BIOMIN Holding GmbH
Erber Campus, 3131 Getzersdorf, Austria
Tel: +43 2782 8030
www.biomin.net

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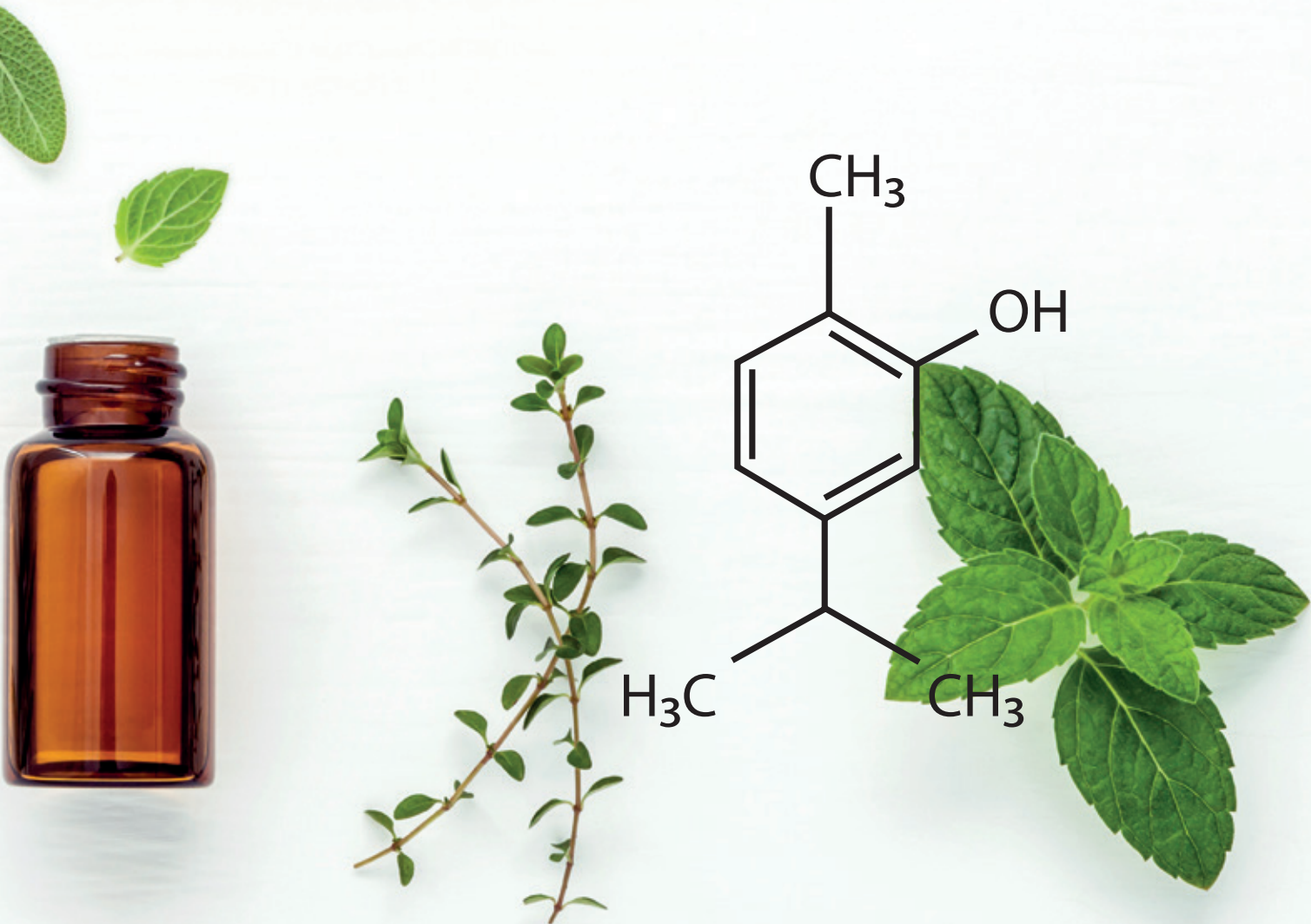
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How Phytogetic Feed Additives Can Deliver Long-Term Performance Benefits to the Dairy Industry

Achieving and maintaining high feed intakes in calves, followed by good muscle and skeletal growth in young stock, are the targets for successful dairy producers. Phytogetic feed additives can help achieve these targets by improving the palatability and digestibility of starter feeds.

By **Carina Schieder**, MSc, Product Manager PhytoGENICS



Producing highly productive dairy cows with good longevity starts with healthy, prosperous calves. Even though producers are usually aware of this, sickness and losses in calves are still major discussion topics. According to the Dairy Heifer Raiser overview from the USDA (2012), mortality in pre-weaned heifers was 4.2%. The biggest causes of pre-weaning mortality are digestive disorders and respiratory problems. Calf losses before weaning have a short-term economic impact, but they also influence the future genetic and earning potential of the production unit.

Another economically relevant factor for successful dairy cow production is the achievement of good growth development in calves. In a study from Cornell University, Van Amburgh *et al.* (2009) showed that early life events appear to have long-term effects on performance. Soberon and Van Amburgh (2013) concluded that 100 g of additional pre-weaning daily weight gain could result in approximately 155 kg of additional milk yield during the animal's first lactation.

Key factors for calf development

Any factor that challenges the health or growth rate of calves should be prevented. Important measures that

farmers can take which are associated with optimal calf development include:

- Ensuring an adequate supply of colostrum for new born calves
- Optimizing housing conditions
- Offering plentiful fresh water
- Supplying sufficient high quality milk or milk replacer and starter

In particular, the supply of water and starter feed are vitally important for adequate rumen development, which will subsequently lead to muscle and skeletal development and growth.

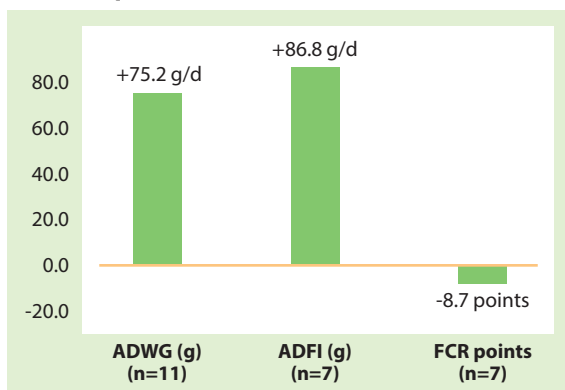
The importance of calf nutrition

Calves are young, non-ruminant animals that develop into ruminants over the course of only a few months. During this time, calves undergo tremendous change. Their first diet is composed of 100% liquid milk and transitions to being 100% solid feed (roughage and concentrates).

This dramatic change in their nutrition represents a huge challenge for calves in terms of ensuring a sufficient level of feed intake. Calves are also susceptible to environ-

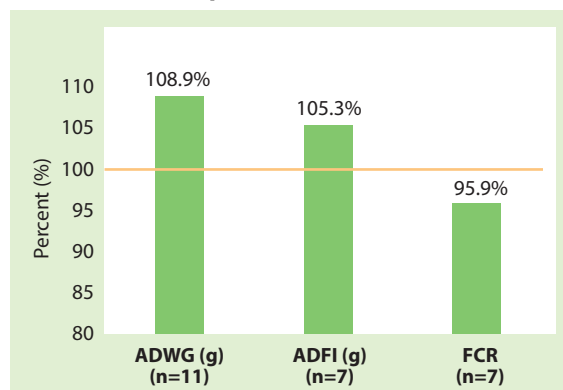
100 g of additional pre-weaning daily weight gain could result in approximately 155 kg of additional milk yield during the animal's first lactation.

Figure 1. Improvements (absolute numbers) of Digestarom® compared to Control calves in a pool-analysis ["n" represents the number of trials in which a parameter was recorded; the orange line represents the Control group of medicated and non-medicated calves].



Source: BIOMIN

Figure 2. Improvements (relative numbers) of Digestarom® compared to Control calves in a pool-analysis ["n" represents the number of trials in which a parameter was recorded; the orange line represents the Control group of medicated and non-medicated calves].



Source: BIOMIN

mental stressors such as housing or grouping changes, which can influence feed intake and the digestion and utilization of feed, resulting in poor health and growth development.

Supporting solutions

During this challenging time, a feed additive that improves the palatability of the feed and supports the development of the gastrointestinal tract can be of great benefit. Specially selected phytogetic feed additives (PFAs) that have flavoring properties and support the optimal functioning of the intestinal tract can help ease calves through this critical period in their development. Digestarom® is a unique blend of herbs, extracts and essential oils that improves the palatability of feed, ensuring that calves reach and maintain optimal feed intake levels.

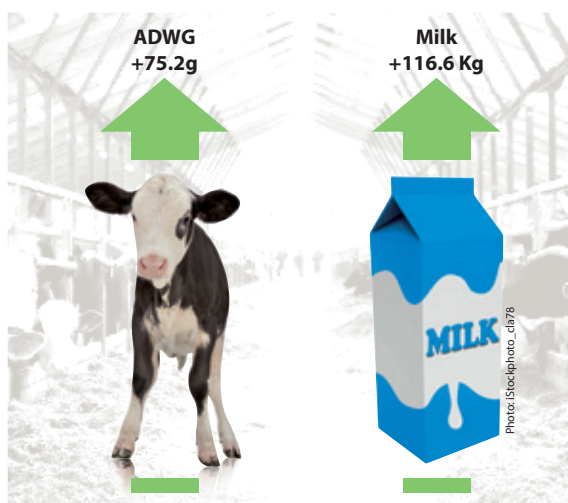
Furthermore, Digestarom® also enhances digestibility, which is a pre-requisite for the efficient conversion of raw materials into growth performance, while also reducing intestinal stress. Improved digestibility of feed means

there are less free nutrients available in the gut to nourish pathogenic bacteria. By adding Digestarom® to the diets of calves, the growth of pathogenic bacteria in the gut is limited, reducing the bacterial challenge faced by the calf. Moreover, Digestarom® directly supports the gastrointestinal tract through its anti-inflammatory and anti-oxidative properties.

Pool analysis of trials with Digestarom®

The positive effects of Digestarom® in calves have been observed in a number of field and scientific trials in pre-weaning and weaning calves (males and females). A pool analysis was conducted to evaluate improvements with Digestarom® based on the results of several trials. Parameters evaluated for the pool analysis were average daily weight gain (ADWG), average daily feed intake (ADFI) and feed conversion (FCR). Average daily weight gain was recorded in eleven trials, while ADFI and FCR were recorded in seven trials. Trials for the pool analysis were conducted in the United States and Europe. The performance of calves in the control groups were

Figure 3. Average performance improvement with Digestarom® suggests an additional 116.6 kg of milk in the first lactation.



compared to calves receiving Digestarom® in milk/milk replacer or calf concentrates. The groups receiving milk replacer and/or feed supplemented with Digestarom® were compared to non-medicated milk replacer/feed or to medicated milk replacer/feed. The Control group in the illustrated results (Figures 1 and 2) combines the medicated and non-medicated milk replacer/feed. The majority (82%) of the trials were conducted with between 48 and 56 calves, while 18% of the trials were conducted with 100 or more calves. Nine of the eleven trials lasted 56 days, one trial lasted 42 days and the final trial lasted 72 days.

Consistency in performance improvements

Results of the pool analysis showed consistent improvements in ADWG, ADFI and FCR when Digestarom® was present (Figure 1 and Figure 2). Average daily weight gain improved by 75.2 g or 8.9% when the diet was supplemented with Digestarom®. Average daily feed intake improved by an average of 86.8 g or 5.3%, while fed-out feed was also utilized 4.1% more efficiently (an improvement of 8.7 FCR points) in the presence of Digestarom®.

The pool analysis results indicate that there is a direct positive economic benefit when Digestarom® is added to the diet, because of a more efficient transformation of feed into growth performance. When the economic benefits of Digestarom® supplementation in young stock are combined with the conclusions drawn from a meta-regression by Soberon and Van Amburgh (2013), Digestarom® supplementation could increase first lactation performance by an additional 116.6 kg (Figure 3).

Conclusion

To operate a successful dairy production business, and to realize the potential of calves, we need to focus on their health and growth rates. As well as a good management program, calves can benefit from the supplementation of a selected phytogenic feed additive such as Digestarom® to ensure a smooth transition from liquid to solid feeding in the first three months of life. In numerous trials, Digestarom® improved feed intake and gut performance resulting in better weight gains. 🌿

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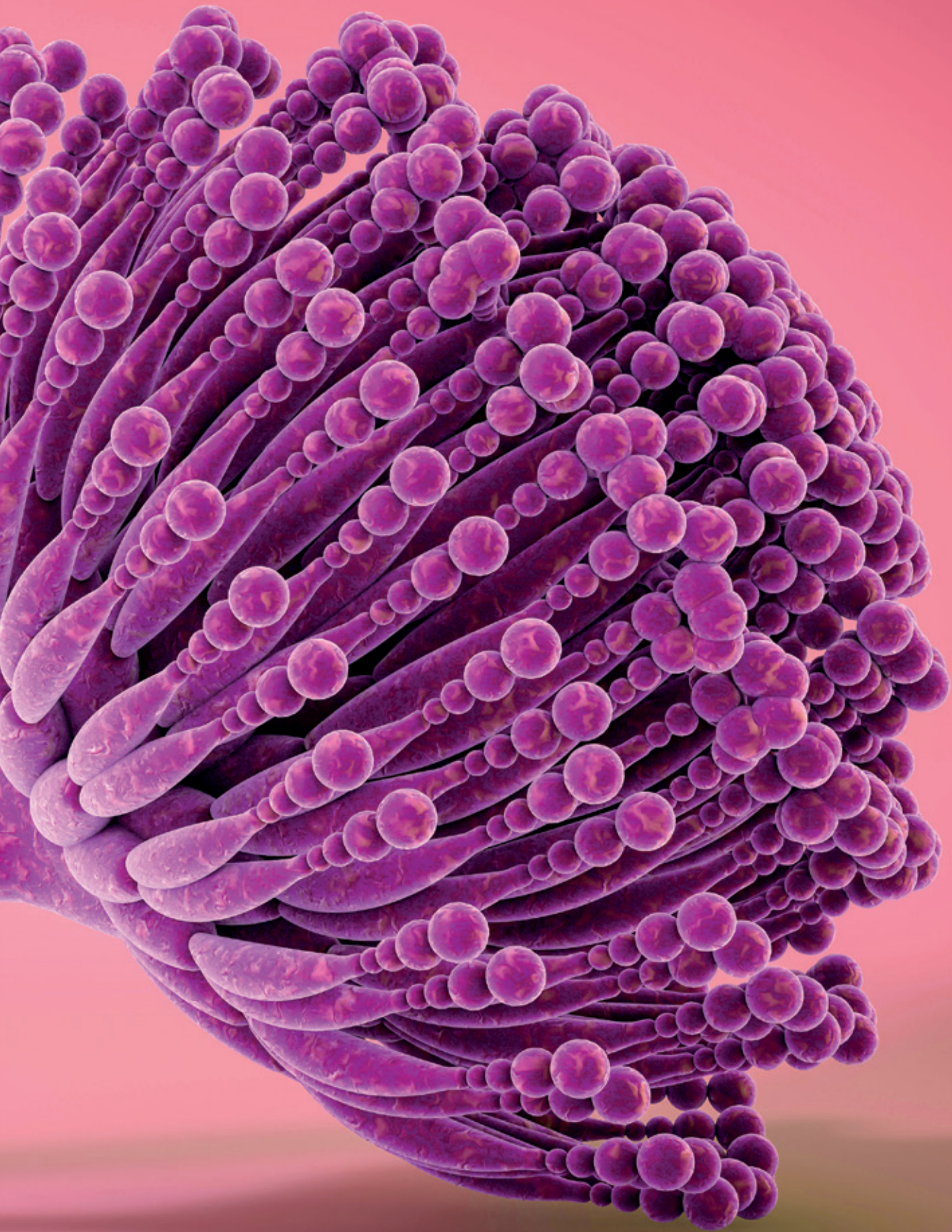
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The Performance Inhibitor Hiding in Feed

Mycotoxin contamination is not usually the first thought of most producers, but it may be an underlying contributor to poor performance. Crops are subject to mycotoxin contamination both during growth in the field and in storage. Each year's crop provides its own unique set of challenges, which are explored here.

By **Paige Gott**, PhD, Ruminant Technical Manager



Low to moderate levels of mycotoxin contamination can cause subclinical effects which reduce animal health and performance.

The basics of mycotoxins

Mycotoxins are toxic secondary metabolic products of molds, which negatively impact animal health and productivity. A wide array of grains and forages can be contaminated with mycotoxins and more than 400 mycotoxins have been identified. Not all molds produce mycotoxins and not all mycotoxin-producing molds constantly produce toxins. As a result, mold growth does not guarantee the presence of mycotoxins, but indicates the potential for contamination is there.

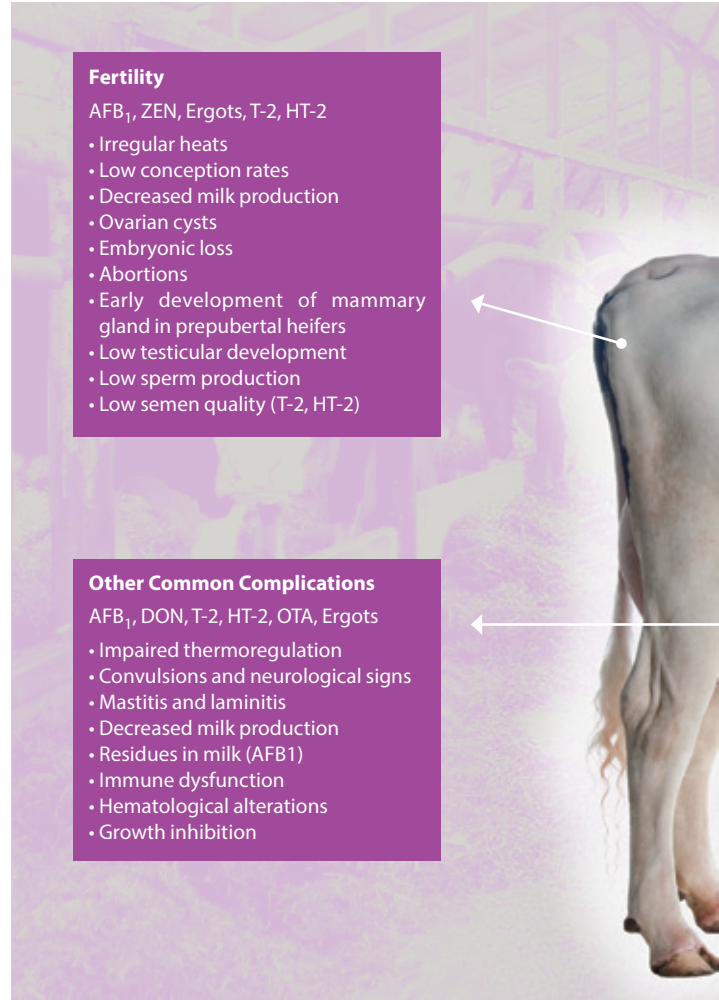
Mycotoxin producing molds are commonly divided into two categories based on when the mycotoxin is formed: pre-harvest (field fungi) or post-harvest (storage fungi). The *Fusarium* species of mold are considered field fungi while *Aspergillus* and *Penicillium* species are categorized as storage fungi. Exceptions can occur when conditions are right, allowing storage fungi to contaminate crops in the field, and field fungi may continue to produce mycotoxins once crops are in storage.

Multiple factors influence mold growth and mycotoxin formation including temperature, moisture content, oxygen levels, and physical damage to the crop. Stress factors, including drought or excessive rainfall, can increase plant susceptibility to mold colonization and mycotoxin formation.

Six major mycotoxin categories include: aflatoxins, trichothecenes, fumonisins, zearalenone, ochratoxins, and ergot alkaloids. Additional mycotoxins exist, however, these six categories include the most frequently detected and the most studied.

Mycotoxins affect animals in a variety of ways (Figure 1). Many factors influence the impact mycotoxins can have including mycotoxin type, animal species, age of the animal, and the level and duration of exposure to mycotoxins. Environmental conditions, animal health

Figure 1. Effects of Mycotoxins.



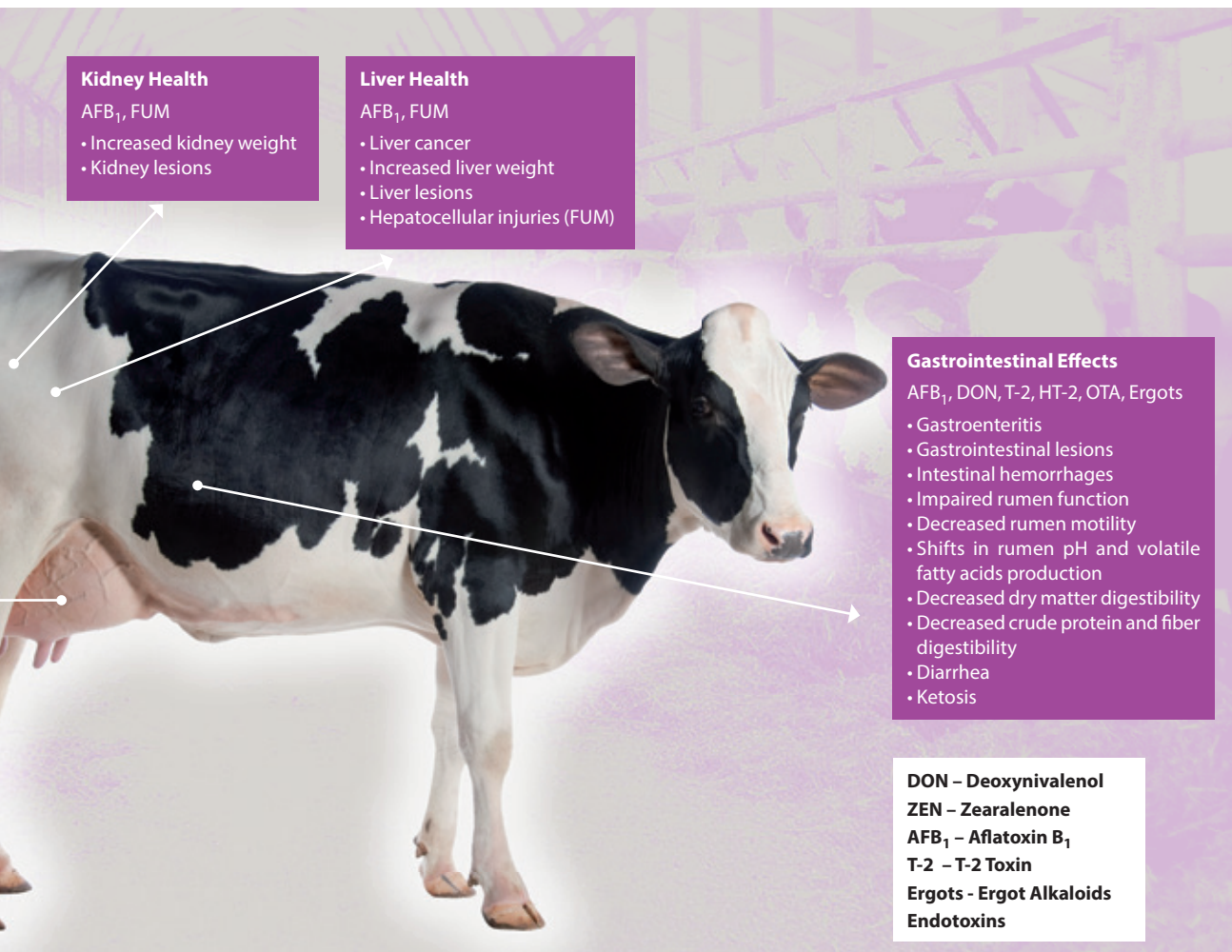
Source: BIOMIN

status, and other stresses also play a role in the negative effects mycotoxins have. Some toxins target specific organs such as the liver or kidneys. In general, mycotoxins can cause immune dysfunction, increasing an animal's susceptibility to disease.

High levels of mycotoxins are typically needed for expression of classical mycotoxicoses, but low to moderate levels of mycotoxin contamination can cause subclinical effects which reduce animal health and performance.

Mycotoxins in cattle

Traditionally, cattle were assumed to be less sensitive to mycotoxins as a result of rumen fermentation. However, greater production demands and changes in cattle feeding practices in both dairy and beef herds have increased opportunities for mycotoxins to negatively impact production and animal health.



Kidney Health

AFB₁, FUM

- Increased kidney weight
- Kidney lesions

Liver Health

AFB₁, FUM

- Liver cancer
- Increased liver weight
- Liver lesions
- Hepatocellular injuries (FUM)

Gastrointestinal Effects

AFB₁, DON, T-2, HT-2, OTA, Ergots

- Gastroenteritis
- Gastrointestinal lesions
- Intestinal hemorrhages
- Impaired rumen function
- Decreased rumen motility
- Shifts in rumen pH and volatile fatty acids production
- Decreased dry matter digestibility
- Decreased crude protein and fiber digestibility
- Diarrhea
- Ketosis

DON – Deoxynivalenol
ZEN – Zearalenone
AFB₁ – Aflatoxin B₁
T-2 – T-2 Toxin
Ergots - Ergot Alkaloids
Endotoxins

Focus on deoxynivalenol (DON)

One of the most commonly occurring mycotoxins in livestock feeds is deoxynivalenol (DON), better known as ‘vomitoxin.’ The name ‘vomitoxin’ originates from the toxin causing vomiting in swine. Deoxynivalenol is a member of the trichothecene family of mycotoxins, specifically Type B trichothecenes. Several species of *Fusarium* molds are capable of producing trichothecenes. Additionally, some *Fusarium* mold species can produce the mycotoxins zearalenone and fumonisins. It is not uncommon to detect more than one toxin in a feed sample since molds can produce more than one type of mycotoxin.

Deoxynivalenol inhibits protein and nucleic acid (DNA and RNA) synthesis. The negative effects of DON are mainly seen in the gastrointestinal tract and immune system, but the toxin can cause lesions and necrosis of the skin and mucosa as well. The cells lining the intestines are

continuously being renewed and are especially sensitive to the effects of DON. The intestinal epithelium serves two main purposes: 1) to absorb nutrients and 2) to act as a barrier to prevent harmful substances from entering the bloodstream. Both of these functions can be disrupted by

Take home points

- Even low doses of mycotoxins can negatively impact animal health and productivity
- Mycotoxin contamination can occur in the field as well as during storage
- DON also known as ‘vomitoxin’ can negatively impact more than just gut health
- Testing of feeds can help identify mycotoxin contamination
- Products are available which can help mitigate the negative effects of mycotoxins in livestock


Mycotoxins are not evenly distributed in feeds, so obtaining representative samples for testing can be difficult.

DON, leading to reduced nutrient uptake and increased passage of toxins and pathogens into circulation. This can limit animal growth or production capacity as the required nutrients are not absorbed and utilized. Additionally, other organs may be exposed to pathogens or toxins which enter the bloodstream, increasing the possibility for disease. Disruption of the intestinal mucosa can also lead to diarrhea. A large portion of the immune system is located in the gastrointestinal tract. Immune function can be impaired by disruption of the gut mucosa. Additionally, DON can impair production of the white blood cells, which help fight infection. Deoxynivalenol can also weaken the immune system by negatively impacting cytokine and antibody production. The animal's natural immune response to vaccinations may also be reduced, leaving them susceptible to disease despite vaccination. All of these factors can lead to immune dysfunction in cattle, increasing vulnerability to infections.

Managing mycotoxins

Reducing animal exposure to mycotoxins is key, but not always possible when feeding livestock. Identifying contamination can help to reduce exposure. Unfortunately, mycotoxins are not evenly distributed in feeds,

so obtaining representative samples for testing can be difficult. A highly contaminated sample does not mean the entire crop is bad and a 'clean' sample does not guarantee that all of the feed is mycotoxin-free. Additionally, many mycotoxins exist, but relatively few are routinely tested for. Although limitations exist, mycotoxin analysis of feeds can provide useful information to producers.

Commercial products are available which can bind (adsorb) mycotoxins including clays and yeast products. The chemical structure of the mycotoxin plays a big role in whether the toxin can be controlled well by binders. Additionally, binder products vary in their composition and chemical structure, leading to variability in their effectiveness at adsorbing mycotoxins. Aflatoxins and ergot alkaloids are often controlled well by binders. Other mycotoxins, such as zearalenone and trichothecenes, are not as readily adsorbed by binders. Commercial products which have enzymatic activity can detoxify these mycotoxins by physically altering their chemical structure, leaving inactive or much less toxic substances. Several plant and algae extracts have been identified which can help reduce damage to the liver and provide support to the immune system. Combination products can provide broad spectrum mycotoxin control. 

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This article was originally published in *Progressive Cattleman*.

What's Wrong With My Herd?

Part 5: Ketosis

By **Bryan G. Miller**, Ruminant Technical Support Manager



Even if you only own one dairy cow, if she has had a calf it is likely that you have had a case of at least mild subclinical ketosis. Yes, it is that prevalent. Most cows go through at least a short time period where they lack the glucose to meet all of their needs. In many ways, the herd's milk production and health status are linked to the duration and severity of subclinical and clinical ketosis within the herd.

The negative energy balance that causes ketosis can decrease milk production and often accompanies other metabolic diseases such as milk fever (hypocalcemia), metritis, mastitis, and displaced abomasums (DA).

Cows with ketosis conditions take longer to be bred successfully and often will not reach their full potential in peak milk production.

Symptoms of ketosis

One of the primary effects of ketosis is a decrease in dry matter intake, which is much easier to diagnose in tie stall barns vs. free stall barns. A classic detection is for the odor of acetone on the breath of cows, which can be useful for clinical ketosis but will probably not identify subclinical ketosis cows.

If a cow herd has a high level of DA (over 3.5%), consider the link to ketosis. As both afflictions affect dry matter intake, it is not necessarily a cause and effect relationship, but the two are highly associated. When viewing cows early in their lactation that have dull coats and appear unthrifty or listless, consider ketosis as a possible source.

Additionally, cow herds with more ketosis also tend to have increased levels of metritis. If one is looking at increased disease conditions, consider potential links to subclinical ketosis.

What is ketosis?

By definition, it is the result of finding ketone bodies – primarily made up of acetone and beta-hydroxybutyrate – in the blood. These byproducts come from poor utilization of fats. There is a saying that 'fats burn in the flame of carbohydrates', which is to say you need sufficient carbohydrates (or carbohydrate derived compounds) to properly utilize fat, much like a pilot light is needed for the furnace to run properly.

The rumen, which allows cows to digest fibre, is of great benefit. However, it does not allow for the passage of sugars and most of the starch. As a result, cows rely on the liver to produce needed glucose through gluconeogenesis. This process can take propionate, a volatile fatty acid produced in the rumen, amino acids, and other compounds that can be broken down into a unit containing three directly attached carbon atoms, and convert them to glucose. Because the liver is critical to the manufacturing of glucose, any factors that decrease its ability to produce glucose increases the risk of developing ketosis.

This is particularly true in early lactation where the energy demands for high milk production cannot be met by the dry matter that cows typically consume. Fatty infiltration of the liver can decrease liver function and is common in transition cows, particularly in cows with excess body fat (body scores of 3.75 and above). This is a major contributor to increased ketosis observed in over-conditioned cattle.

Treatment for ketosis

The first course of action is to increase the circulating glucose concentrations in the blood. This is done through infusion of 500ml of 50% dextrose solution IV. This is more effective in cows that develop ketosis soon after calving and may need to be repeated. Sometimes, glucocorticoids, such as dexamethasone or isoflupredone acetate (5-20mg) are administered intramuscularly to stimulate glucose production.

Rumen precursors for glucose production can be fed, usually propylene glycol (400g/day) to allow the cow to produce her own glucose.

Treatments should be discontinued after cattle both appear more normal and increase their dry matter intake to appropriate levels.


Preventing ketosis

Ketosis is prevented primarily through improving liver health and maintaining dry matter intake, in particular in the first five days after calving. The most important thing a producer can do is to maintain proper body condition and avoid fat cows. Research indicates that cows of normal to slightly thin condition have less fatty liver infiltration and less ketosis.

Increasing the rumen bypass of methionine and choline has been demonstrated to reduce ketosis and foster greater feed intake post calving. Niacin supplementation can also be helpful, but tends to work better with fat cattle than those in better body condition. Where legal to do so, feeding monensin can increase the amount of propionate (glucose precursor) produced in the rumen.

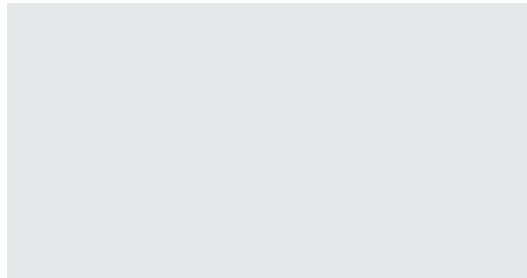
Herds that experience high levels of ketosis should also consider the possibility of mycotoxin contamination. Many mycotoxins have a negative effect on liver function which can reduce the ability to produce glucose. Producers that use mycotoxin control products in the lactating herd should also use them in the dry cow herd as well.

Although it is important to avoid fat cows, it is also important to minimize the drop in dry matter intake commonly associated with calving.

Products that can encourage dry matter intake, including the use of yeast products and phytochemical compounds should also help reduce the incidence of ketosis. 

This article was originally published in International Dairy Topics.

DISCLAIMER: This page contains general advice on ruminant-related matters which most commonly affect cattle and may be related to the presence of mycotoxins in feed. Ruminant diseases and problems include, but are not confined to the ones present on the page. BIOMIN accepts no responsibility or liability whatsoever arising from or in any way connected with the use of this information. Before acting on the basis of the contents of this page, advice should be obtained directly from your veterinarian.



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