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SCIENCE & SOLUTIONS

Keeping you naturally informed | Issue 65 | Ruminants

Boosting milk production profitably

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No matter where your operation is located, when it comes to raising cows, ensuring profitable production is at the forefront of your mind. Supporting and improving your herd's performance to maximize output requires close management and the very best inputs to ensure you stay naturally ahead.

In this issue of Science & Solutions magazine, we explore a number of topics related to improving performance. Digestarom®, the phytogenic feed additive in the BIOMIN gut performance range, delivers a number of benefits when included in rations for both calves and mature animals. Bryan Miller shares some trial results showing how Digestarom® increased milk production in an already high-performance dairy herd.

The benefits of Digestarom® can also be seen in younger animals, including beef calves. Improving creep feed palatability for nursing calves can increase feed intake, improving weight gain and ultimately increasing profits.

However, dietary supplements cannot mask poor quality raw materials. Vesna Jenkins explains the importance of getting the ensiling process right when storing forage materials. Silage makes up a big part of a total mixed ration, so making sure you start with excellent quality forage can dramatically improve herd performance.

Finally, part nine in our series looking at common herd problems focuses on rumen fermentation and the importance of getting the right balance of bacteria in the gut.

Enjoy reading this issue, keeping you naturally informed.

Plinio Barbarino, DSc
Head of Global Product Management G2P

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Boosting Milk Yield with Digestarom® Dairy

Bryan Miller, MSc
Ruminant Technical Support Manager

An investigation into the benefits of Digestarom® Dairy has revealed its ability to boost milk production in both heifers and mature cows. In addition to its other benefits, this phytogenic feed additive from BIOMIN can reduce inflammation, putting cows in a better energy balance and enabling increased milk production.

A feed trial was conducted in a high-production dairy herd in the United States to investigate the effect of Digestarom® Dairy on performance. Previous studies had demonstrated improved production in dairy cows fed Digestarom® Dairy. However the product had not formally been tested in herds producing more than 45 kg of milk per cow per day, nor in cows that were also receiving monensin in the diet.

IN BRIEF

- Digestarom® Dairy is a phytogenic feed additive produced by BIOMIN that delivers many benefits to milking cows, including reducing inflammation.
- Reducing inflammation in the gut enables a better energy balance and increased milk production, improving yields.
- Digestarom® Dairy also supports overall gut health, improving nutrient utilization and feed efficiency.

The trial site

A commercial 'robot' herd in Minnesota, USA, was used for the trial. Digestarom® Dairy can be used in herds milked by any method, not only robotically. However, robotically milked herds provide an excellent opportunity to conduct field trials as trial groups are fed the same feed, except for the concentrates that are offered in the robots during milking (control and treatment concentrates). The herd also has the same general genetics, the same environmental conditions, and the same farm management practices.

In this trial, animals were split into two groups of 62 cows each. The final trial results were based on the data from 118 animals that had completed the entire testing protocol. Milk production was recorded for two weeks prior to the start of the trial to ensure that production levels were similar in both groups.

Treatments

The cows were fed either a control concentrate, or a concentrate containing Digestarom® Dairy (2g per cow per day) for four weeks. Both groups averaged intakes of 5.67 kg of concentrates in the milking parlor.

Photo: Jose A. Bernat Bacete

After the four-week trial period, treatment was withdrawn for two weeks (the washout period) and then Digestarom® Dairy was introduced into the group that had previously been the control group. This switchback trial design allowed any potential differences that may have existed in the animals or pen conditions to be equalized.

The pre-trial and washout periods showed that both groups were starting from the same production level. Changes in milk production during and after consumption of Digestarom® Dairy indicated that it was necessary to feed Digestarom® Dairy for two weeks to see tangible results. The effect of Digestarom® Dairy dissipated two weeks after the additive was removed from the diet. Statistical analysis compared production during the final two weeks of the four-week feeding period.

Data was evaluated by looking at 4 groups: heifers less than 60 day in milk and more than 60 days in milk and cows less than 60 days in milk and cows more than 60 days in milk.

Increased milk yield

Milk production in the heifers fed Digestarom® Dairy increased by 0.7 kg per day and the mature cows that were given the additive produced 1.6 kg more milk per day. Interestingly, mature cows less than 60 days in milk increased daily energy-corrected milk (ECM) by almost 1.4 kg and milk protein by 63 g. In both heifers and cows, and in both early and late days-in-milk; cows receiving Digestarom® Dairy numerically produced greater milk fat. With no detected changes in body weight or feed intake, the cows receiving Digestarom® Dairy appeared to be more efficient.

Where does the extra milk come from?

The increase in total milk volume is related to the amount of lactose produced. All cows in early lactation are typically in negative energy balance, which limits milk production. Lactose is produced from glucose, which is generally available in smaller quantities during the early part of lactation. Cows produce glucose partly by deaminating proteins and combining them with other sources of three carbon units from the carbon skeleton originating from other sources.

Reducing inflammation

The results of this trial, including the increased milk production and improved milk protein levels, suggest that the energy balance was better in the animals given Digestarom® Dairy. Research from Dr. Barry Bradford's group at Kansas State University has shown how reducing inflammation in post-parturient cows improved production and health. These findings are very much in line with the observations from this trial in terms of improved energy balance, suggesting that Digestarom® Dairy may reduce inflammation.

Supporting gut health

Phytogenic compounds, such as those found in Digestarom® Dairy, have not only been associated with improved inflammatory conditions but also improved gut integrity. The trial performed by Kansas University was conducted in mid-winter in extremely cold conditions, but multiple studies have shown that cows suffering from heat stress have leaky guts and a demand for glucose that goes beyond any lack of glucose from their feed intake alone.

In heat stress conditions, Digestarom® Dairy may prove to be an important tool to mediate the effects of high temperatures and improve productivity in general. The other benefit that needs further investigation is the potential of Digestarom® Dairy to improve reproductive efficiency. Improving energy balance and glucose availability is important to improve uterine involution and ovulation, and could potentially result in fewer open days and healthier herd finances.

Overall, the trial confirmed the potential of Digestarom® Dairy to improve performance under field conditions, especially supporting animals in early lactation.

How Creep Feeding Calves Can Boost Growth and Profits

Supplying young calves with supplementary feed enables growth rates to increase towards their maximum potential, and reduces stress during the hungry-calf gap. Creep feeding potentially delivers many benefits to businesses wishing to increase productivity, acting as the first step to greater growth and profitability at later stages.

How creep feeding works

Providing beef calves with supplementary feed (usually concentrates) before weaning, is known as 'creep feeding', and it can make a significant difference to financial returns, but there are certain factors to consider to ensure the best performance and efficiency.

A creep feeder, which prevents adult cows accessing the supplementary feed, is used to feed the calf.

IN BRIEF

- Creep feeding consists of supplying supplementary feed to the nursing calf.
- The milk of a lactating beef cow only provides 50% of the nutrients the young calf needs. Creep feeding will provide the other nutrients necessary to achieve full growth.
- Adding Digestarom® to the creep feed can enhance palatability, encourage intake, support digestion and optimize feed efficiency and performance.

The milk of a lactating beef cow only provides 50% of the nutrients required by a young calf for full growth so additional nutrients must be provided from an alternative source in order for the calf to fulfill its potential. The most economical source is high-quality pasture, but this can be a problem for spring-calving herds, and the shift from milk to grass could well come at a time when the availability of fresh, high-quality grass is limited. If quality grass is lacking, creep feeding should certainly be considered.

The potential benefits

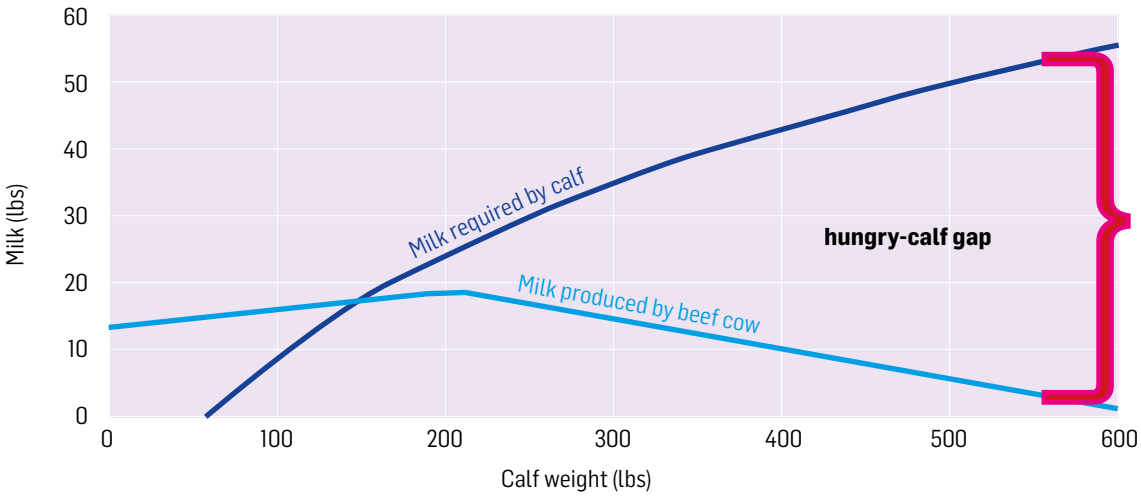
Depending on conditions (including feed type, calf genetics, and season), the average increase in weaning weight for a creep-fed calf is 18 kg, with 10–27 kg being a common range. Creep feeding also reduces grazing pressure on available pasture, and accustoms the calf to grain so that weaning is easier. During the hungry-calf gap, when the milk produced by the beef cow dwindles and the calf's requirements increase, creep feed can provide all the necessary nutrients.

So far, the benefits of creep feeding are hard to argue with, but it is not an immediate solution for all production units: viability and financial returns must be considered.

For example, some producers might be averse to the cost of the extra feed and feed delivery system. Creep feeding requires close monitoring to ensure feed is restricted to

Creep feeding consists of supplying supplementary feed to the nursing calf.

Figure 1.
Milk yield of a typical beef cow and nutrient requirements of a nursing calf



Source: Eversole, 2009

0.5–1 kg a day to ensure that the calf does not get too fleshy and potentially be discounted by buyers.

The investment vs. the return

Is creep feeding worth the investment? The cost of the feed must be weighed up against the weight gained by the calf, and the initial purchase of feeders, while the type of feed used and the weather conditions must also be taken into account. For example, Alan Medd at a beef unit in Darlington, UK, ran an experiment with creep feeding one spring, using his own feed comprising homegrown cereals, soya hulls and meal, and pot-ale syrup. His calves gained an extra 100 kg by weaning (at nine months) compared with those later in the year, representing a 4:1 return on investment for bull calves, and 3:1 for heifers. In this case, the figures came out in Mr. Medd's favor; whether they will on all beef units requires consideration of the particular system and the end market.

When selecting creep rations, it is important to consider cost as well as palatability, nutrient content and nutrient quality. Supplements such as Digestarom®, which combines the biologically active effects of phytogenic substances with unique flavoring properties, can increase the benefits of creep feeding. The two main properties of Digestarom® (active ingredients and flavors) encourage feed intake, support digestion, improve nutrient utilization and optimize feed efficiency and performance.

Is creep feeding right for you?

Creep feeding your calves can boost your herd's productivity and, if financially viable, it could deliver a much-needed performance advantage. With a relatively small adjustment to farm management, a program where the rewards far outweigh the costs can be implemented.

Reference

Eversole, D.E. (2009). Creep feeding beef calves. Virginia Cooperative Extension, Virginia Tech. VCE Publications. [Online]. Available from: https://pubs.ext.vt.edu/400/400-003/400-003.html [Accessed 25.09.18].

Ensuring Excellent Silage Quality

Silage is an important part of the total mixed ration (TMR) and is a valuable nutrient source for cows throughout the year. Getting the ensiling process right is vital to ensure good quality silage, and consequent herd performance.

Vesna Jenkins, PhD,
Product Manager

Ensiling is a key process used to preserve forage and crops for cost-effective animal feed. Getting the ensiling process right is critical to maximize feed value, and to ensure good animal productivity and health throughout the year.

Preservation

Preservation is the key word here. All too often, a sub-optimal ensiling process compromises the feed value of the silage, with the loss of valuable energy and protein. The expert BIOMIN team can guide you in your silage-making decisions and help you to achieve top-quality silage.

IN BRIEF

- The ensiling process has a huge effect on silage quality.
- Different bacterial strains will drive the fermentation process in different ways, so should be carefully selected for ensiling purposes.
- Smells can indicate problems with the fermentation process and should be investigated.
- The BIOMIN technical team are equipped with the knowledge and tools to help produce the highest quality silage for your herd.

Part of the ensiling process is to ensure that the right bacteria are driving the fermentation process. A quality silage inoculant with the right blend of homofermentative and heterofermentative bacteria helps ensure a good silage quality is not left to chance.

Use the right bacteria

The homofermentative (lactic acid-producing) bacteria should be selected to ensure the silage pH drops as fast as possible, to prevent undesirable bacteria from becoming established. The heterofermentative bacteria should produce a balance of lactic acid and acetic acid to help maintain that low pH and prevent the growth of undesirable yeasts and molds. They should also ensure good aerobic stability so that the silage can maintain its quality in the feed-out stage.

The right bacteria help to drive fermentation in the right direction, preventing undesirable microbes from removing valuable protein and energy resources from the ensiled forage. However, even the best bacteria cannot replace getting the fundamentals of silage making right. The BIOMIN staff have the knowledge and tools to help guide you in assessing and ensuring silage quality.

How smelly is your silage?

The most desirable fermentation product is lactic acid, which hardly smells at all. Other silage smells can be indicators of problems in the fermentation process. The BIOMIN technical team have samples of the natural chemicals to help identify

Figure 1.
Thermal image of silage with temperature profile

Figure 2.
Silage corer

the dominant smells in your silage. Butyric acid causes a pungent smell that can reduce palatability and is an indicator of clostridial fermentation. *Clostridia* metabolize sugar, protein, amino acids and lactic acid, significantly reducing silage quality. The proliferation of *Clostridia* can also have a detrimental effect on animal health and productivity.

A vinegar smell (from over-production of acetic acid) or alcohol smell (from yeast growth) on the other hand, could indicate energy and dry matter wastage in the silage. A strong smell of ammonia indicates protein breakdown, again compromising silage quality.

Total silage management

BIOMIN can help with all aspects of silage production and management. To help diagnose problems with aerobic stability, BIOMIN uses infrared thermal cameras to visually check the whole surface of the bunker (*Figure 1*), as well as thermometer rods to probe under the surface, as it is important to investigate at least 20 cm deep into the silage face (Borreanni, 2010).

Professional silage corers (*Figure 2*) enable good, representative sampling for analysis, and the laboratory results can be interpreted with BIOMIN technical support. Silage pH can be tested on the spot.

It is vital to remember that silage is an important part of the TMR and its quality will affect cow digestion and productivity. BIOMIN technical staff can assess TMR particle size using the Penn State Separator method, and check manure quality and digestion with a 'digestion analyzer' sieve kit.

Contact BIOMIN to find out more about the Biomin® BioStabil silage inoculant product line and access the full range of educational tools and technical support provided by the BIOMIN team.

Reference

Borreani, G., and Tabacco, E. (2010). The relationship of silage temperature with the microbiological status of the face of corn silage bunkers. *Journal of Dairy Science*. 93(6), 2620–2629.

What's Wrong With My Herd?
Part 9 – Rumen Fermentation

Bryan G. Miller, MSc
Ruminant Technical Support Manager

The major benefit of dairy cattle lies in their utilization of forage, which enables us to use land that may not be appropriate for traditional grain crops. The symbiotic relationship with the microbial population in the rumen enables fiber that would otherwise be indigestible to be converted into microbial protein and volatile fatty acids (VFAs), which are converted by the cow into a highly nutritious product within the mammary gland: milk.
However, genetic improvements in cows and the pressure for increased production have required more energy-dense products, including grains and specialty products, to be fed. This opportunity to increase protein production comes with potential problems, such as subacute ruminal acidosis.

Protein production

Animals do not really have a requirement for dietary protein, but rather a requirement for dietary amino acids. The 'ideal protein' would provide the cow's digestive system with her requirement for essential amino acids (the building blocks of proteins).
The protein that reaches the intestine is a combination of amino acids from the growth of micro-organisms in the rumen and protein that originates in the feed and has remained undigested.
Microbial protein has the correct ratio of essential amino acids, so maximizing microbial protein is a very efficient method of meeting the cow's protein requirements. The two most limiting amino acids are methionine and lysine, as they are in short supply, and a market has developed to provide rumen-protected sources of both these amino acids. Corn grains are also a good source of bypass methionine and certain 'treated' soybean meals can be a source of lysine.
The microbial population in the rumen can also take advantage of non-protein nitrogen (NPN) sources like urea and convert them into microbial protein. However, in order to fully utilize NPN, there must be a readily available source of energy that encourages microbial growth and also provides the carbon that is required for amino acid production. Multiple computer modeling systems are available to help the nutritionist maximize microbial protein production.

Fiber is converted into milk by a symbiotic relationship between the microbial population and the rumen.

Energy from forage

Mammalian enzymes cannot digest fiber, but rumen microbes can, producing VFAs as by-products, and these can be used for energy by the cow. Acetic acid (acetate) and propionic acid (propionate) are the two most prevalent and important VFAs.
Acetic acid is a two-carbon sugar closely associated with milk fat production. Acetate production is lower in diets with limited fiber, or fiber that is poorly utilized. The cow eructates and re-chews her feed as part of the rumination process, introducing additional buffering capacity with her saliva.
This pH balance is essential for healthy rumen fermentation and subsequent VFA production, and it is one of the reasons that poor milk fat is associated with diets that either lack total fiber or contain effective fiber that is the wrong size to stimulate re-chewing of the feed.
Rumen bacteria utilize starch, so the cow does not need to be fed enough digestible carbohydrate to meet her needs. The liver is responsible for the production of glucose from non-carbohydrate

sources and one such source is the deamination and use of carbon from certain amino acids. Fortunately, propionate can also be used to produce glucose, and feed additives may be used in jurisdictions that allow them.

Monensin

The ionophore monensin can shift the ratio of VFAs in the rumen, increasing propionate production to support the production of glucose, which is used for energy and lactose synthesis. Levels of lactose in the milk are more constant than levels of milk fat or protein.
A shortage of glucose can manifest in reduced milk production as lactose helps drive milk volume by regulating the amount of water drawn into the secretory cells in the mammary gland.

Buffering compounds

Feeding grain can result in over-production of VFAs and lactic acid production, which can cause subclinical or clinical acidosis, which can reduce the integrity of the rumen wall and cause liver abscesses.
Some of the effects of grain feeding can be compensated for by various buffing compounds, which help to increase pH.

Yeast products

Live yeast, autolyzed yeast and yeast cultures can be used to improve rumen fermentation, increasing the digestibility of the fiber and organic matter in the diet.
These yeast products may work in different ways, whether by improving fermentation by creating a more anaerobic environment or supplying the nutrients required to stimulate bacterial growth.

Protein reaching the intestine is a combination of amino acids from the growth of micro-organisms in the rumen and protein in the original feed.

Toxin mitigation products

Rumen bacteria can break down many plant and fungal toxins, but some toxins can reduce microbial production, and subsequent animal production. Producers should avoid feeding contaminated feedstuffs to high-yielding cows, which are susceptible to more disorders, and consider mitigation programs to minimize the effects of these toxins.
An effective rumen allows the cow to utilize forage and produce food for human consumption, and feeding programs that maximize rumen fermentation by creating a healthy environment for microbial growth will help maximize animal production.

This article originally appeared in International Dairy Topics.

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