Issue 21 • Ruminants
A magazine of Biomin®

Science & Solutions

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Fast Start
to Greater Lifetime Profit

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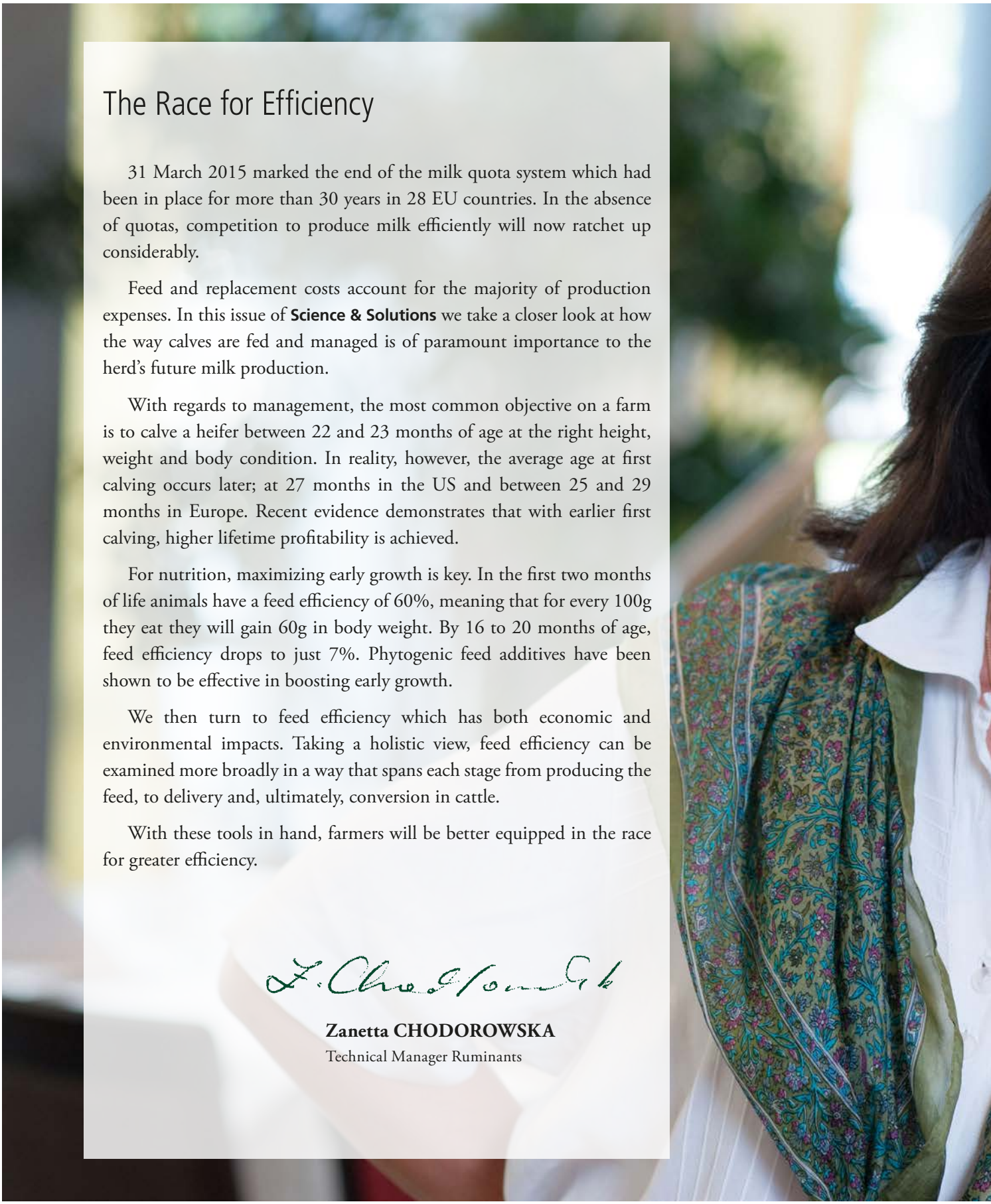
Rearing Dairy Heifers

Photo: Audy_Indy

Why We Need a Holistic View of Feed Efficiency

Editorial



The Race for Efficiency

31 March 2015 marked the end of the milk quota system which had been in place for more than 30 years in 28 EU countries. In the absence of quotas, competition to produce milk efficiently will now ratchet up considerably.

Feed and replacement costs account for the majority of production expenses. In this issue of **Science & Solutions** we take a closer look at how the way calves are fed and managed is of paramount importance to the herd's future milk production.

With regards to management, the most common objective on a farm is to calve a heifer between 22 and 23 months of age at the right height, weight and body condition. In reality, however, the average age at first calving occurs later; at 27 months in the US and between 25 and 29 months in Europe. Recent evidence demonstrates that with earlier first calving, higher lifetime profitability is achieved.

For nutrition, maximizing early growth is key. In the first two months of life animals have a feed efficiency of 60%, meaning that for every 100g they eat they will gain 60g in body weight. By 16 to 20 months of age, feed efficiency drops to just 7%. Phytogenic feed additives have been shown to be effective in boosting early growth.

We then turn to feed efficiency which has both economic and environmental impacts. Taking a holistic view, feed efficiency can be examined more broadly in a way that spans each stage from producing the feed, to delivery and, ultimately, conversion in cattle.

With these tools in hand, farmers will be better equipped in the race for greater efficiency.

Zanetta CHODOROWSKA
Technical Manager Ruminants

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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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Dairy Heifer: A Fast Start to Greater Lifetime Profit

By **Bryan Miller** - Ruminant Technical Support, North America

Maximizing lifetime profit per cow – a good measure of a dairy operation's overall profitability– requires diligence at all stages, starting at birth. What happens in the first 9 weeks of life can set heifers up for long-term success.

Photo: catnap72

Cow turnover is a part of every modern dairy. Herd replacements present the opportunity to improve genetics and increase production. It is important to raise calves that both assure the opportunity to become a contributing part of the herd and to do so in a manner that maximizes the number of days a cow spends in production (lactation) versus growth to first calving and dry periods.

Multiple studies have shown that reducing the age of first calving from 24 to 25 months down to 22.5 to 23.5 improves lifetime profitability. Data interpreted from Changhee Do et al. demonstrates how lifetime profit-

Phytogenic feed additives derived from plant extract have proven to be effective part of a calf-rearing program.

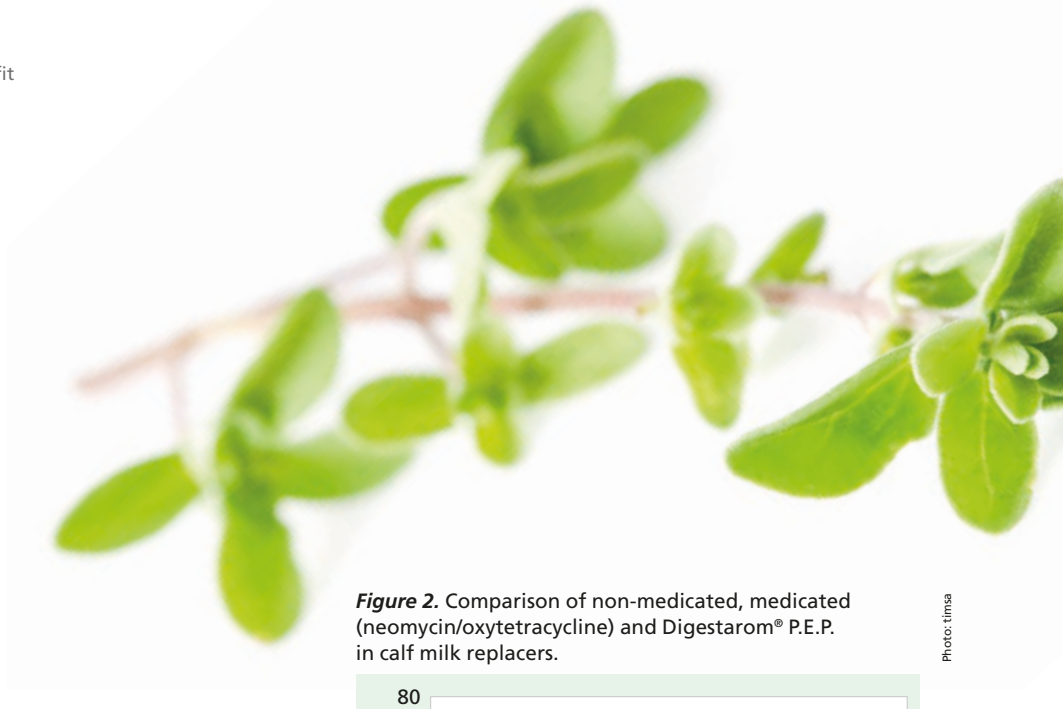
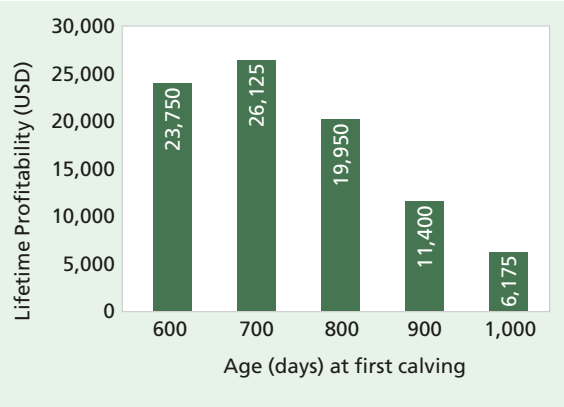


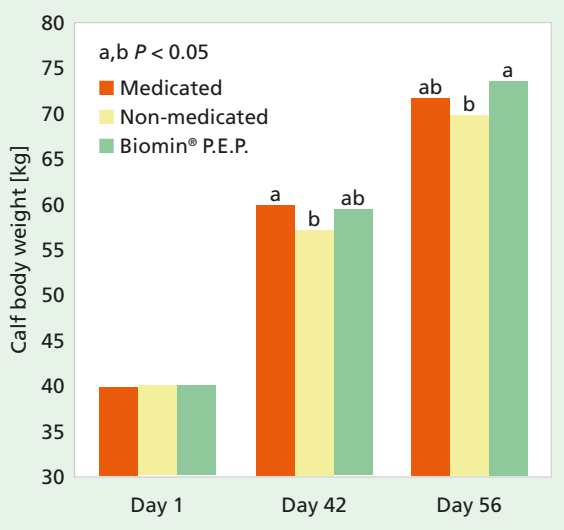
Photo: timsa

Figure 1. Days to first calving effects upon lifetime profitability.



Source: Changhee Do et al., *2013.*

Figure 2. Comparison of non-medicated, medicated (neomycin/oxytetracycline) and Digestarom® P.E.P. in calf milk replacers.



Source: Chester-Jones, et al., *2010.*

ability peaks around a first calving age of 23 months (*Figure 1*). Thereafter, as age to first calving increases, the net return per cow decreases.

Maximizing cow potential starts early

In order for profitability to be improved with earlier first calving age, heifers must reach that age in a condition that allows good milk production and –just as in later lactating cows— should not be overly heavy or light in weight.

Age is less important than body weight and height at the time of first breeding. In Holsteins the recommendation is weight around 350 kg and a height of approximately 120 cm. It is important that the growth be in both frame size and in lean muscle growth rather than adipose tissue.

Dairy cattle breeds obviously carry less muscle than do beef or dual-purpose breeds. In part we have selected them to maximize milk rather than muscle: maintaining more muscle than needed would represent a loss in efficiency. However, it is equally important that we raise our heifers to provide adequate muscle. In dairy cows the skeletal muscle system not only represents a method of movement but also acts as a reservoir of nutrients. Particularly in early lactation when feed intake does not meet the needs of the cow, muscle protein is used to not only provide amino acid for protein production but also the carbon backbone for production of glucose through gluconeogenesis. (*For more on negative energy balance in dairy cows, see Science & Solutions Issue 17*)

Currently there are a number of calf-rearing programs proposed to increase this early growth. Programs that maximize this growth and wean calves on less expensive dry feeds provide for better long-term growth. Increased average daily gain (ADG) pre-weaning can increase subsequent milk production, as shown in *Table 1*.

Calf rearing requires attention to details to reduce morbidity and mortality among calves. One of the keys to success is getting calves to eat consistently and convert from consuming milk to consuming dry feed, i.e. calf starter. Feed consumption and health are well correlated. Calves that eat more tend to be healthier and healthier calves tend to eat more. Regardless of which one may precede the other, the goal is the same. Along these lines antibiotics have often been included in milk replacers. However, consumers in many places have

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Photo: Vitalina Rybakova

Table 1. Predicted differences in TDM residual milk (kg) for 1st, 2nd, and 3rd lactation as well as cumulative milk from 1st through 3rd lactation as a function of pre-weaning average daily gain and energy intake over predicted maintenance for the Cornell herd.

Lactation	n	Predicted difference in milk per 100g of pre-weaning ADG	P value	Predicted difference in milk (kg) for each additional Mcal intake energy above maintenance	P value
1st	1,244	85.0	<0.01	236	<0.01
2nd	826	88.8	<0.01	109	0.26
3rd	450	4.8	0.91	352	<0.01
1st – 3rd	450	228.0	0.01	905	<0.01

Source: M. E. Van Amburgh, et al., Cornell University, New York 2014.

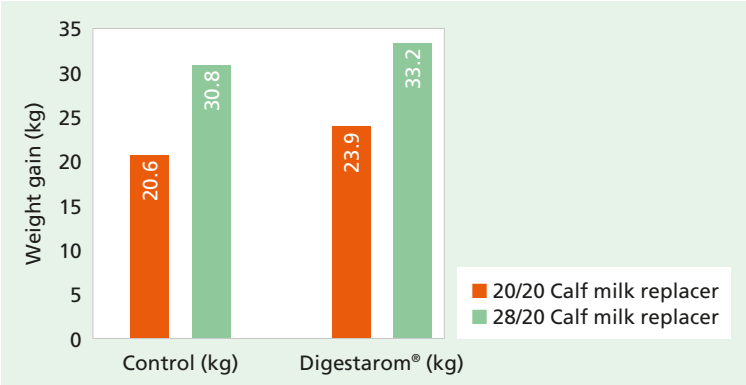
voiced strong concern about sub-therapeutic antibiotics in dairy and livestock production. In a growing number of countries the use of antibiotic growth promoters has been banned—in part reflecting subsequent greater antibiotic-resistance in bacteria.

Ways to improve growth

Fortunately today we have other options to help maintain health, increase intake and improve performance. Phytogenic feed additives derived from plant extract have proven to be an effective part of a calf-rearing program. Research conducted at the University of Minnesota demonstrated that calves receiving calf milk replacer (CMR) containing Digestarom® P.E.P. performed equal to or better than that containing medication (*Figure 2*). In addition to increased body weight, calves receiving only Digestarom® P.E.P. also had significantly (P<0.05) improved feed conversion rate over non-medicated feeds and a numeric improvement over medicated feeds. Calves receiving Digestarom® P.E.P. milk replacer had reduced medication costs vs. calves receiving either non-medicated or medicated feed.

Additionally, Digestarom® Milk and Digestarom® Calf, for application in either milk or calf starter, respectively, have both been demonstrated to improve calf feed intake and performance. In a study conducted by a major milk replacer company in the United States, Digestrom® Milk improved the performance of calves fed both a 20% protein/20% fat diet and a 28% protein/20% fat product, as shown in *Figure 3*. The average of the two is a weight gain improvement of 2.85 kg. Based on the data from Cornell this would suggest a 154 kg improvement in milk production through the first 3 lactations.

Figure 3. Increased weight gain from the inclusion of Digestrom® Milk over a 42-day feeding period using to milk replacer formulations.



Source: BIOMIN

In a study conducted with Digestrom® Milk and Digestarom® Calf conducted in Austria calves demonstrated an improved growth rate of 100 g per day. If such results were translated in dairy calves the increased milk production through 3 lactations would be 228 kg of milk.

Conclusion

Early calf growth is important for long-term profitability through a combination of improving the calf physiologically to support subsequent lactations and by increasing the number of lifetime days in lactation. Digestrom® Milk and Digestrom® Calf can help improve growth that can result in increased milk production.

Why We Need a Holistic View of Feed Efficiency

By **Mark Nooijen** - Product Manager Microbials

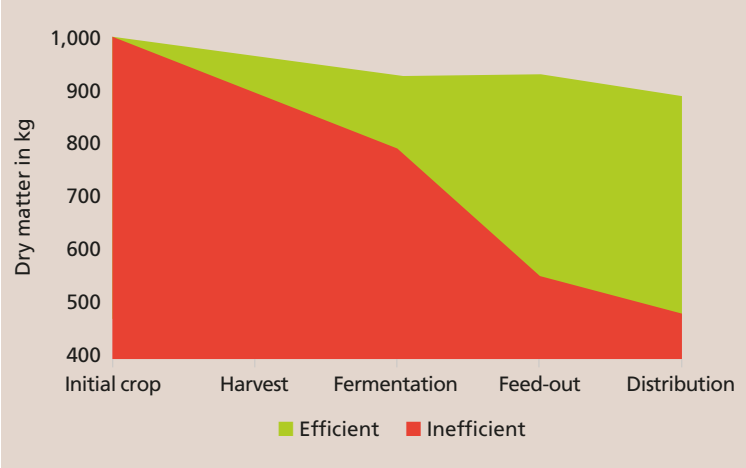
Feed efficiency is one parameter of gut performance management. Improvements in feed efficiency result in greater economic benefit and reduced environmental impact. The traditional definition of feed efficiency narrowly focuses on dry matter conversion within the animal. A more comprehensive approach to feed efficiency is needed.

While monitoring the feed efficiency of beef production is quite common, dairy farms worldwide have been slower to catch on. Efficiency monitoring stands to gain ground in dairy, particularly with the recent demise of the 31-year-old milk quota system in Europe that promises to unleash significant competitive pressures across the industry.

Delivering dry matter

Efficiency is typically calculated as a ratio of output to input. For dairy, the measure is milk yield over dry matter intake (yield/DMI), where the higher number, the better. For beef the formula is reversed: dry matter intake over average daily gain (DMI/ADG), where a lower figure means greater efficiency. In both cases delivering dry matter for consumption is crucial. On most dairy farms crop feed produced on farm accounts for the majority of the total mixed ration (TMR) while the rest comprises mainly purchased concentrates. The efficiency of turning crop production into taken up feed is often overlooked.

Figure 1. Two scenarios for total dry matter losses.



Source: BIOMIN

Yet, the difference in effective delivery of dry matter through efficient versus inefficient methods can vary considerably. *Figure 1* shows how an initial crop yield of 1000kg dry matter incurs losses at each step in the

Types of dry matter losses

Crop production

Field losses

Photos: spooh, zilkovec

Figure 2. Biomin® BioStabil reduces fermentation losses.

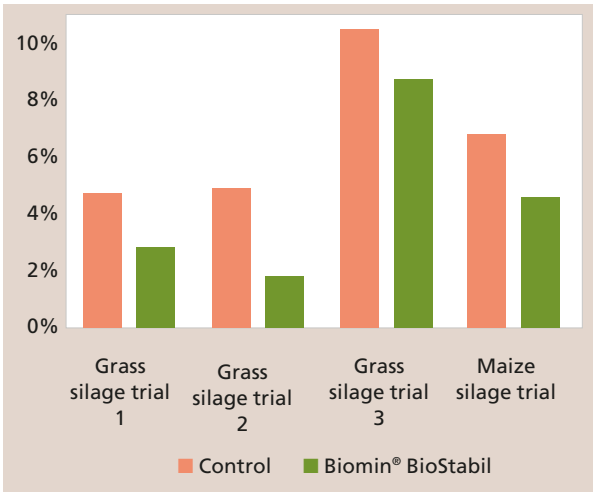


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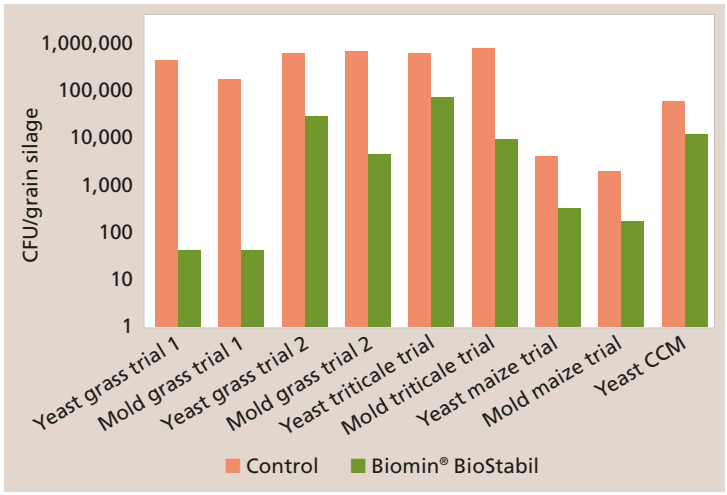
Figure 3. Reduction in yeast and molds using Biomin® BioStabil.



Source: BIOMIN

The efficiency of turning crop production into taken up feed is often overlooked.

silage and feeding process before reaching the animal. This example assumes good soil management, which can influence crop yield, as the starting point. Overall, an efficient silage harvest, storage and delivery process will lose 10% of dry matter while an inefficient one will lose more than 50% due to wastage and spoilage. A closer look at the types of losses that occur at each stage reveals strategies to conserve dry matter.

Harvest

Harvesting leads to field losses ranging from 3% to 10% of crops.

Fermentation

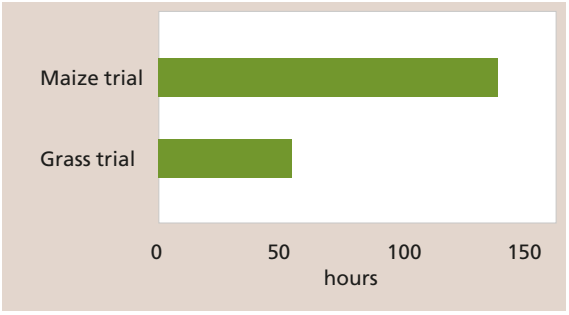
Fermentation losses always occur when making silage, though these range from 2% to more than 10%. By providing greater and faster production of lactic acid that lowers the pH value, Biomin® BioStabil prevents spoilage organisms from taking hold and thus improves silage quality. In trials Biomin® BioStabil has been shown to reduce dry matter losses by up to three percentage points (*Figure 2*).

Feed-out

Once the silage is exposed to oxygen, yeast and mold can become active and cause feed-out losses of up to 30%. Molded silage is easily identified and discarded. Yeast consumes high levels of valuable nutrients such as sugars and lactic acid, withdrawing both dry matter and energy.

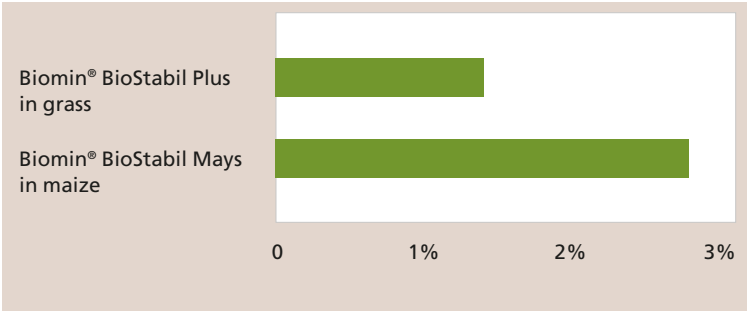
Mark Nooijen
Product Manager Microbials

Figure 4. Longer storage life from Biomin® BioStabil versus untreated silage.



Source: BIOMIN

Figure 5. Feed efficiency gains with Biomin® BioStabil.



Source: BIOMIN

Biomin® BioStabil also reduces the yeast and mold count by a factor of 10 to 10,000 (*Figure 3*). The different heterofermentative bacteria strains in Biomin® BioStabil produce acetic acid and hinder yeast and mold growth.

The number of yeast cells in silage is normally not measured on farms, so on farms increased silage temperature is often the only indication of yeast growth. Aerobic stability – the time it takes for silage temperature to rise two to three degrees Celsius above ambient temperature – is a good way to measure the quality of silage after exposure to air. *Figure 4* provides results of trials that show Biomin® BioStabil can extend silage storage life by two days for grass and more than five days for corn (maize).

A number of additional measures can help reduce feed-out losses, including maintaining anaerobic storage, good compaction to lessen the exposure to air, a high feed-out rate (making fast progress into the silo), achieving the optimal dry matter percentage and using appropriate removal techniques.

Distribution

Getting the feed to the animal relies on accurate feed distribution. A modest level of feeding losses will occur. Lactating dairy cows should always have access to feed, so feed leftovers of 3% to 5% are normal.

Benefits to the animal

The end result of efficient dry matter delivery along these steps is more and better quality feed with higher energy and protein levels and more palatable feed. As a consequence, use of a silage inoculant such as Biomin® BioStabil has been shown to improve dairy feed efficiency in the animal by 1% to 3% (*Figure 5*).

Kiwi case study

In New Zealand dairy production often fully relies upon grazing. Because less feed is purchased there the traditional way to measure feed efficiency is calculated as the quantity of milk solids (kg of fat plus protein) per hectare. Interestingly, this is essentially a holistic view of the dry matter delivery and conversion processes.

Conclusion

Feed efficiency is one parameter of gut performance management. As competition in the cattle industry mounts, feed efficiency will play a greater role. The traditional definition looks at conversion of dry matter within the animal. A holistic view of feed efficiency that encompasses all steps from crop production to dry matter conversion can offer broad improvements through less waste and improved output, with both economic and environmental benefits.

Biomin® BioStabil

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Blend of homo- and heterofermentative bacteria

- Better fermentation
- Longer aerobic stability
- Reduced dry matter and energy losses
- Higher productivity and profitability

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