Using feed additives to improve milk production and dairy farm efficiency

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Wherever milk is produced from cows, profit margins remain very tight. This automatically means attention is concentrated increasingly on efficiency – efficiency of feed and of animal production.

The more farmers invest in high quality genetics – also important for highest efficiency milk production – the greater the importance of maintaining very high quality rations. But margins can still be increased in almost every case! There's plenty of solid evidence from trials and practical experience that indicate reliable cost effective, ways of earning more profit from cows through optimizing feed with the right additives. Tried and tested methods that:

- Ensure a longer productive life for cows with more lactations per lifetime and therefore higher returns from rearing and feeding investments. A longer productive lifetime also depends on one calf per year. There are feed additives that demonstrate great efficacy in this aim too.
- Reduce feed costs effectively by ensuring feed is used in the most cost efficient way by the cow. This brings more milk per kg fed. This means also higher health. Better control of foot problems and mastitis are examples.

The fertility vitamin

Longer productive life is associated with low culling rates and high fertility. No one can afford to keep a cow in the herd that does not breed regularly. Regular breeding can be helped by β-carotene.

	Before	After
	Supplementation with 500mg/hd/d β-carotene	
Calving interval (d)	407	380
Pregnant after 1st AI (%)	43	60
Average AI pregnancy	2.2	1.6
Milk yield (kg/head/lactation)	8103	8530
Milk fat (%)	3.91	3.95
Milk protein (%)	3.18	3.32

Table 1. Effect of the supplementation with Rovimix β-carotene on calving interval and milk yield (field trial in France, 2010).

This is a plant pigment that acts as a fertility vitamin in dairy cows. It accumulates in the ovaries, participates in synthesis of the hormones oestrogens and progesterone, both are important for ovulation and for safeguarding the embryo. Trials conducted worldwide show that optimal dietary levels of β-carotene increase conception rates and lower the number of abortions. Trial results prove also that cows on diets supplemented with β-carotene have more marked heat expression (easier for the AI person to spot) and are also more fertile and easier to get in-calf. Pregnancy rates to first inseminations in a practical farm trial conducted in France increased by almost 40% in β-carotene supplemented cows.

Calving intervals were reduced by 27 days and milk yield increased by more than 400kg per cow and lactation (Table 1).

Supplementation with β-carotene is always advisable because this crucial carotenoid is not always available in optimum amounts in today's dairy cow feed. For instance, maize silage has a negligible concentration of β-carotene. Also the presence in most grass silage is below the requirement for optimal cow fertility (Fig. 1).

Lower than ideal dietary levels often mean oestrus is hard to identify. The result is missed breeding opportunities. Even just one missed oestrus means 21 days lost before the next lactation starts. Every day that the calving interval is reduced saves €10.

Unfortunately, this is not the only damage. Missing several oestruses means otherwise perfectly good cows are usually culled. In fact, statistics collected by USDA (2007) reveal that around 26% of cows culled from modern dairy herds are slaughtered because of fertility problems.

Furthermore, this incorrect culling of dairy cows reduces the opportunity for improving genetic gain within the herd. Correct supplementation of β-carotene in rations means fertility, health and therefore cow welfare are improved. Other recorded advantages: more regular ovulation, better foetal health and reduced incidence of retained placenta.

Another advantage of β-carotene in the calving ration: a certain amount of it is transferred directly to the calf via colostrum so that the young animals get off to a tremendous start in life with studies demonstrating a reduction in diarrhoea.

Vitamin E's crucial role

Another cause of losing otherwise productive cows are health issues such as mastitis. An important feed additive for natural control of mastitis is vitamin E.

Optimal levels of this vitamin (which cannot be synthesised by the cow) in pre-calving and immediate post-calving rations proves – to increase immune system resistance to mastitis infection, reducing mammary infections at calving by up to 80%. Clinical and sub-clinical mastitis remain among the biggest drains on dairy profitability (Table 2).

Supplementing rations with vitamin E has proved cost effective and efficient in combating this serious problem (Fig. 2).

Correct amounts of vitamin E have also proved to decrease duration of

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Fig. 1. β-carotene content in different forages (DNP 2006-2013).

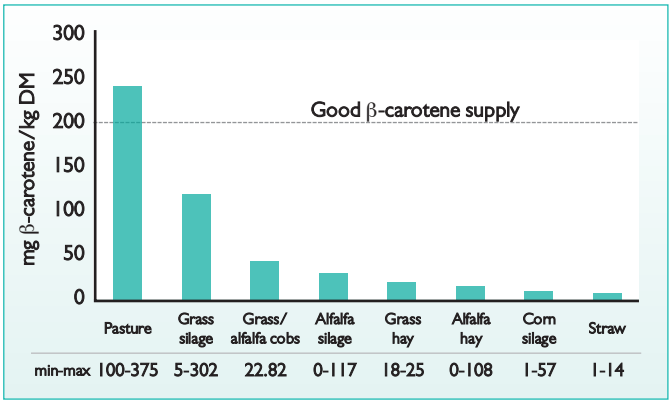
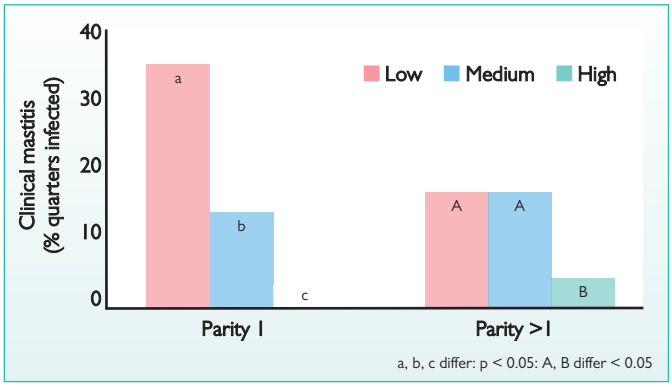


Table 2. Mastitis decreases the profitability of dairy farms (Nielsen, 2009).

	Primiparous cows	Multiparous cows
Clinical mastitis (€)	275	275
Subclinical mastitis (€)	60	60
Milk yield loss (kg in 305 d)	150	450
Profit loss (€0.35/kg milk)	52.50	175.50



Treatment: Vitamin E	Dry period (mg/d)	Lactation (mg/d)
Low	100	100
Medium	100	500
High	1000 (for 46 d) 4000 (for 14 d)	2000

Fig. 2. Supplementation with Rovimix E reduces the prevalence of clinical mastitis of dairy cows (Weiss et al., 1997).

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mastitis in infected cows by as much as 50%. Moreover, higher levels of the vitamin E in the rations for dairy cows showed that the correct levels reduce cases of udder oedema and milk somatic cell counts.

There are also clear advantages in dairy cow management through boosting rations with biotin. A summary of five published studies in the US and Europe indicated that daily biotin (20mg/cow/d) boosted milk yield by more than 2kg per day, even when these cows were already giving 36kg (Fig. 3).

Biotin is a key component of glucose synthesis in the liver, the main energy source for milk production. While it is true that some biotin is synthesised by rumen microbes, modern research shows that high yielders respond well to extra biotin in their rations.

This is due to the fact that the natural biotin synthesis by the cow decreases when high energy diets are fed. Therefore the cows that need biotin most, produce less themselves. Biotin is also a crucial component in metabolism for synthesis of keratin and lipids, important building blocks for naturally strong horn, giving robust hoofs, the best possible support for optimal lifetime production from high yielding dairy cows.

Results from independent trials worldwide prove that just 20mg of biotin per day significantly reduces incidence of the most common hoof disorders in dairy cows such as sole ulcers, white line disease, sand cracks and digital dermatitis.

Preventing lameness in this way is not only an economic advantage for biotin supplementation, it represents an important role in enhancing animal welfare in the dairy herd.

Enzymes for dairy cows

Feed enzymes are a radical innovation in dairy cow nutrition and a shift in paradigm. There is currently only one enzyme for dairy cows in the market that works in the rumen.

Ronozyme RumiStar is a pure amylase that helps to hydrolyse slowly fermentable corn starch shifting the digestion more towards the rumen.

This provides more energy for microbial growth of cellulose degrading bacteria and thus increases fibre digestibility in the rumen (Fig. 4).

Trials in North America and Europe with the feed additive Ronozyme RumiStar show that this has the capability of optimising utilisation of corn starch in the rumen.

This characteristic especially alleviates the energy gap in the first 150 days of lactation. Extra energy allows the cow to recover rapidly from energy deficiency during the critical early lactation period. The result: the animals do not 'milk off their backs' but achieve the ultimate goal of optimum feed efficiency.

The more forage can be utilised profitably by the cow, the greater the potential reduction in feed costs! After all, starch in the ration contributes 50-75% of the energy value in maize silage and corn grain.

Trials prove that this feed additive results on average in an extra 1.5kg milk with increases up to 3.6kg per cow per day – with no increase in feed intake and no negative effect on rumen pH (Figs. 5 and 6).

This gives a significant rise in feed-to-milk efficiency.

Essential oils

Eubiotics are a new range of feed additives to improve gut health in monogastrics and they have shown that they modulate the rumen microflora as well. Precise blends of essential oil components have proven in trials to deliver real benefits as a supplement to dairy cow rations but also in beef cattle.

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Raw material	(kg/Mt)	Optimised with Crina Ruminants (kg/Mt)	Difference (kg/Mt)
Soybean extracted	95.0	44.7	-50.3
DDGS	95.0	95.0	0
Rape seed extracted	178.75	206.70	+27.95
Rape seed expeller	55.86	61.45	+5.59
RaPass	55.86	50.28	-5.58
Beet pulp	-	111.73	+111.73
Wheat	167.58	111.73	-55.85
Corn	189.92	134.08	-27.91
Rye	161.99	162.01	+0.02
Glycerin	-	22.34	+22.34
Costs per Mt (€)	208.33	201.72	-6.61 €/Mt

Table 3. Crina Ruminants allows cost savings without changing the energy and protein content of the compound feed

Item	Control	Crina Ruminants
Milk yield (kg/cow/day)	32.2	34.1
Fat (%)	4.05	3.96
Protein (%)	3.56	3.50
FCM 4% (kg/cow/day)	32.4	33.9
Milk urea (mg/dL)	26.3	24.7

Table 4. Effect of Crina Ruminants on milk production in dairy cows.

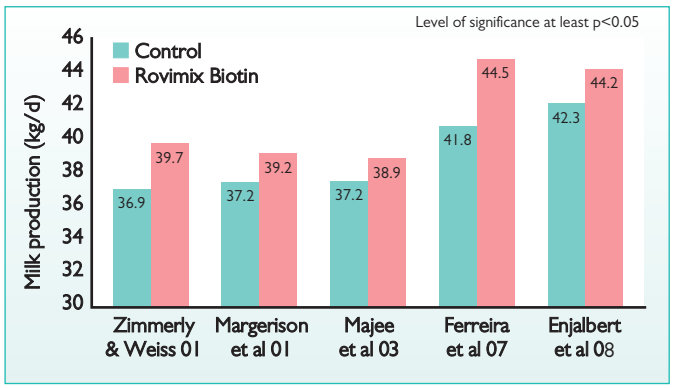

Fig. 3. Results from a series of research trials in Europe and the USA show that Rovimix Biotin increases milk production in high yielding dairy cows by >2kg/cow/d.

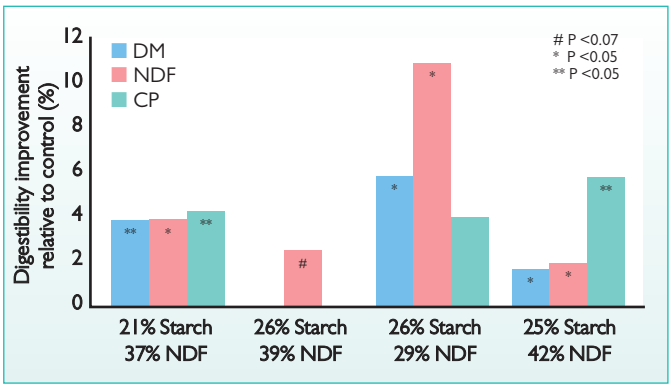

Fig. 4. Ronozyme RumiStar improved feed digestibility of corn based diets in dairy cows (Gencoglu et al, 2010; Weiss et al, 2011; Klingerman et al, 2009; Phipps et al 20.

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Essential oils allow potential reductions in specification of rations without affecting animal performance. Their specific activity against high ammonium producing bacteria in the rumen slows down protein degradability.

More by-pass protein from cheaper raw materials gives feed compounders the freedom to use more lower-priced ingredients and also help in reducing the impact of variations in raw material quality (Table 3).

Looked at in another way, essential oils help limit the effect of expensive protein raw material price volatility for compounders.

But before we go any further, just what are 'essential oils'? These are based on completely natural products from plants: aromatic substances such as thymol, eugenol, limonene and vanillin. Some have been used for centuries in human and animal medicine.

Some have a real effect in stimulating appetite, but science has found more recently that, once the essential oils have encouraged the consumption of more feed, they go on to play an even more important role inside the cow.

Crina Ruminants essential oils, for example, have proved to be able to optimise ruminal bacteria activity by slowing down protein degradation thus enhancing protein protection in the rumen.

This talent helps cows get more feed value out of their rations.

Essential oils in trials also showed milk yields increasing on average by 1.5kg/day when top-dressed. The modulation of rumen bacteria by essential oils can lead to more than 7% increase in milk production and thus a 10:1 return on feed supplement expenditure.

What is more, the cattle receiving the essential oils in this trial proved to have lower levels of milk urea.

In other words, the essential oils prevent the growth of the types of rumen bacteria that turn valuable feed amino acids into waste ammonia (Table 4).

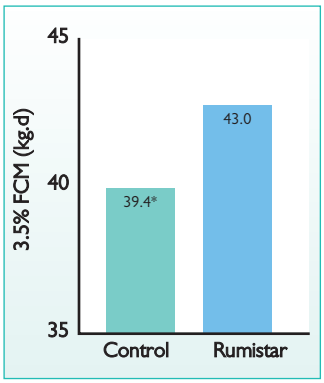
In short, the essential oils stimulate animal appetite and feed consumption, optimise rumen environment to help feed transition management in the digestion tract. This in turn allows optimum production of milk and its protein and fat components.

Essential oils give better synchronization between energy and protein degradation in the rumen. The efficiency of dietary nitrogen and carbohydrate utilisation by the cow is improved. This ensures a better health status in the herd and, finally, more milk from the same amount of feed and therefore additional profit.

All the above mentioned feed components – carotenoids, vitamins, enzymes and essential oils – represent unique and innovative feed and health enhancing products.

Improving dairy cow longevity by using these feed additives is the first step into efficient, sustainable and profitable dairy farming. ■

Fig. 5. Ronozyme RumiStar improved milk yield in high producing dairy cows (Klingermann et al, 2008).



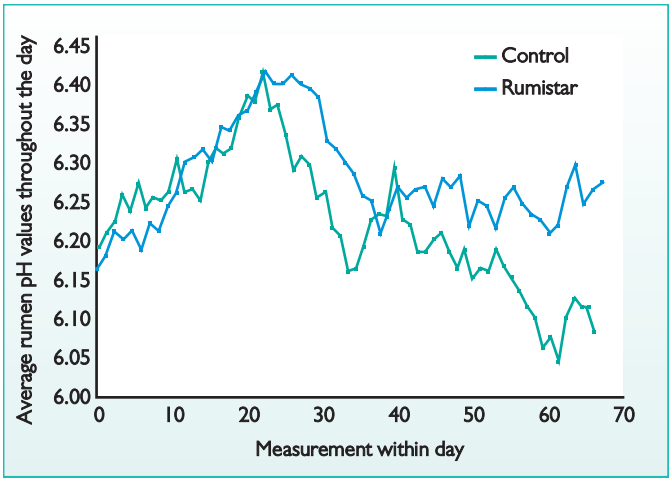


Fig. 6. Although Ronozyme RumiStar increases the fermentation of slowly degradable starch in the rumen it does not lower ruminal pH (Bach, 2011).