Rumen fine tuning for improved profit

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Confronted with falling milk prices, farmers are looking at ways to maintain or improve their income. Their first reaction is often to increase herd size but is not always the first option they should consider. A recent survey in the UK has shown that income per cow can vary greatly amongst herds of a similar size and that smaller herds can be more profitable than larger ones. The first option they should consider is getting better before getting bigger.

The engine of cattle

High yielding cows are frequently compared to Formula One racing cars. In other words, the fine tuning of all the single production parameters is a must to achieve production targets.

The challenge is to satisfy nutritional requirements corresponding to genetic potential, without jeopardising optimal rumen function. Rumen pH should not fall below 6.2-6.0; otherwise, the activity of the cellulolytic bacteria will decrease, leading to a significant decrease in fibre digestion, feed intake and a deterioration in feed conversion. A further decrease in ruminal pH could induce serious health problems such as laminitis, ruminal ulceration, liver abscesses and even death.

Terms such as latent, sub-acute or acute acidosis are used, depending on the severity of pH decline. It has, however, to be kept in mind that values of 5.8-6.0 favour propionate synthesis and thus milk yield. Consequently, the range between optimal and at risk is very narrow.

Item	Steers	Dairy cows
Exp. animals	Holsteins	Holsteins
No.	8	8
Weight (kg)	454k	636
Stage	Compensatory gain	Early lactation
Av. daily ruminal pH	5.99	5.90
Forage in diet (%)	26.3	52.9
DMI (kg/d)	13.2	21.4
NDF (%)	20.0	28.9
NFC (%)	58.3	36.9
NFC (kg/d)	7.7	7.9

Table 1. Comparison of diet and and ruminal pH in beef and lactating dairy cows (Oetzel, 2003).

Risk of acidosis

High milk yield necessitates high dry matter intake to satisfy energy requirements. Although dairy cow diets contain relatively high fibre levels, they face a similar risk of acidosis as beef cattle fed high energy diets because they consume similar quantities of non-fibre carbohydrates (Table 1).

In beef cattle, the problem and consequences of rumen acidosis are well-known and documented. The impact is somewhat secondary because these cattle will be slaughtered once they have reached their target weight. With dairy cows, rumen stability can directly influence their longevity.

Today, an increasing number of scientific studies highlight the importance of this issue.

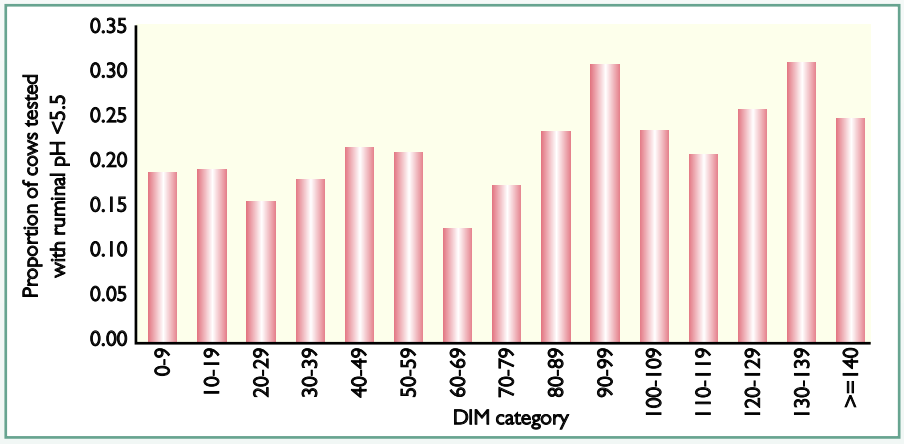
The maintenance of good rumen stability during the entire lactation should be the goal. Different field investigations have demonstrated that two periods are particularly critical – the first 20 days and day 40-120 of lactation.

In herds of high yielding cows (>8200 l) fed a total mixed ration (TMR), the percentage of cows with a ruminal pH lower than 5.5 increases to more than 30 % at day 100 in milk (Fig. 1). The effect was even more pronounced in primiparous cows. This was related to high VFA production resulting from high dry matter intake and not associated with lactic acid.

Throughout lactation, all aspects are important, but the following points deserve special consideration:

- TMR (physical structure, nutrient content).
- Concentrate characteristics (starch digestibility, fibre levels, buffering capacity, feed additives).
- Feed and bunk management.
- Housing and environment.

Fig. 1. Risk of low ruminal pH (<5.5) by days in milk (Krause et al, 2006).



Financial impact

The overall financial impact of subacute ruminal acidosis (SARA) is difficult to estimate. A few years ago, it was reported to cost the US dairy industry between US$500 million to 1 billion per annum.

More recently, in a case study of a 500 cow dairy, the loss of income per cow per year was estimated at US$400-475.

These figures do not consider the associated disorders such as lameness and its deleterious effect on reproduction, the costs of which are higher than those of lost milk production.

Various strategies providing innovative and cost effective solutions must be adopted by

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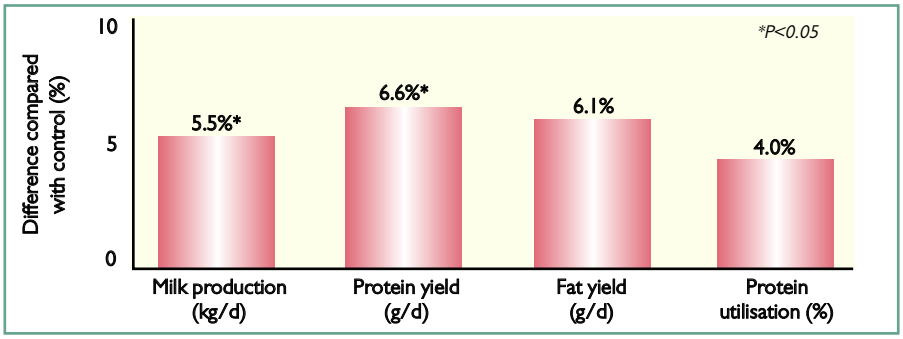

Fig. 2. Effect of Crina Ruminants on production parameters (Offer et al, 2004).

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nutritionists and advisors to address this problem.

Essential oil compounds

Essential oils are concentrated liquids containing volatile aromatic compound extracts from plants typically obtained by steam or water distillation. The term 'essential oils' is misleading because it does not mean that they are essential for nutrition or metabolism; nor are they oils in the sense of being lipids. Because of their wide range of properties, they have applications in perfumes, cosmetics, flavours, incense and aromatherapy.

Following promising pioneering work, increasing interest has been shown in animal nutrition, resulting in considerable research and publication of trial data. Nowadays, researchers are convinced that some compounds found in plant extracts or essential oils have a key role to play in modern animal husbandry. The prevailing opinion is that research should first be conducted in vitro with pure active compounds to explain their mode of action. Possible synergetic effects between compounds should simultaneously be investigated. In vitro trial observations should then be validated in vivo under well controlled research conditions. Finally, these in vivo trial results should be confirmed with commercial studies.

Based on this concept, Crina Ruminants, a specific and standardised blend of essential oil compounds was developed. Following intensive in vitro and in vivo research investigations under different conditions, it was demonstrated and reported that Crina Ruminants alters the pattern of colonisation of starch rich substrates as they enter the rumen.

This suggests that the effect is mediated at the level of bacterial attachment and colonisation of plant material and that this unique mode of action slows down starch and protein degradation in the rumen. In practice, this results in a higher ruminal pH, a better match between energy and protein supply in the rumen with improved microbial synthesis and more protein bypassing the rumen.

This is supported by observations in a continuous culture system, where a higher rumen pH was recorded, resulting in increased nutrient digestion coefficients and a trend for greater bacterial synthesis.

It was also demonstrated that this specific blend of essential oil compounds selectively reduces the number of 'hyper ammonia producing (HAP) bacteria', involved in the deamination process in the rumen.

The advantages of this particular mode of action have been confirmed under numerous field trials under different feeding systems.

At the Scottish Agricultural College (UK), cows fed a grass silage based diet supplemented with 1g/head/day Crina Ruminants had significantly higher milk production (1.7kg/head/day), significantly increased protein yield, increased fat yield and protein utilisation, with no significant increase in feed intake (Fig. 2). A Penn State University study on a 1,200 cow commercial unit reported during the first 120 days of lactation a significant increase in milk production by 1.6kg/head/day, an increased protein and fat yield, with no change in the milk component concentration (Fig. 3).

Conclusion

Maintaining a healthy rumen environment means that fibre digestion and feed intake will be maximised. With high yielding cows, this can be a real challenge particularly during the first 120 days of lactation.

Crina Ruminants, a specific and standardised blend of essential oil compounds, helps to fine tune rumen function by improving the efficiency of nitrogen and carbohydrate utilisation and feed conversion. This means additional profit for dairy producers due to rumen fine tuning. ■

References are available from michel.chuffart@dsm.com

Fig. 3. Effect of Crina Ruminants during the first 120 days of lactation (Varga et al, 2004).