Synergistic combination of phytogenic agents for profitable milk production

by Martin Veit, Delacon Biotechnik GmbH, 4221 Steyregg, Weissenwolffstr. 14, Austria.

In dairy production the rumen functions, feed intake, and health status have to be optimised to achieve competitive yields. Furthermore, the demand for emission reduction in livestock production is getting more and more important. This article discusses how phytogenic feed additives affect the metabolism of ruminants and reduce gaseous emissions while enhancing profitability.

Efficient utilisation of nutrients is essential, especially under today's conditions in milk production. Phytogenic feed additives belong, as they are highly accepted by consumers, to the most promising additive group to improve performance parameters in dairy. The diversity of the plant world offers an enormous range of effects, wherein flavouring and appetite stimulation are undoubtedly the most well known effects of botanical substances.

In particular, the essential oils stimulate the papillae in the mouth of animals. This supports the release of gastric juices through the vegetative nervous system, which, in turn, stimulates the appetite. Also other active agents are of interest for ruminants. Saponins, for example, optimise processes in the rumen and reduce ammonia emissions.

Saponins

Feeding ruminants primarily means feeding micro-organisms in the rumen as there are bacteria, protozoa and yeast. These micro-organisms convert feed of low digestibility into high quality protein but the protozoa mainly exploit bacterial protein. Thus, they cause serious losses of energy and nitrogen by undesired dissociation processes.

Furthermore, they are, in large part, responsible for the methane production.

Trials in which the effects of a removal of protozoa were investigated showed that the efficiency of nitrogen utilisation in ruminants could be increased and the methane production was reduced significantly.

However, protozoa also fulfill important

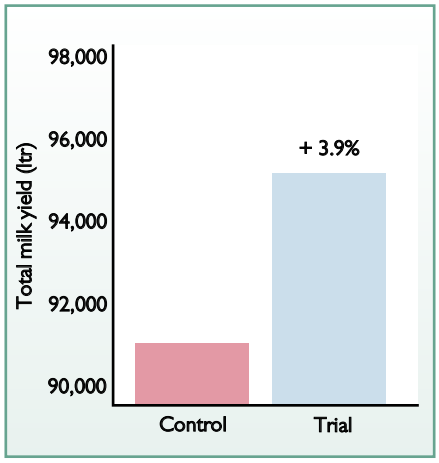

Fig. 1. The effect of Rumex SC on milk yield (Scientific trial in Poland 2005).

functions in the rumen with stabilisation of the pH and suppression of pathogenic germs. For that reason, instead of a total removal of protozoa, a reduction is preferred, which can be achieved by the application of saponins.

In case of high passage rate, parts of the saponins are not degraded in the rumen and reach the small intestine where they enhance the absorption of protein and minerals by increasing the permeability of the gut wall.

Furthermore, saponins selectively inhibit the activity of the urease enzyme which leads to a reduced ammonia production in the hindgut. This reduction implies a notable relief for the liver, because there is no need for an energy intense detoxification.

Essential oils

In pig and poultry production essential oils are already established as state of the art alternatives for antibiotic growth promoters.

They are known for positively affecting feed intake, digestibility of nutrients by an enhanced secretion of digestive juices and for anti-inflammatory effects.

Regarding palatability, essential oils show tremendous results in dairy production. During periods of high temperatures feed intake of lactating cows decline dramatically which leads to serious performance depressions.

By a supplementation of Rumex/Rumex SC, a phytogenic feed additive containing essential oils, this well known impact of heat stress could be clearly reduced.

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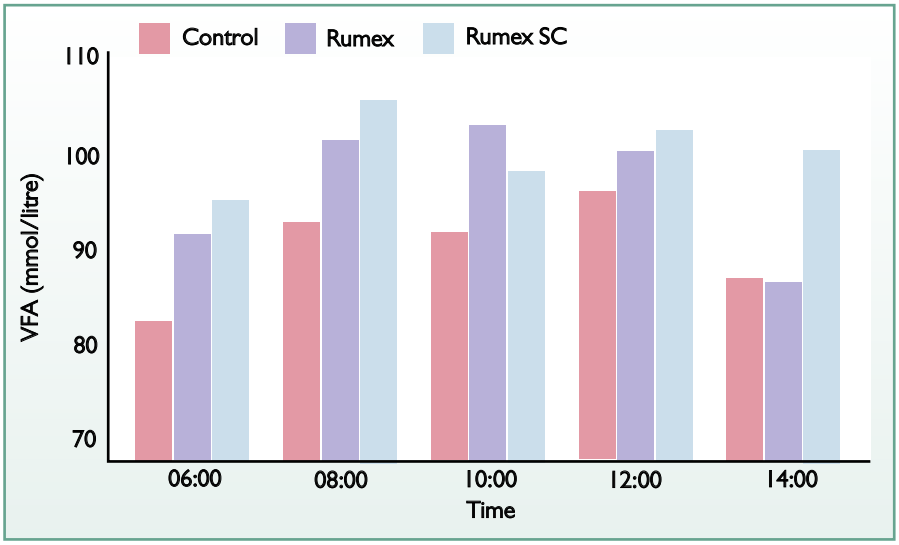
Fig. 2. Effect of Rumex and Rumex SC on VFA content in the rumen (four rumen and two duodenal fistulated oxes per treatment; Hungary 2007).



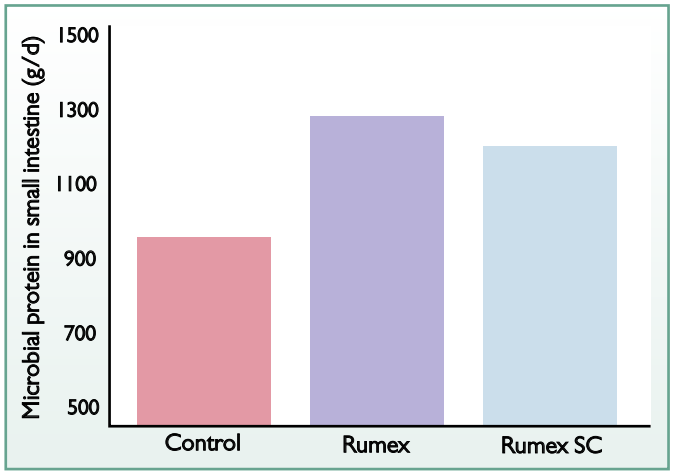


Fig. 3. Effects of Rumex and Rumex SC on intestinal microbial protein (four rumen and two duodenal fistulated oxes per treatment; Hungary 2007).

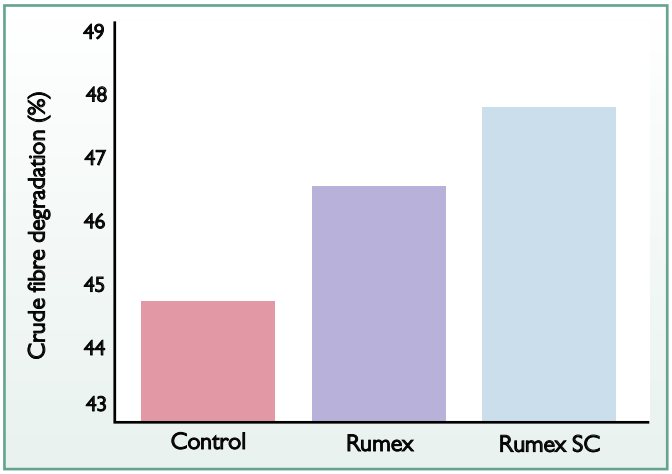


Fig. 4. Effects of Rumex and Rumex SC on crude fibre degradation (four rumen and two duodenal fistulated oxes per treatment; Hungary 2007).

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Flavonoids

Flavonoids represent a large group of plant pigments with numerous positive effects. Sources include citrus fruits and onion. As powerful anti-oxidants they bind to free radicals in animal organisms. Due to an especially positive influence on the permeability of the cell walls in the gastrointestinal tract, flavonoids are also sometimes known as vitamin P (for permeability).

Functional carbohydrates

Functional carbohydrates are mucilages, primarily found in plant seeds. They have the ability to absorb liquids and to form a protecting layer on the gut wall that blocks the receptors for pathogen bacteria.

These mucilages are also able to absorb toxic agents and normalise the consistency of faeces.

Synthetic substances

Many active agents from botanicals can be produced synthetically today, for example thymol or carvacrol with their natural source thyme, but there is a huge difference between natural synthetic products.

In the essential oil of thyme (Thymus vulgaris L.) there are about 60 substances besides thymol and carvacrol which, even in small quantities, stimulate important effects due to its synergistic activities. The higher costs for natural products are compensated because the quantity to achieve effects is far smaller than with synthetic substances.

Dosage

In the application of natural products containing plants or plant based substances it has to be considered that levels of active agents are subject to variation due to location and seasonal factors. Therefore, a chemical analysis of the ingredients is of vital importance to equilibrate the quantities in order to guarantee a batch to batch standardisation.

Another challenge in processing products containing essential oils is the reduction of losses during the storage of feeds, mechanical treatments like pelleting or other heat treatments.

The solution to this problem is a protective microencapsulation which offers heat stability of these volatile elements and a full release in the intestinal tract. However, the dosage of phytogenic feed additives has to be exact. It has to be assured that each animal receives sufficient active agents to achieve the desired effects. Meanwhile an excessive use leads to a loss of profitability.

To ensure that the right amount of active agents reaches the animal, a standardisation and microencapsulation of these sensitive ingredients is of utmost importance.

Combined efforts

In Rumex SC synergistic effects of triterpenoid saponins, microencapsulated essential oils, mucilages, flavonoids and live yeast lead to a maximum performance enhancement of lactating cows (Fig. 1).

Starting with a stimulation of sensory receptors to improve feed intake this mixture is affecting the main processes in the digestion of ruminants.

The rumen functions are improved and the reduction of protozoa lead to less dissociation of protein and ammonia production, the enhanced secretion of gastric juices and the better permeability of the gut wall lead to a better nutrient retention and the saponin induced inhibition of the urease enzyme clearly reduces the ammonia exposure. The live yeast fraction in Rumex SC mainly affects the fermentation process in the rumen. Based on trial results (1680 cows) a return on investment for additional milk production of 1:4.5 was calculated for Rumex SC in dairy cows.

Lower costs for treatments and higher prices for improved milk quality were not accounted in the calculation.

Rumex

Rumex is the pure phytogenic counterpart of Rumex SC, which means the live yeast fraction is removed resulting in an all natural phytogenic additive.

Results of in-situ trials show comparable results regarding increase of VFA content (Fig. 2) and the reduction of the acetic to propionic acid ratio. In addition, microbial protein in the small intestine (Fig. 3) and crude fibre degradation (Fig. 4) are enhanced by both products.

Respectable ammonia, methane and carbon dioxide reductions were also achieved by adding these feed additives to heifers and cows in scientific trials. Both, Rumex and Rumex SC are produced by Delacon in conformity with the strict European Feed Additives and Pre-Mixtures Quality System (FAMI-QS) which ensures safety, purity and standardised product quality to achieve maximum success for the customers.

Summary

For better performance and lower emissions in dairy, substances from natural sources were investigated intensively in recent years.

The different active agents with their wide range of impacts provide sound solutions to the given challenges. When selected with prudence, and combined in optimised concentration and ratio, costs for the natural substances are held low while synergistic effects are fully utilised. Thus, phytogenic feed additives are the first choice for the reduction of emissions and the enhancement of performance and profitability in dairy production. ■