Increased propionate and decreased methane production in the rumen

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Numerous trials have shown that the hydrolysed brewery yeast (Progut Rumen) has enhanced rumen fermentation with different diets providing more energy and protein for the cow.

This has resulted in trials with higher milk yield and better feed utilisation during the whole lactation period.

Recent research has given more detailed information about the functions of the product in dairy cow nutrition. These trials show the ability of the hydrolysed yeast to stimulate the growth of cellulolytic and lactic acid utilising bacteria groups in the rumen which may explain the seen effects on rumen fermentation. The hydrolysed brewery yeast has also been shown to decrease methane production, possibly through modulation of the rumen microbiota.

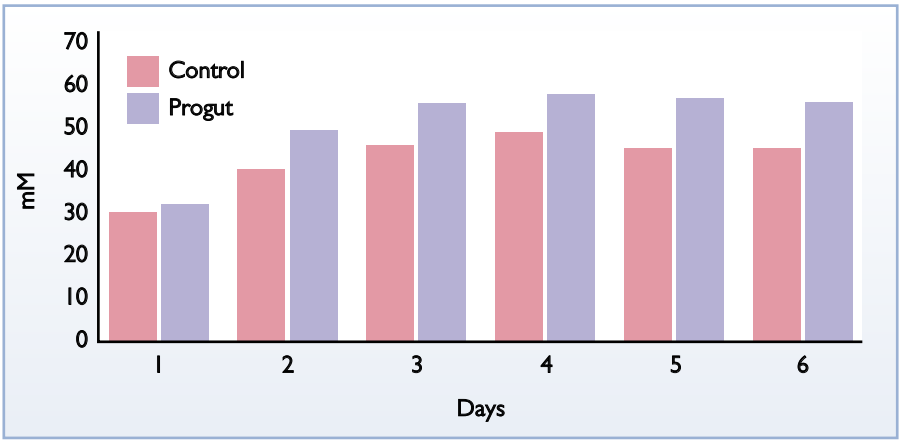

Fig. 2. The effect of hydrolysed brewery yeast on the propionate production in vitro (Alimetrics Ltd, 2009).

Rumen fermentation

In a rumen simulation trial with different compound feed to silage ratios (Alimetrics Ltd) the hydrolysed brewery yeast (HBY) tended to increase the amount of lactate utilising Selenomonas spp. group bacteria with the two highest compound feed diets and significantly ($p<0.05$) increased its amount with the high silage diet (Fig. 1). It also increased ($p<0.01$) the proportion of cellulolytic group bacteria from 17 to 46% in the high silage diet. Selenomonas spp. group bacteria are using lactic acid as a nutrient supply and converting it to propionate in the rumen.

Propionate is converted into blood glucose in liver and its amount has an essential effect on milk yield, energy balance of the cow and its fertility.

In a Swiss trial the HBY tended to increase the content of glucose and significantly decreased the content of β-hydroxybutyrate (ketone body) in blood, indicating better energy utilisation. A continuous rumen simulation trial (Alimetrics Ltd, 2009) showed that the HBY significantly increased the production of propionate during the experimental period (Fig. 2). The difference to the control was statistically significant in most of the time points of the simulation.

Interestingly, the HBY addition also decreased methane production in the later stages of the simulation (Fig. 3).

The seen decrease in methane production may have been caused by changes in the composition of the rumen microbiota.

Ruminant methane production is an

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Fig. 1. The effect of hydrolysed brewery yeast (Progut) on the amount of lactic acid utilising Selenomonas spp. with different compound (C) feed to silage (S) ratios in vitro.

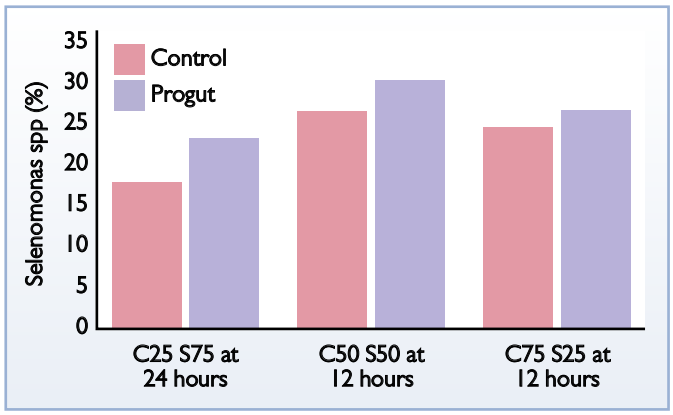
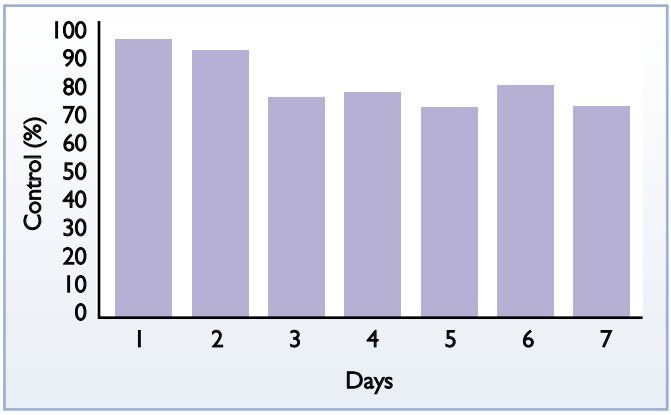


Fig. 3. The effect of the hydrolysed brewery yeast on methane production, compared to the control (= 100) (Alimetrics Ltd, 2009).



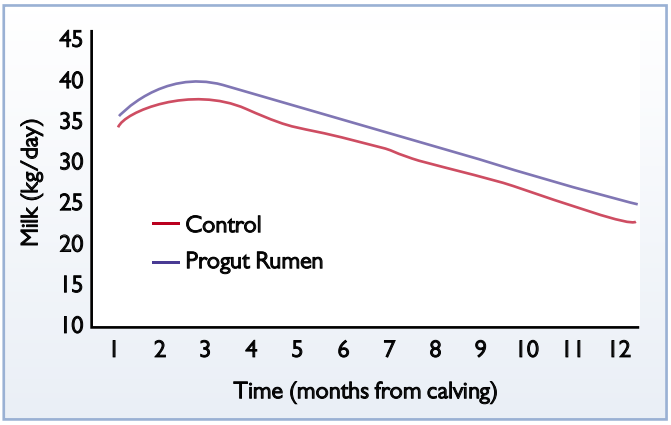


Fig. 4. The effect of Progut Rumen on milk production. A summary from field trials in Finland 2006-2009.

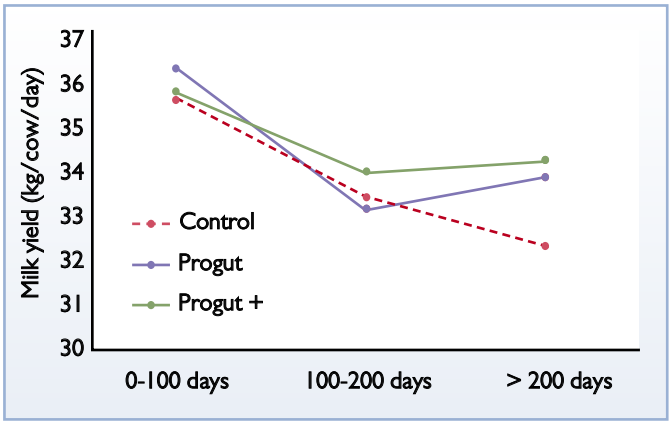


Fig. 5. The effect of Progut Rumen on the milk yield in different lactation stages. Farm trial in the Netherlands 2010.

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important source of global greenhouse gas emissions which must be reduced remarkably during the next few years. Besides, methane emissions from dairy represent a loss of dietary energy.

Experimental evidences indicate that cattle lose 6-12% of ingested energy as eructed methane.

Reduction of methane production by the HBY addition may partly explain its effects on the improved energy utilisation seen in the performance trials.

Improved milk yield

Field trials carried out in Finland at 40 dairy farms between 2006 and 2009 showed increased daily milk yield, on average 2.1kg per cow (Fig. 4).

The data from 9,318 individual milk records and the test-day milk records were collected before and after introduction of the HBY in the diet.

The difference to the control was statistically highly significant ($p<0.001$) but slightly lower during the first two months of the lactation than in later lactation stages.

A total of 125 Holstein Friesian cows were used in a Dutch farm trial in 2010 that was organised according to a 3*3 Latin square design.

Dietary treatments were control, HBY and HBY + extra protein and starch and the feeding was based on grass and corn silage (55:45), wet brewers' grain and concentrates.

In this trial the HBY addition increased numerically the daily milk yield (+0.6kg) compared to the control during the whole trial period. While the HBY addition increased the milk yield only slightly in the early lactation (0-100 days) it significantly improved the milk yield (1.5kg/d) in the late lactation (Fig. 5).

The milk yield of the HBY+ treatment followed a similar trend and resulted in significantly higher milk yield (1.9kg/d) in the late lactation stage. In these trials the HBY addition has slightly lowered the percentage protein and its effect on the percentage fat has varied from a slight reduction to a slight increase.

However, due to the higher milk yield, the production of protein and fat has typically been higher than the control.

Although the addition of the HBY in dairy cow diets has been shown to increase milk yield over the whole lactation period with different diets, it seems to have most pronounced and consistent effects after the first 2-3 months in milk.

The changes in the composition of rumen microbiota with different compound feed to silage ratios suggest that the effect of the HBY on milk production can partly be dependent on the compound feed to silage ratios or rumen pH level.

The potential benefits of the higher propionate production by the HBY addition in early lactation on the energy balance, health status, longevity and fertility of the cows have not been measured so far and needs further research. ■

References are available from the author on request