A nature-based solution for improving protein nutrition in cattle

Effect of the application of Vertan in the diet of high-performing dairy cattle

Results

Total dry matter intake of cows in the performance trial was 22.6 kg/cow/day for all treatments and did not differ. Average crude protein content of the diets was 15% on a dry matter basis. The intake of metabolisable protein (expressed as DVE according to the Dutch protein feeding value) was higher for SBM-bp, due to the higher DVE value of SBM-bp. Milk yield did not differ between treatments, however milk protein content was lower (P=0.037) for SBM-bp compared to SBM. Longitudinal analyses of milk protein content showed an increase during the main period of the trial for both treatments SBM and SBM-V compared to SBM-bp (Figure 2). The DVE requirement was approximately 2000 g/cow/day for all treatments, and the DVE intake was 2005, 2193 and 2009 g/DVE per cow per day. So, it can be concluded that cows on the positive control SBM-bp did not respond to the higher DVE supply, or cows on the negative control diet SBM produced more efficiently. Blood urea of cows on SBM was higher (P=0.002) compared to cows on SBM-bp and SBM-V. Blood urea differences in the performance trial were in accordance with the differences in rumen ammonia concentrations found in the parallel trial with cannulated cows. Rumen ammonia concentration (Table 1) tended (P=0.073) to be lowest for SBM-V and highest for SBM. The lower variation in ammonia concentration (P=0.024) for SBM-bp and SBM-V compared to SBM, may have reduced N loss from the rumen as result of a more steady ammonia concentration of ammonia. Also Volatile Fatty Acid (VFA) concentrations differed between treatments. The total VFA concentration was highest (P=0.014) for SBM compared to SBM-bp and SBM-V, and this was the result of differences in mainly Acetic acid, Butyric acid, and Valeric- and iso-Valeric acid. The lower (P=0.031) isovaleric acid concentration (a branched chain fatty acid) on SBM-V compared to SBM can indicate a lower protein degradation in the rumen with Vertan, benefitting the outflow of intestinal digestible protein. Rumen pH tended (P=0.055) to be higher for SBM-bp compared to the other treatments. The rate of protein degradation differed between soybean meals as expected based on table values; no significant differences in degradation kinetics were seen between SBM and SBM-V. The amount of rumen bypass protein of the total diets calculated with the *in situ* results, was higher for SBM-bp (38.4%) compared to SBM (30.0%) and SBM-V (29.4%). It can be discussed if the *in situ* method can be used to determine effects of total diets, because the method is developed for feed evaluation of individual feeds and ranking between feeds. Fecal digestion did not differ between treatments, and supplementation with Vertan had no effect on total tract digestibility.

The output of rumen modelling simulations showed similar differences in estimated rumen ammonia concentrations compared to measured values. While estimated rumen OM and NDF degradation, microbial protein synthesis and enteric methane production were comparable between SBM and SBM-V, and lower on SBM-bp. Not all *in vivo* results and differences between treatments of ammonia concentration and VFA were not fully confirmed by the model simulations.

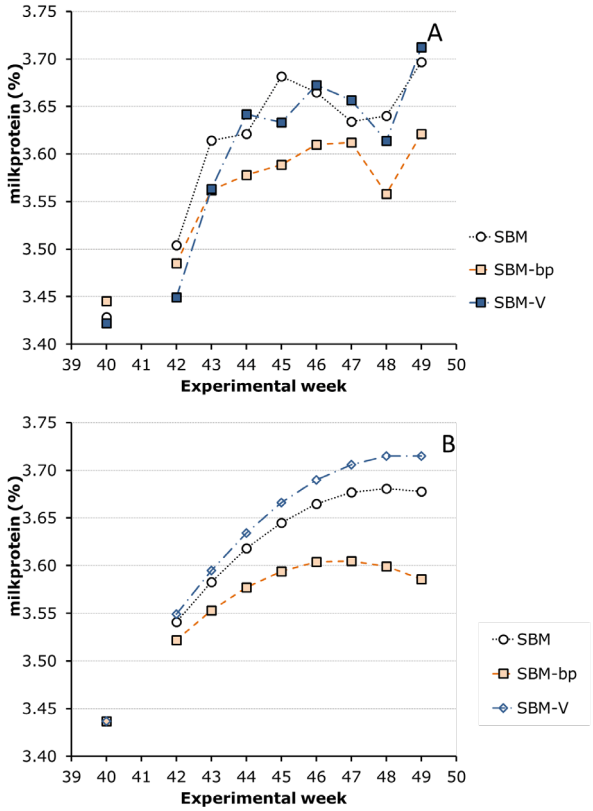

Figure 2.
Effect of treatment on average milk protein (%) per experimental week (pre period: 39-41; main period: 42-49), presented as mathematically calculated means (Figure A) or as predicted means by REML analysis (Figure B).

Table 1 (rumen fermentation & rumen pH)

Average rumen fermentation parameters per treatment, and effects of treatments during the experimental period (by ANOVA), of each of the three treatment groups.

		Treatment			Effect of treatment	
		SBM	SBM-bp	SBM-V	lsd†	P-value
Rumen fermentation						
Ammonia (NH_3)	mg/l	133.8	104.8	103.5	29.3	0.073
Variation of NH_3	mg/l	80.5[b]	62.8[a]	52.9[a]	13.3	0.024
HAc	mmol/l	76.8	67.8	68.8	9.0	0.083
HProp	mmol/l	23.4	18.9	21.2	5.9	0.152
H-iso-But	mmol/l	0.60	0.55	0.55	0.10	0.252
HBut	mmol/l	14.3	12.2	12.2	2.0	0.068
H-iso_Val	mmol/l	1.11[b]	0.96[a]	0.90[a]	0.11	0.031

HVal	mmol/l	1.34[b]	1.07[a]	1.12[a]	0.11	0.017
totalVFA	mmol/l	117.5 [b]	101.5 [a]	104.7 [a]	6.2	0.014

Rumen pH

Mean pH	6.14	6.25	6.18	0.08	0.055
Minimum pH	5.52	5.65	5.54	0.20	0.173
Maximum pH	6.64	6.72	6.75	0.11	0.103
pH <5,8 (Minutes/day)	217	132	233	265	0.390
pH <6,0 (Minutes/day)	462	282	426	315	0.228
Area pH <5,8 (Δ pH*minutes/day)	40	24	47	82	0.551
Area pH <6,0 (Δ pH*minutes/day)	106	64	112	144	0.454

Conclusions

From this study it is concluded that the use of Vertan, as a nature based solution for improved feed protein utilisation, has an effect on rumen fermentation and milk protein. Supplementing Vertan has an effect on rumen protein fermentation and VFA concentrations, resulting in lower *in vivo* rumen ammonia, iso-valeric and valeric acid concentrations and a lower blood urea concentration. These results are indicators for a better protein utilisation. However, not all results could not be fully explained by the outcome of *in situ* measurements on nitrogen degradation or by model predictions.