

This article was presented on June 25, 1998  
at the Purdue Hay Day.

## **A Healthy Cow has a Happy Rumen**

Dr. Simon Kenyon  
School of Veterinary Medicine  
Purdue University

The rumen is the largest of the four compartments of a cow's stomach. In a Holstein cow it holds about forty gallons of water and food. It is a digestion vessel in which billions of bacteria and single-celled protozoa break the cow's food down into components that can be digested further down in the gut. The principle products of the rumen microbe activity are fatty acids from the fiber and grain part of the ration, which the cow uses as energy sources, and amino acids from the protein-rich ration components such as bean meal or good quality hay. The volatile fatty acids (VFAs) are absorbed through small projections of the wall of the rumen (papillae) which give its inside wall the appearance of outdoor carpet. Cows use very little simple sugars in their diet so the volatile fatty acids are the major energy source.

The challenge in feeding high producing dairy cows is to maximize dry matter intake and energy density of the ration, while maintaining rumen health. The main risk to rumen health in current cattle feeding practice is feeding too much rapidly digestible starchy portion of the diet (e.g. finely ground grain) or too little good quality fiber (roughage).

Fiber forms a mat or matrix in the rumen which is essential for the proper functioning of the rumen microbes. It also slows the passage of material through the rumen so that proper digestion takes place.

Fiber is a powerful stimulus of cud chewing. Cudding is important because it in turn stimulates saliva production. Saliva contains a lot of bicarbonate buffer, which prevents the rumen becoming too acid. We usually add 4 - 8 ounces of bicarbonate buffer to a lactating cow ration, but when you think that a high producing cow produces 4 - 7 pounds of bicarbonate herself it becomes obvious why cud chewing is so important. We depend on the cow to do most of the buffering of rumen acidity herself.

The principle consequence of having highly fermentable lactating cow rations which are high in grain and /or deficient in fiber is chronic rumen acidosis.

## Signs of Rumen Acidosis

- Variable but reduced dry matter intake
- Decreased passage time for feed in the gut (undigested grain in manure)
- Scarring of the rumen wall, eventually leading to "nutritional burn out"
- Milk fat depression
- Laminitis (hemorrhage in the foot, sole abscesses, overgrown hooves)

## Tips for preserving rumen health:

- Build ration from forages upwards. The healthiest rumen comes from meeting as much as possible of the nutrient needs of the high producing cow from forages.
- Increase the chop length of forages incorporated into the TMR as much as possible, consistent with your ability to pack it properly, and to get it out of the silo without burning up the unloader.
- When feeding a TMR do not feed hay separately if it can be avoided. You can not depend on all cows to get sufficient effective fiber if you feed hay separately. If you do feed hay separately make sure there is plenty of space at hay feeders and enough feeders. If the manure consistency varies from cow to cow then there is likely a problem with some of them not getting enough hay.
- If feeding grain separately from forages feed the fiber source first, feed concentrate 3-4 times/day, and do not feed a concentrate meal of greater than 8 lbs at a time. Feeding the roughage first helps to buffer the rumen pH, which falls dramatically about two hours after a substantial meal of grain.
- Exceed NRC requirements for ADF and NDF in the lactating cow ration.
- Limit non-fiber carbohydrate (NFC/NSC) to 38-39%.
- Provide buffers in the ration of early lactation cows (sodium bicarbonate @ 0.75 -1.00% ration dry matter).
- 6-12% of the TMR on a weight basis should have a fiber length of greater than 1.5 inches. The Penn State Forage Separator is a useful tool for estimating fiber length. See the attached work sheet with recommendations for analyzing results from the Separator. These are based on the recommendations of Dr. Mike Hutjens, University of Illinois.
- Do not over mix the TMR. Over-mixing is a common cause of reduction in effective fiber. Only mix for long enough to mix the ration, and never for more than six minutes.

- Steam up cows moderately before calving to adapt the rumen microbes and thus help control rumen acidosis. Increase concentrate dry matter to approx. 0.75% of body weight (maximum 10-12 lbs).
- Up to 1 pound of fat may be substituted for grain in the ration of high producing cows. This spares NFC and provides energy without contributing to rumen acidosis. One pound of fat contains the energy equivalent of 2 ¼ pounds of ground corn. Too much added fat is bad for rumen health and is unpalatable.