

Basics of the Rumen: pH

When it comes to health and production, dairy cows depend on the microorganisms that populate their rumen. These microbes ferment feedstuffs and generate volatile fatty acids (VFAs), the major source of energy for ruminants. In addition, this microbial population also provides cell mass that is an important source of protein for the host.^[1]

These facts make optimal ruminal fermentation a key to maximizing feed utilization, thereby increasing dairy cattle productivity.

Dairy cattle nutritionists are very aware of the importance in maintaining optimal rumen conditions. However, when formulating rations for high-producing dairy cows, they may feel the need to make decisions that lessen fermentation and weaken conditions for ideal microbial population growth. For example, when feeding high-energy diets, VFAs and lactic acid can buildup in the rumen, reducing pH. If this occurs for prolonged periods every day, it can affect feed intake, microbial metabolism, and feed digestion. It has also been linked to inflammation, diarrhea, and milk fat depression.^[2]

An ideal ruminal pH will vary depending on the specific microorganism populations. However, it is accepted that pH between 7 and 6 is generally the ideal for microbes. More important than absolute numbers, research shows that the amount of time pH falls below a certain threshold (5.8 to 5.6) is vital when assessing effects on digestibility, VFA production, and microbial growth.^[3]

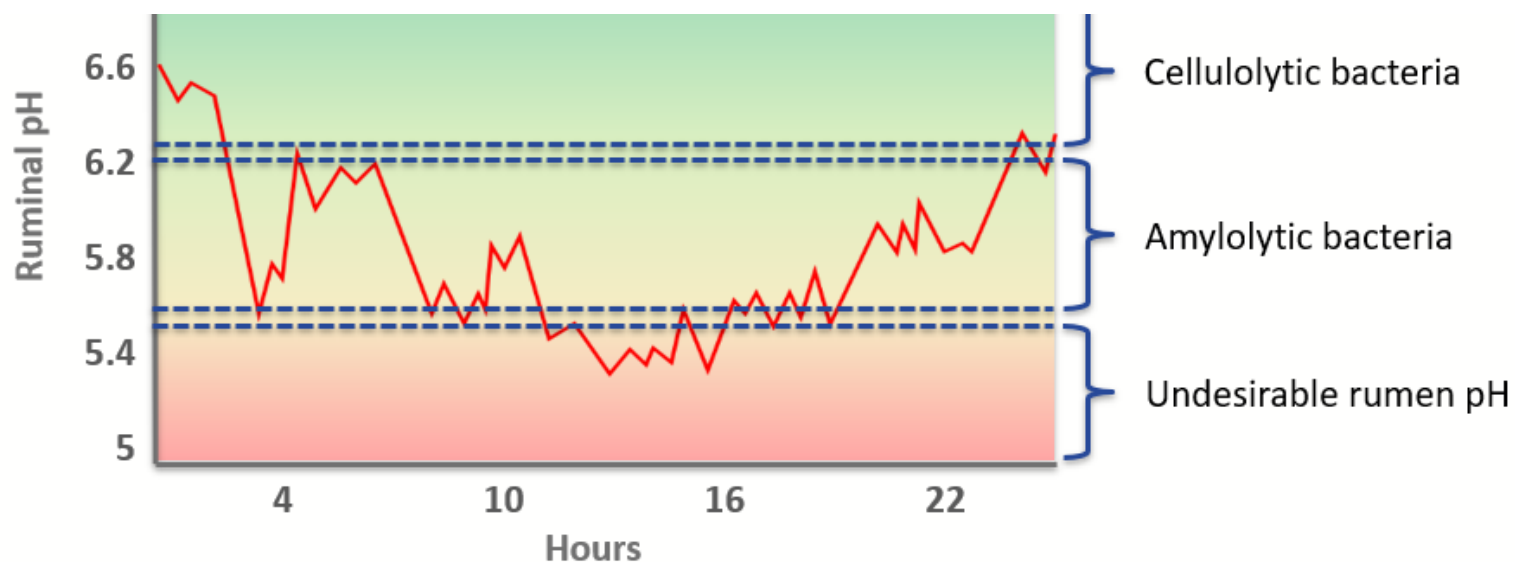


Figure 1. Variation on the ruminal pH over a period of 24 hours.

[1] Nagaraja, T. G. (2012). A microbiologist's view on improving nutrient utilization in ruminants. College of Veterinary Medicine, Kansas State University. <http://dairy.ifas.ufl.edu/rns/2012/11NagarajaRNS2012.pdf>.

[2] Dijkstra, J., et al. (2012). Ruminal pH regulation and nutritional consequences of low pH. *Animal Feed Science and Technology*, 172: 22–33.

[3] Cerrato-Sanchez, M., et al. (2008). Effect of the magnitude of the decrease of rumen pH on rumen fermentation in a dual-flow continuous culture system. *Journal of Animal Science*, 86: 419–431.

[4] Adapted from Van Soest, P. J. (1994). *Nutritional ecology of the ruminant*. Ithaca, NY: Cornell University Press.

The Recommended pH^[4]

As an example, Figure 1 charts the fluctuations of a random cow's ruminal pH over 24 hours. There is high variability between the average and actual pH throughout the day. Although the microbial population has great flexibility and can recover quickly, research shows that certain types of ruminal microbes are more efficient in certain ranges of pH.



Cellulolytic Bacteria

To be most efficient, cellulolytic bacteria — which digest fiber — need a rumen pH between 6.8 and 6.3. The primary end product of fiber fermentation is acetate, the main precursor of milk fat at the mammary gland. Therefore, when fermentation of cellulolytic bacteria is depressed milk fat levels are lowered. These bacteria are the most sensitive to low ruminal pH.



Amylolytic Bacteria

Aiding in the digesting of starch and sugars from the non-fibrous part of dairy cow diets, amylolytic bacteria thrive in ruminal pH levels between 6.2 to 5.8. The end product of this bacteria is propionate, which is further converted by the liver into glucose as a precursor of lactose in the mammary gland.



pHix-up has high neutralizing capacity and combines both fast and long acting - thereby able to maintain ruminal pH at optimal levels.