The importance of managing rumen pH

Mark Corrigan for *Progressive Cattle*

AT A GLANCE

Know how acidosis breaks down proper function of the rumen, and manage your feed with the proper balancing decisions. This requires a grasp of feed ingredients that enhance digestion properly.

There are more microbes in the rumen of a single feedlot animal than there are humans on earth. If you think it's challenging for all of those people to work together, imagine what's going on in the rumen.

Some of those organisms are protozoa and fungi, but bacteria make up most of the vast rumen microbial population. These microbes' job is to digest feedstuffs through fermentation to create energy and protein the animal needs for maintenance, growth, reproduction and milk production. That's a tall order and involves a complex process that hinges on pH balance in the rumen. An upset in rumen pH can send the entire digestive system off the rails, taking animal health and performance with it.

The rumen evolution

At birth, the rumen is sterile – there are no bacteria. Within the first 24 hours of life, the bacterial population begins to build through contact with other animals and the environment. Forage intake is instinctive, and calves can start ruminating as early as 3 days old. We have all seen calves start picking at grass or hay within the first week of life; this is what initiates rumination. Rumen bacterial growth requires a favorable environment – the presence of substrates (feed), water, optimal rumen temperature and optimal pH.

Cattle are metabolically hardwired to live as ruminants. As they grow larger, they cannot survive without a fully functioning rumen. Cattle must utilize the end products of ruminal fermentation for energy, and the rumen is the main site of absorption of those nutrients.

Cattle feed is made up of protein, carbohydrates, fat, vitamins and minerals. Carbohydrates are the primary energy source for ruminants and include fiber, which is digested slowly in the rumen, and starch and sugars, which are broken down rapidly in the rumen.

As ruminal microbes digest carbohydrates, they produce volatile fatty acids (VFAs) – mainly propionate, acetate and butyrate. VFAs are "good" rumen acids. Propionate is used by the animal to produce glucose, and it's the VFA most efficiently converted to energy, followed by butyrate. VFAs provide 60% to 80% of an animal's energy needs and also are food for some rumen microbes. In addition to butyrate being an energy source, it has another unique benefit. Butyrate is metabolized by the epithelial cells that line the rumen and digestive tract, and it contributes to the growth of the finger-like rumen papillae and intestinal villi. A healthy rumen looks like a shag carpet – it's lined with papillae that increase the absorptive surface area of the rumen to absorb VFAs and other nutrients.

There is one rumen acid that causes problems – lactate or lactic acid. It is the primary influencer of rumen pH. Under normal conditions, lactate does not accumulate in the rumen, but feeding high-grain diets to cattle that are not adapted to them can cause lactic acid to build up. Lactate is 10 times stronger than other VFAs and has a significant influence on pH reduction and the health of the rumen microbial population.

Normal ruminal digestion occurs when the rumen pH is between 5.5 and 6.5. If grain is rapidly introduced as a feedstuff and the cattle are not used to it, fast-growing bacteria such as streptococcus and lactobacillus produce more lactic acid than can be utilized. In some feedlot cattle, subacute acidosis sets in between rumen pH 5.5 and 5.0. A rumen pH below 5.0 can be indicative of acute acidosis. Acidosis is one of the things that causes animals to go "off-feed" and can lead to significant problems.

You may have seen the effects of acidosis if you have transitioned cattle too quickly to a hot ration or if you've turned cows that are not adapted to grain out on cornstalks where there is a lot of corn on the ground.

A rumen microbial boost

Cattle producers use a variety of microbial products to improve rumen health and performance. One is unique and stands out from the crowd. *Megasphaera elsdenii* is a strict anaerobe that was discovered in 1953. Its mode of action is well documented and well understood. Other rumen microorganisms consume simple sugars and amino acids first, but *Megasphaera elsdenii,* or *Mega e.*, prefers lactic acid and seeks out that energy source above all others.

If lactic acid is not present, *Mega e.* can survive in the rumen because it will consume sugars and amino acids. *Mega e.* metabolizes lactic acid into butyric and propionic acids, two beneficial VFAs. As the primary and most prolific lactic acid utilizer in the rumen, *Mega e.* enables rumen pH regulation, contributes to the growth of rumen papillae and supports the development and maintenance of a healthy rumen.

Mega e. naturally exists in cattle rumens, but its levels are low in cattle consuming a high-forage diet.

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As cattle consume higher levels of grain, the *Mega e.* population in the rumen increases to counteract the potential increase in lactic acid. However, it can take weeks to establish a ruminal *Mega e.* population to effectively handle grain-based diets.

Researchers found that cattle who were well adapted to consuming high-grain diets had higher numbers of *Mega e.* They hypothesized that seeding the rumen with a large volume of the bacteria could reduce the risk of acidosis. However, *Mega e.* is a strict anaerobe, meaning it dies in the presence of oxygen, making it difficult to produce commercially.

A healthy rumen microbial population is critical to cattle health and performance. When navigating the delicate dance between improving performance through high-energy rations and regulating rumen pH, *Mega e.* is a tool that can help bridge feeding transitions and keep the rumen microbial team working together in the right direction.

Acidosis can …

- Slow or stop rumen fermentation, impacting cattle performance.
- Damage rumen papillae and rumen epithelium (This is known as rumenitis and results in lesions that prevent nutrient absorption and allow bacteria to enter the bloodstream.)
- Reduce rumen motility, causing bloat
- Destroy gram-negative bacteria, releasing endotoxins that cause inflammatory responses and impact immunity
- Increase laminitis or lameness
- Result in death if severe enough or persists long enough

PROGRESSIVE CATTLE

Reprinted from February, 2021