# Can we feed cattle in the Southeast? Understanding and preventing acidosis


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As the movement to regional food production increases, smaller-scale beef processing plants are opening. The result is that many people who have not had a long history of finishing cattle on high-grain diets are starting to feed cattle. The diets used in growing yards are more forage based, whereas finishing diets have more grains and grain by-products. So, why do we need to feed diets that have a greater percentage of grain in order to get more average daily gain (ADG), be more efficient, and get better marbling? Well, the major volatile fatty acids (VFA) produced by rumen microorganisms are acetic acid (CH3COOH), propionic acid (CH3,CH2COOH) and butyric acid (CH3,CH2,CH2COOH). These VFA are the main products of the digestion of feed by bacteria in the rumen, and serve as the main precursors for both glucose and fat in ruminants. On a forage-based diet, the proportion of VFA would be approximately 65-70% acetic, 15-25% propionic, and 5-10% butyric. Feeding grain-based diets high in readily fermentable carbohydrate (starch) increases the proportion of propionic acid produced through ruminal fermentation, and results in VFA proportions of approximately 50-60% acetic, 35-45% propionic, and 5-10% butyric. Acetic and butyric acids are not converted to glucose, but go to fat synthesis. The doubling of propionic acid is extremely important to carcass characteristics, because only propionic acid goes to glucose production in the liver. Greater glucose production in the liver increases ADG, improves feed efficiency, and results in more intramuscular fat (marbling). Acetic acid, which is not converted to glucose, results in greater back fat, seam fat, and milk fat (in lactating cows). So, we want diets that result in a greater percentage of propionic acid, and those diets are high in grain. Now, the goal is to prevent metabolic issues.

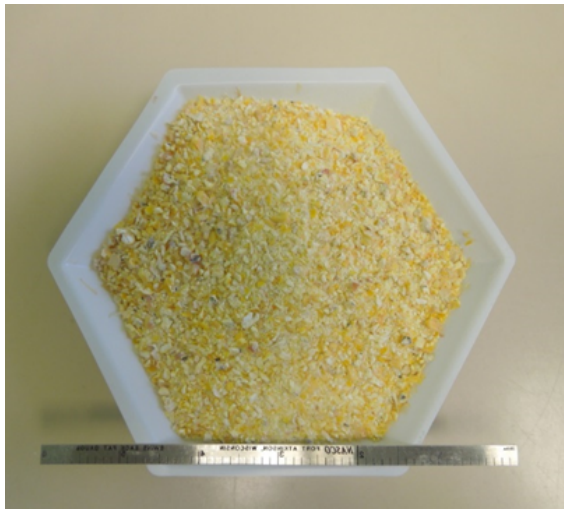
Acidosis is a prerequisite to classic feedlot bloat. Acidosis is most common when high-grain diets are fed. Ruminal bacteria digest feed by attaching to the feed's surface. Any grain processing that increases the surface area available for bacterial attachment increases the number of bacteria digesting feed at any one time. Processing of grains through ensiling, grinding, and pelleting all can increase the incidence of acidosis, because the surface area of the feed increases, as each particle of feed decreases in size, and the rate of ruminal fermentation is increased. Most starch-digesting ruminal bacteria can replicate in approximately 15 to 30 minutes, depending on the species. However, when we process grains too finely, large amounts of starch and sugar stimulate bacteria that make lactic acid. In this instance, bacteria that normally use lactic acid (Megasphaera elsdenii, Selenemonas ruminantium, and Selenomonas lactilytica) cannot keep up with production. Lactic acid is about ten times stronger acid than the other VFA, and it's

produced by the bacteria Streptococcus bovis, which is the fastest replicating ruman bacteria, with a doubling time of approximately 6 minutes, which means that we can get a lot of lactic acid produced in a short amount of time, and the rumen pH declines, rapidly. The optimal rumen pH with cattle on a high-grain finishing diet should be between 6.0 and 6.5, but when lactic acid is being over-produced, the rumen pH continues to decline and can fall below 5.5, at which point many other rumen bacteria species also begin to die. The difference between a pH of 6.5 and 5.5 doesn't sound like a lot, but pH is the negative log of the hydrogen ion (acidity) concentration. This is confusing, so just know that a pH of 5.5 is 10 times more acidic than a pH of 6.5.

The two most efficient forms of corn are steam-flaked corn and whole-shelled corn, as shown by F. N. Owens in 1997 in a large-scale meta-analysis of grain processing studies with finishing cattle. The reason is, partly, that both are relatively consistent in size and digestibility, versus ground or ensiled corn that can vary greatly in particle size, which makes formulating diet fiber levels very difficult.

With whole-shelled corn, keep the fiber level below 15% of the diet. Work published by Karen Beauchemin and her colleagues in 1994 found that corn is the only grain that can be fed to cattle whole. In fact, with feedlot cattle, when whole corn is fed, most of it is chewed and enters the rumen as coarsely ground corn. Yes, there are some whole kernels in the manure, but starch digestibility with whole-shelled corn diets is still around 95% when forage levels in the diet are kept to 15% forage or less.

***With coarse ground corn, feed 15% to 30% fiber***



***This grind is far too small to feed to cattle.***

The accumulation of lactic acid in the gut causes an influx of water from the tissues into the gut and thus a common sign of acidosis is diarrhea. As lactic acid accumulates in the rumen, it is absorbed across the rumen wall into the blood, and lowers the pH of the blood. A decrease in blood pH then occurs as a result of a buildup of lactic acid in the blood. When the pH of the blood declines, capillaries constrict.Capillaries in

the esophagus constrict, causing a constriction of the muscles in the esophagus. When this occurs, the ruminant can no longer get rid of gas from the rumen, and it can't regurgitate its food to chew its cud. As a result, there is a buildup of gasses (mostly carbon dioxide [CO2] and methane [CH4]). The rumen then expands (bloats) to the point where the animal cannot breathe, because the rumen puts pressure on the lungs. This is what causes cattle with bloat to take short, rapid breaths. Unless the bloat is treated in a timely manner, the animal will suffocate and die, because the lungs are compressed downward onto the heart, increasing the pressure needed to pump blood, and the animal either suffocates or has a heart attack. One of the techniques to monitor a group of cattle is to pay attention to the manure. Cattle being fed a high-grain diet don't have much fiber in the diet, so it may be fairly flat, but it should not be watery.



***Picture A shows normal manure from an animal being fed a high-grain diet. Picture B shows the manure of an animal that has diarrhea, as seen by the watery manure and mucous, which comes from the lining of the intestine. This is an indication of acidosis in that animal, and careful attention should be given to the cattle to see if they are eating a consistent amount of feed from one day to the next.***

There are several ways to help prevent acidosis:

- Implement a bunk management plan that controls the amount of feed in the bunk during the early morning bunk check, so that cattle are stimulated to eat when they are fed.
- Increase the frequency of feeding from once a day to twice a day.
- Increase the percentage of roughage in the diet. With high grain diets, this could be soybean hulls, whole cottonseed, dried distillers grains, wheat midds, ground straw or hay (higher NDF concentrations are better). Keep the forage between 1 to 3 inches, if possible.
- Feed complementary grain sources to increase the time of ruminal digestion, so that less starch is available at any one time. For instance 50% whole corn and 50% coarse ground corn.
- Implement a gradual diet adaptation period that ranges from 14 to 21 days.

One word of caution is not to rely on sodium bicarbonate to buffer a high-grain diet, because it is only effective in moderate energy diets, such as dairy diets that are high in forage.