Preventing Acidosis in Feedlot Cattle: Management from Arrival Through the Finishing Period

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Pre-Weaning Management:

Pre-weaning programs are becoming standard in alliance programs, but many cow-calf producers do not have appropriate confinement facilities to contain, and manage, calves for long periods of time. The ultimate goal of a weaning management strategy should be to avoid stress on the calf, as stress increases sickness and increases the incidence of acidosis in the receiving period when calves are placed in the feedlot. In recent years, fence-line pasture-weaning strategies have allowed producers to wean calves on pastures, in a familiar environment. In this weaning management strategy, calves and cows have nose-to-nose contact, as well as visual and auditory access, but suckling is not possible. A great deal of research has been done with fence-line weaning over the past 15 years, and one of the major findings is that the calves are more attached to their dams than the dams are to their calves, as long as the dams have visual contact. Therefore, what a producer must have is a good fence that calves won't try to go through, and one that will not cause damage to them, if they do. Woven wire would be the first choice, with good high-tensile fence being the second choice. However, barbed wire would not be recommended. Also, since calves tend to walk the perimeter of a field after weaning, smaller fields work better than larger fields. A weaning pasture of approximately 5 acres is satisfactory. Boyles et al. (2007) conducted a trial to evaluate weaning management strategies and the ultimate impact on calf health. 'Three weaning strategies were investigated: 1) weaned at trucking, 2) weaned 30 d before trucking and confined in drylot, and 3) weaned 30 d before trucking and pastured with fence-line contact with their dams. Steers from the drylot weaning strategy lost 0.6 kg/d the first week in the feedlot, whereas steers from the truck weaning and pasture-weaning treatments gained 0.5 and 0.4 kg/d, respectively ($P = 0.01$). Weaning effects on incidence of morbidity also were detected ($P = 0.03$), with only 15% of the pasture weaned calves requiring treatment for respiratory disease. This incidence was doubled for truck-weaned calves and nearly 2.5 times greater for calves weaned in drylot' (Boyles et al., 2007).

Immediately After Feedlot Arrival:

The use of electrolytes in the water when cattle arrive at the feedlot would be beneficial in restoring critical potassium and B-vitamins. This will result in cattle having a greater desire to eat, as well as making their digestive, metabolic, and endocrine systems more effective. Receiving diets need to be formulated with 16% to 18% crude protein on a dry matter basis, instead of 12%, because animals that are experiencing a limited intake are not reaching their protein requirements, which are in grams per day, not percent protein. This is important, because antibodies are proteins, and for the animal to stay healthy, it must not be mobilizing muscle protein to meet its requirements.

Receiving diets should not contain Rumensin® or urea, as these have an astringent quality, and cause some calves not to eat for up to 4 to 5 days. This needs to be avoided, as these cattle are much more likely to become sick and/or die. I would replace Rumensin® with Virginiamycin® from Phibro, which NutreFeed markets. I will send information on Amaferm® an all-natural extract of *Aspergillus oryzae* that NutreFeed is in the process of bringing to Argentina. I have worked with this product for 10 years, and it is exceptional at increasing fiber digestibility and stabilizing rumen pH, as well as increasing the amount of microbial protein delivered to the small intestine. It does this by stimulating the growth rate and enzyme activity of the rumen bacteria. It also stimulate the growth rate and enzyme activity of the rumen fungi, which are the only microorganisms that release enzymes that break the hemicellulose-lignin bonds in forage, making more cellulose and hemicellulose available for bacterial attachment and digestion, thus increasing the digestible energy in forage.

Receiving diets should contain no more than 60% grain for the first 14 days, as the cattle are undergoing adjustments to a new environment, feed source, and water source. In addition, the stress involved with weaning, trucking, and establishing a new social hierarchy cause a rise in glucocorticoids such as cortisol, which are immune suppressants. Anything that increases stress decreases the animal's ability to mount an immune response to the vaccines that are meant to keep them healthy.

During the receiving period, cattle should be started on feed at a level between 1.5% and 1.7% of their body weight, on a dry matter basis. The can be increased .1% per day until they leave feed, or reach 2.2 to 2.5% of body weight, and then they need to be held 2 days at the same intake. When they leave feed, they need to be held at that level until the feed bunks are cleaned for three days in a row.

At all diet change times, the cattle should have their feed intake reduced by 10% so that they are not experiencing an increase in energy density at the same time that they are experiencing an increase in feed intake. This is being recommended to avoid acidosis.

All of the diets contain urea. However, water is being added, and all diets except the finishing diet have a high percentage of corn silage. When urea becomes wet, it volatilizes, making the diet lower in protein than formulated. Low protein diets are a causative factor in acidosis. I would recommend replacing at least 50% of the urea with slow release urea such as Optigen® from Alltech. This will help to assure that the nitrogen from the urea is available to the rumen bacteria. This is important, because rumen bacteria use ammonia as their nitrogen source. All natural protein that is available in the rumen is broken down to ammonia by the bacteria and used to produce bacterial protein, which is broken down to amino acids in the abomasum and absorbed in the small intestine.

The small particle size of the diets can be a leading factor in the acidosis that has occurred. I would not put the water directly on the pellets in the mixer, and I would reduce the mixing time. This will require some trial and effort to get correct. Additionally, I would increase the corn silage percentage in the finishing diet by 10%, replacing corn and pellets each by 5 percent. Since corn silage is approximately 50% corn on a dry matter basis, this should not decrease the energy density of the diet, but cause an

Bloat is an excessive accumulation of gas in the rumen and reticulum

Symptoms:
distension of left side
death by asphyxiation

Feedlot bloat is a side effect of lactic acidosis. Therefore, understanding how to prevent acidosis will result in the prevention of the more easily detectable side effect, bloat.

Acidosis is caused by a low rumen & blood pH cause by a rapid ingestion and digestion of starch.

There are two types of acidosis:
1. Chronic; animal is trying to cope with it by not eating. This is normally caused by poor diet formulation, or improper bunk management. It is the most costly, because it often goes undetected, and results in fluctuations in intake to the point where cattle do not consume enough feed on a daily basis to meet their maintenance requirements, and then over-consume the next day, after the pH of the rumen has returned to normal levels. However, on the days where they over-consume a high-starch diet, this leads to another day of under-consumption.
2. Acute; severe case occurs quickly (grain engorgement), resulting in bloat.

Acute Acidosis Explained:
Acidosis is a prerequisite to classic feedlot bloat. Acidosis is most prevalent when high-grain diets are fed. 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 a stronger acid than the VFA, acetate, propionate, and butyrate, which causes the rumen pH to decline, rapidly. The optimal rumen pH should be between 6.0 and 6.2, 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. When the rumen pH drops

below 6.0, bacteria that digest fiber begin to die and thus, fiber digestion is depressed. In addition, the accumulation of acid 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 expel gas from the rumen. It can also not regurgitate its= food (chew its= cud). A buildup of gasses (mostly carbon dioxide; CO2 and methane; CH4) results. 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.

Processing of grains through ensiling, steam flaking, grinding, and pelleting all increase the incidence of acidosis, because the rate of ruminal fermentation is increased. Ruminal bacteria digest feed by adhering to the feed's surface. Any type of processing that increases the surface area available for bacterial attachment increases the number of bacteria digesting feed at any one time. Ruminal bacteria can replicate in approximately 6-30 minutes, depending on the species. Therefore, large increases in the bacterial population occur very rapidly. When bacteria digest feed, volatile fatty acids (VFA) are produced. The three major VFA=s are acetic, propionic, and butyric. These are absorbed across the rumen wall into the blood stream, and are transported to the liver. In the liver, they are converted to glucose and precursors of milk fat and body fat. When high-grain diets are consumed and digested very rapidly, the bacteria can produce VFA faster than the liver can convert them to other compounds. Small grains such as wheat, barley, or steam flaked corn, have more surface area available for bacterial attachment, due to the structure of the starch granules. These can lead to a very rapid fermentation, which leads to the acidosis cycle described above. When the rumen pH falls, one of the results is a decrease in rumen contractions, which results in less regurgitation of feed (cud chewing), resulting in less saliva being swallowed, thus lowering buffering capability. Under these rumen conditions, the bacterial species Streptococcus bovis, the major lactic acid producing strain, grows rapidly. It has a generation time of approximately 6 minutes, which is faster than any of the other rumen bacterial species.

Prevention of Acidosis:

- Implement a bunk management plan
- Increase the frequency of feeding.

- 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).
- Feed complementary grain sources to increase the time of ruminal digestion, so that less starch is available at any one time.
- Implement a gradual diet adaptation period that ranges from 10 to 14 days.
- Utilize products that buffer the effect of lactic acid producing organisms, such as sodium bicarbonate (only effective in moderate energy diets, and much less effective in high grain diets).

Roughages are fed at a low concentration in feedlot diets to:
1. Help prevent digestive disorders by altering ruminal pH and osmolality (osmotic pressure) through increasing the rate of rumen contractions, which increases rumination resulting in increased saliva production and increased buffering capacity. However, roughage particles should be relatively small (less than 1.6 inches or 4 cm) when highly-processed grain diets are fed or undigested grain will pass through the rumen.
2. Maximize net energy for gain (NEg) intake by cattle. Several researchers have found that increasing the neutral detergent fiber (NDF) concentration in finishing diets stimulates intake to a point where NEg intake is greater than if no additional fiber were fed, resulting in increased gain and efficiency of gain (Guthrie et al., 1996, Prof. Anim. Sci., 12:192-198; Theurer et al., 1999, JAS, 77:1066-1073; Defoor et al., 2002, JAS 80:1395-1404).

Defoor et al., (2002) conducted a study where cattle were fed steam-flaked corn diets, with chopped alfalfa hay (40% NDF), chopped sudan hay (66% NDF), wheat straw (80% NDF) or cottonseed hulls (86% NDF) fed at either 5, 10, or 15% of diet DM. The NEg intake (Kcal/kg BW.75) increased linearly ($P < .05$) as NDF from roughage increased. The NEg intake (Kcal/kg BW.75) was greater ($P < .05$) when diets contained cottonseed hulls (45.55) versus alfalfa hay (35.74), with sudan hay (40.66) and wheat straw (43.33) being intermediate. The authors reported that the effect of roughage source on NEg intake is a direct result of the NDF concentration of the roughage, and confirms the results of Theurer et al. (1999) where wheat straw and alfalfa were added to high concentrate diets at the same level of NDF. At a constant NDF level, wheat straw and alfalfa had equal effects. These results demonstrate that the level of NDF in a finishing diet can impact performance by increasing total energy intake, due to buffering capacity and reductions in metabolic stress related to chronic acidosis when cattle are fed high-starch diets.

Amaferm has been shown to increase enzyme production by both cellulolytic and starch digesting bacteria, to increase the rate and extent of digestion, to increase the microbial protein yield on a variety of diets which provides essential protein to animals under stress during periods of reduced feed intake, as well as being shown to reduce the time that animals require to resume consumption during diet transition. Amaferm helps to stabilize the rumen environment, as it has been shown to increase the growth rate of the fiber digesting bacteria in the rumen, *Fibrobacter succinogenes* S85 and *Ruminococcus albus* 7 as well as several strains of the lactate utilizing bacteria *Megasphaera elsdenii, Selenemonas ruminantium,* and *Selenomonas lactilytica*. (Beharka, A. A. and T. G. Nagaraja. 1998). Amaferm has also been shown to stimulate the growth of, and lactate uptake by, *Megasphaera elsdenii*, the predominant lactate utilizing ruminal bacteria, potentially providing a means to reduce the economic losses associated with feeding high-concentrate diets that are caused by lactic acidosis. (Waldrip, H.M. and S.A. Martin. 1993). Amaferm is so effective that its addition increased lactate uptake over 700% by the ruminal bacteria *Selenomonas ruminantium* in one study. (Nisbet, D.J. and S.A. Martin. 1990). When digestibility is enhanced, and lactate in the rumen is decreased, then an improvement in feed efficiency may result. Therefore, think of Amaferm any time calves, or feedlot cattle, are being transitioned from one diet to another, or are under any stress that may impact rumen stability or feed intake.

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