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Buckin' Stock Talk

by Terry Ann Lidral

We talked with veteran bovine ruminant nutritionist Dr. Greg Nunnery of QualiTech, Inc. about the benefits and implementation of mineral supplementation programs.

Define mineral supplementation.

"Mineral supplementation is the process of providing animals with minerals that are or may be lacking in the diet they are consuming."

What are the benefits of mineral supplementation?

"Proper mineral nutrition is necessary throughout all phases of an animal's lifetime. Animals, like humans, require seven macro (major) minerals and seven micro (trace) minerals for growth, reproduction, and immune function. Together, these minerals have important roles in the formation of bones and teeth, muscular contraction, energy and protein metabolism, DNA/RNA replication, skin and hoof integrity, wound healing and immunity, as well as a host of other functions too lengthy to list. When one or more of these minerals is not consumed in the proper quantities, a deficiency is created and animal performance will suffer. In cases of extreme deficiency, an animal may even die."

What are these minerals and what amounts are required?

"Macro minerals – major minerals – are required in amounts of grams per day and include: calcium, phosphorus, magnesium, potassium, sulfur, sodium and chloride. In contrast, the micro minerals – trace minerals – are only required in amounts of milligrams per day; however, this does not mean they are any less important. The seven micro minerals are: zinc, copper, manganese, iodine, iron, cobalt, and selenium." For mineral sources, please see entry at the end of the article.

What are the indications that mineral supplementation is needed?

"Probably the most noticeable indicators for providers will be inability of a cow to breed/rebreed, extremely slow growth rates, or decreased feed intakes. These conditions can all point to a lack of one or more minerals. Supplementation with the appropriate mineral may correct these issues, provided they are not caused by some other factor. Aside from these three general clues, it is not always easy to determine when mineral supplementation is needed, at least from a visual perspective. When a provider can see a problem, a deficiency may already exist and the animals will have to play catch up once minerals are supplied. Between the times when a feed or forage is meeting the animal's needs and when the animal becomes clinically deficient is a period of subclinical deficiency. During this period, an animal may continue to grow and reproduce; however, it will be at a reduced rate. The ability of an animal to mount an immune response will also be reduced if they are subclinically deficient.

In my opinion, providers should follow the old adage, ‘an ounce of prevention is worth a pound of cure,’ and supply their animals with some form of mineral supplement year round. One of the best things a provider can do is take forage samples from the pastures animals are in and send them off to a lab for mineral analysis a few times a year. Doing this, the provider will know what minerals need to be supplemented at different times. The state Cooperative Extension Services can be helpful for interpreting results as well as helping to design a program. In addition, many of the companies that supply mineral supplements will have information regarding forages in a specific region.”

Compare needs for mineral supplementation as it applies to climate conditions, forage types, and feed programs. Under what conditions is mineral supplementation most beneficial? Least beneficial?

“Very little to no information is available with regards to the needs of mineral supplementation under different climate conditions. Most of the research in this area tends to focus on energy and protein needs in climate changes.

Forage type can play an important role in determining what and how much of a mineral to supplement. In general, legumes (like alfalfa and clover) have a greater concentration of most of both the macro and micro minerals (especially calcium) when compared to grasses. Again, the best thing a provider can do here is to have a forage analysis conducted or see if s/he can locate data specific to their own area. The amount of mineral in a plant is dictated by the amount of availability of the mineral in the soil. Many forages in Texas are deficient in zinc and copper whereas, the same forage in another state might contain adequate concentrations of these minerals.”

Describe a scheduled mineral supplementation program. What are its pros and cons?

“In a scheduled mineral supplementation program, the provider supplies animals with the amount of mineral they need for a defined period of time. The exact time period depends on how often the provider wants to add mineral to the feeder. In this system, there may not always be mineral supplement in the feeder because the animals may eat multiple days' worth of mineral in one day. However, this averages out over the days the feeder is empty. Animals have some capacity to store minerals so over the defined period each animal is theoretically consuming the amount they should. The pros to this system are that the provider knows when and how much mineral he needs to feed before heading out to the pasture. The cons to this system are that extremely dominant animals may prevent other, less aggressive animals from consuming enough of the supplement to meet their needs."

Describe a free-choice mineral supplementation program. What are its pros and cons?

"In a free-choice mineral supplementation program, mineral is always present for the animals to consume. The provider must maintain vigilance to make sure the feeder doesn't go empty. One of the main advantages to this system is that all of the cattle will be able to consume enough of the supplement to meet their daily needs. One of the cons to this system is that animals may consume too much mineral which can become expensive. Another of the cons is that providers will often supply animals with a large quantity of mineral to keep from having to fill the feeder and, if an unexpected weather event occurs, the mineral may be wasted."

Explain the use of limiters. Compare the different types of limiters by feed programs, benefits, positives and negatives.

"Limiters are ingredients added to a mineral supplement to help control cattle intake. Some mineral supplements are so palatable that it is necessary to add limiters to keep the cattle from over consuming and adding unnecessary expense. Limiting consumption of mineral supplements is often achieved through a combination of physical form - blocks, tubs, and liquids - as well as intake limiting compounds. This is especially true when carbohydrates, protein, or molasses are added to the mineral. The most common ingredient used as a limiter is salt because it is inexpensive and generally thought of as safe. Over all, salt works well, but cattle can get accustomed to it over time and the amount of salt in the supplement has to be increased to

maintain proper intake. Another limiter, which works very well in conjunction with salt, is monensin. When monensin is used as a limiter, the amount of salt in the mineral supplement can be decreased and cattle do not become accustomed to the salt level. Also, when monensin is used, variation in day to day intake is decreased. The main drawback to monensin is that it is a drug and thereby regulated by the FDA. Gypsum has been used effectively as a limiter, and less gypsum is required to achieve the same level of intake as salt. However, using gypsum as a limiter greatly increases the amount of sulfur in the diet and this may lead to the neurological disorder called polioencephlomalacia (PEM). Calcium chloride has also been successfully used to limit supplement intake. Like gypsum, less calcium chloride is necessary to lower intake than salt. The main disadvantages of calcium chloride are its corrosiveness and the amount of extra calcium it supplies. Finally, phosphoric acid is used with great success to limit intake of liquid supplements. Additional advantages of phosphoric acid are that it adds phosphorus to the diet and helps maintain molasses in its liquid form during the winter months."

In extreme weather conditions such as drought, extended periods of extreme heat and severe cold, is mineral supplementation beneficial and if so, how?

"During weather extremes, mineral supplementation is just as critical, if not more so, than during normal conditions. Minerals are necessary for proper immune function and many of the body's enzyme systems require a mineral element or cofactor. During periods of extreme heat or cold, the animal has to expend energy to try to keep itself cool, or warm, as the case may be. Every energy transferring reaction in the body requires magnesium. Other minerals are necessary to keep the osmotic pressure of the body's fluids optimum. Finally, these extreme conditions place the animal's body under a great deal of stress and minerals are a key component of a healthy immune system."

Sources of macro and micro minerals to create mineral supplements:

"A number of different mineral sources are used to create mineral supplements. Most of the 14 required minerals each come from a separate mineral source. For calcium, the most common form used in supplementation is limestone; although calcium can also come from sources like dicalcium phosphate (usually used to supply phosphorus) or dolomitic limestone, which also supplies magnesium. Phosphorus will typically be supplemented as dicalcium phosphate or phosphoric acid. Some supplements may contain rock phosphate; however, this should be avoided as very little of the phosphorus is available to the animal. The predominant source of magnesium is magnesium oxide as it has a very high magnesium concentration and a small amount can go a long way. One drawback to magnesium oxide is that it is not very palatable and if there is too much in a supplement, animals will not consume it. Potassium is generally provided by potassium chloride, but can also be supplied by potassium carbonate and potassium bicarbonate. Salt provides both sodium and chloride, which can be used to either increase consumption of a mineral or, when in high amounts, limit consumption. Sulfur is usually not supplemented directly because it is can be found in high enough concentrations in the feed and can also be found as a component of many of the trace minerals.

Micro mineral supplementation is not a straight forward as macro mineral supplementation. When discussing the trace minerals it is much more important to focus on the bioavailability of the mineral source. Bioavailability refers to how much of the consumed mineral an animal can actually digest and absorb. There are a number of factors that can affect trace mineral bioavailability, but the focus here will mainly be on source effects. Many of the trace minerals can be supplied by more than one source. Below is a bullet point list with each of the trace minerals and their main sources ranked from most to least bioavailable.

- Copper – copper chloride > copper sulfate > copper oxide
- Manganese – manganese sulfate = manganese chloride > manganese carbonate
- Zinc – zinc sulfate > zinc oxide > zinc carbonate
- Iodine - ethylenediamine dihydroiodide (EDDI) > potassium iodide = sodium iodide
- Iron – ferrous sulfate > ferrous carbonate
- Cobalt – cobalt carbonate > cobalt sulfate > cobalt oxide
- Selenium – cobalt selenite > sodium selenite

"With the exception of EDDI, all of the trace minerals listed above are considered inorganic trace minerals, meaning they are composed of all inorganic compounds. Over the last 20 plus years, another form of trace minerals has played a large role in mineral supplements. These are the organic trace minerals, which are basically a mineral element bound to an organic compound. Organic trace minerals are also sometimes referred to as chelates or complexes. The organic compound in these minerals can be a polysaccharide, amino acid(s), or a volatile fatty acid. The minerals most often associated with organic trace minerals are zinc, copper, and manganese, although organic forms of cobalt and iron are also available. Selenium can be found in an organic form as well; however, it is made through a wholly different process from those listed above. Organic selenium is available as either a selenium yeast or selenomethionine. In general, all of the organic trace minerals are as bioavailable as the best of the inorganic sources and in many cases (depending on circumstances) are vastly superior to the inorganic trace minerals.