Ridin' Herd

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Minerals for beef cows 101

Many mineral elements and vitamins are essential nutrients with very specific functions. Mineral elements and vitamins are required in small amounts, but a mineral element or vitamin deficiency could potentially result in reductions in growth and reproduction in otherwise adequately nourished beef cows and calves. Provide for mineral deficiencies with an economical mineral supplementation strategy. Supplementing diets at concentrations in excess of requirements greatly increases cost.

Requirements, function of minerals

Mineral requirements are divided into two groups, macrominerals and microminerals. In a nutrient requirement table, macromineral requirements are expressed as percent (%) in a ration on a dry-matter (DM) basis. In contrast, micromineral needs are expressed in parts per million (ppm) or mg/kg (10 ppm of a mineral equal 10 mg/kg of ration dry matter).

Requirements are not listed for some minerals because research data are inadequate for them to be determined.

Macrominerals required by beef cattle include calcium (Ca), magnesium (Mg), phosphorus (P), potassium (K), sodium (Na), chlorine (Cl) and sulfur (S). Microminerals required are chromium (Cr), cobalt (Co), copper (Cu), iodine (I), iron (Fe), manganese (Mn), selenium (Se) and zinc (Zn). Remember that some minerals when fed in excess will cause toxicity. Supplementing diets at concentrations in excess of requirements not only greatly increases cost, but excess mineral not used by cattle end up in cattle waste (manure and urine), can migrate in the soil and possibly into the groundwater.

The functions of minerals can be divided into four major areas:

- ►skeletal development and maintenance, including bone and tooth formation (Ca, P, Mg);
- ►energy, including minerals that are components of enzymes or other compounds in the body essential for energy production and utilization or other activities necessary for normal growth and reproduction (P, Cu, Zn, Mn and Se);
- ►milk production (Ca); and
- ►basic body function, minerals essential for the normal function of basic systems in the body, such as the nervous system (Mg, K, Na, Cl, S, Co, I and Fe).

The common deficiency problems of which beef producers should be aware are shown in Table 1.

Sources of mineral elements

Most feeds contain mineral elements. Forage, the major component of the cow's diet, serves as the most economical nutrient source. Determining the forage's mineral content is important. Unfortunately, there are many factors influencing the amount and availability of minerals in forages.

The mineral content of forages is influenced by both the quantity and availability of the minerals in the soil. Substantial weathering of harvested forages can cause some mineral leaching. For example, potassium levels will be influenced by weathering because potassium is water-soluble. As the plant matures, mineral availability in the forage decreases.

Mineral requirements established in the *1996 Nutrient Requirements for Beef Cattle* published by the National Research Council (NRC) are based on experiments where dietary mineral content was determined from fed ingredients so the differences in availability are taken into consideration. Therefore, NRC requirements shown in requirement tables are the amount of a particular mineral needed by the animal.

Mineral element supplements

Macrominerals: The major supplemental sources of macrominerals are limestone (Ca), dicalcium phosphate and monosodium phosphate (P), white salt (Na and Cl), magnesium oxide (Mg), and potassium chloride (K).

Trace minerals: There are two forms of trace element sources that may be fed to cattle — inorganic and organic. For inorganic sources there are differences in the relative availability of the trace elements. As an example, copper in the sulfate form is highly available to the animal, and copper in the oxide form is not very available.

Organic complexes of a trace mineral have been shown to be more effectively absorbed by the animal. Organic complexes (chelated minerals) are created when trace minerals are connected to a protein or an amino acid. In stress situations, the organic complexes may be beneficial compared to inorganic sources, and a response related to immune function has been noted. Advantages of a mineral bound to a protein or amino acid sources compared to inorganic sources in healthy cows with proper protein and energy nutrition have not been shown.

Developing a supplementation program

When making decisions about mineral supplementation strategies, first know the animal's mineral needs. The mineral requirements of cattle are reported by the 1996 NRC. Producers can use these values to calculate an animal's required daily mineral intake.

The second step is to estimate the animal's mineral consumption from all other

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Table 1: Common deficiency problems of which beef producers should be aware

Signs of problem	Mineral element(s) commonly deficient
Excitability and convulsions (grass tetany)	magnesium
Tender joints and stiff legs with arched back (calves); weak brittle bones (cows)	calcium and phosphorus
Reduced fertility and poor weaning weights (when energy and protein are adequate)	phosphorus
Anemia and depigmentation of hair	copper
Calves born hairless	iodine
Calves show stiffness in front legs and lameness (white muscle disease)	selenium
Excessive salivation, listlessness and scaly lesions (parakeratosis)	zinc

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sources other than the mineral supplement. To accomplish this, an understanding of total feed or forage dry-matter intake and mineral composition of the feed or forage is important.

Finally, provide for mineral deficiencies with an economical mineral supplementation strategy.

The ability of the cow to store minerals allows her to accumulate minerals at times of the year when feedstuffs being consumed are in excess of her requirements. Then, she can subsequently draw from those reserves when deficiencies in feedstuffs or increases in nutrient demands such as milk production occur.

There may be certain periods of time during the year when cows are "deficient" of certain minerals. Oftentimes, as long as this "deficiency" period does not occur for an extended period of time, the cow can utilize stored reserves of minerals and then replenish those stored mineral sources when minerals become more available in feedstuffs again.

An example of when this might not occur is in the case of grass tetany. Cows can store magnesium in times when consumption is greater than demand. However, when grass tetany manifests itself, cows cannot mobilize stored magnesium fast enough to fend off the grass tetany symptoms.

Proper protein nutrition

The relationship of a cow's protein and energy status is a key component in proper mineral utilization. Protein aids in absorption, transport and metabolism and is critical in maintaining the absorption function of trace elements in the intestinal tissues. Carrier proteins are essential for effective transport of trace elements. Copper

and zinc transport involve very specific proteins.

Final thoughts

To predict the mineral status of cattle, the major storage site of the trace element must be sampled. Blood is not the major storage site. For example, a major storage site of copper is the liver. When the diet is deficient in copper, copper in the liver will be released into the blood. So although the liver may be gradually depleted of copper, the amount of copper in the blood will remain constant.

Only in very severe deficiencies does the blood become a good indicator of the trace element status.

The most effective method to prevent urinary calculi is to maintain the total dietary calcium-to-phosphorus ratio of between 1.5:1 and 3:1.

Grass tetany is most common in lactating cows grazing lush spring pastures. The reduction in standing forage magnesium concentration can be substantial during the winter months. Cloudy weather can increase the incidence of grass tetany for cattle grazing lush immature spring forages. Magnesium oxide is a good source.

If you manage cows in an area where grass tetany is a problem, begin feeding the mineral supplement 30 days before grass turnout and continue until growing conditions are not interrupted by cool, cloudy days that interfere with grass growth.

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Editor's Note: *"Ridin' Herd" is a monthly column written by Rick Rasby, professor of animal science at the University of Nebraska. The column focuses on beef nutrition and its effects on performance and profitability.*