

Minerals Still Key to Steer Health

In the world of beef production, where change is the only constant, rethinking mineral supplementation and formulation is the key to steer health.



Above: Making sure even preweaned beef calves do not have a mineral deficiency is key to steer profitability.

Story & photo by
ED HAAG

No one has to be told that it is a very different environment for feeding steers than it was even a couple of years ago. Uncertainties on the price and availability of corn, coupled with higher feedlot tolls and the emergence of new, lower-cost backgrounding and finishing opportunities, have forced savvy beef producers to change how they feed and, in the process, to reconsider their supplementation regimen. Minerals are a big part of that new equation.

"They are essential for normal growth, general production and immune function," says Terry Engle, ruminant nutritionist in the

Department of Animal Sciences at Colorado State University (CSU).

While we are starting to understand how minerals interact with other nutritional components in a properly formulated beef cattle ration, Engle says we still have a lot to learn.

"If we figure first how minerals are absorbed and metabolized, then we can start to understand how minerals function in growth, reproduction and immunity," he says. "We are not there yet in beef cattle."

With that said, livestock scientists have made major strides in understanding the roles minerals play in maintaining healthy animals, and there is an abundance of research-confirmed recommendations beef

producers can follow to ensure steer performance is not diminished by a mineral deficiency or mineral toxicity.

Minerals do matter

Engle notes that it is important to understand that minerals are divided into two categories, macrominerals and trace minerals. In general, macrominerals are required at

concentrations greater than 100 parts per million (ppm) of the diet and are often expressed as a percentage of the diet. Trace minerals are required at concentrations of less than 100 ppm (McDowell, 1992; NRC, 1996).

Macrominerals such as calcium (Ca), phosphorus (P), potassium (K), sulfur (Su), magnesium (Mg), sodium (Na) and chloride (Cl), and trace minerals such as copper (Cu), zinc (Zn), iodine (I), manganese (Mn), selenium (Se), cobalt (Co) and iron (Fe) are considered essential for beef cattle (NRC, 1996).

In a report on mineral supplementation presented by Engle and John Paterson, Montana State University Department of Animal and Range Sciences, the importance of minerals is clearly stated: "Minerals play a vital role in forage digestion, reproductive performance, the immune system and the development of bones, muscle and teeth. An inadequate

intake of minerals and vitamins may result in reduced forage intake, lower reproductive efficiency, poor disease immunity, slower daily gains and poorer feed conversion."

It is noted in the report that while macrominerals play a very important role in animal production, it seems that the majority of mineral questions/problems observed in the field seem

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— *Terry Engle & John Paterson*

to focus around trace minerals. This may be due, in large part, to the narrower spread between deficient and toxic levels of certain trace minerals in cattle.

Engle says it is important to remember that the interactions among trace minerals, animal production and disease resistance are extremely complex. Many factors can affect an animal's response

to trace mineral supplementation. The duration and concentration of trace mineral supplementation, physiological status of an animal, the absence or presence of dietary antagonists, environmental factors, and the influence of stress on trace mineral metabolism are just a few.

A new world out there

Even though the price of corn has dropped from its astronomical June 2008 highs of more than \$7.50 per bushel (bu.) into the range of \$4 per bu., beef producers smarting from recent drops in what they are receiving for live fed cattle are still looking for alternatives to finishing calves exclusively in feedlots on high-concentrate rations.

These options have ranged from grazing stockers on winter wheat to backgrounding steers on cornstalks supplemented with distillers' grains (DGs) to finishing cattle on the farm using homegrown corn alternatives such as barley and dry peas.

Cody Wright, Extension beef specialist at South Dakota State University, is well aware of the changes that have occurred in the

Table 1: Minerals cattle need

Macrominerals	Trace Minerals
Calcium	Copper
Phosphorus	Zinc
Magnesium	Manganese
Salt	Cobalt
Potassium	Iodine
Sulfur	Iron
	Selenium

Source: Montana State University and Colorado State University.

Table 2: Trace mineral requirements for beef cattle, mg of mineral required per kg of dry matter consumed

Mineral	Grow-finish cattle	Cows
Cobalt	0.1	0.1
Copper	10	10
Iodine	0.5	0.5
Iron	50	50
Manganese	20	30
Selenium	0.1	0.1
Zinc	30	30

Source: Montana State University and Colorado State University.

beef industry during the last couple of years. He cautions that some of these new options will require a rebalancing of mineral supplements in order to avoid specific deficiencies or toxicities.

DGs affect mineral ratios

An emerging practice that requires closer mineral monitoring is the feeding of DGs. With the meteoric rise of the ethanol industry and its corresponding output of byproducts, the now ubiquitous feed source has been incorporated into a broad range of cattle-feeding scenarios — from creep-feeding preweaned calves to finishing feedlot steers.

Wright warns that depending on the source and the volume fed, including DGs in a steer's diet usually requires some mineral rebalancing so that the ratios between corresponding minerals are at the appropriate levels.

“With distillers' grains, probably one of the biggest issues of that sort to think about is the calcium-to-phosphorous ratios,” he says. “That is because when you are feeding any kind of volume of distillers' grains, the cattle are getting a lot more phosphorous than calcium.”

The most common cattle disorder associated with an imbalance in the phosphorous-to-calcium ratio is waterbelly.

“Basically they form stones in the urinary tract that create a situation where there is an accumulation of urine that can't be expelled,” Wright says. “To avoid this problem we want to see that calcium-to-phosphorous ratio at a minimum of 1.5-to-1 and preferably 2-to-1.”

He notes that with DGs in the mix, a backgrounder who typically would supplement extra phosphorous in his winter ration might have to add calcium instead.

When feeding DGs in conjunction with higher-quality forage, Wright recommends watching the potassium levels. “These can sneak up on you, but I anticipate when feeding a poor-quality forage, like cornstalks, that wouldn't create a problem.”

One practice that is not new — it has been used regionally in the south for years — but nevertheless could require rebalancing mineral supplementation is backgrounding stocker calves on standing forages like winter wheat.

“Any time when you have a lush, rapidly growing forage, the potential for a magnesium deficiency is high,” Wright says, adding that this could result in a metabolic disorder known as grass tetany.

Also known as grass staggers, wheat-pasture poisoning and hypomagnesemia, the disorder exhibits a variety of symptoms, including grazing away from the herd, irritability, muscular twitching in the flank, wide-eyed and staring behavior, and skittishness.

As the condition progresses, it affects how the nerves fire and how the legs and skeletal structure function. Animals with an advanced case of this disorder become uncoordinated; thrash about and have muscle tremors and staggers — hence the

name ‘grass staggers.’ If not treated, most will collapse, go into convulsions and die.

Tetany usually occurs in the spring when grass is starting to green up and grow, the water content is high and the minerals and other nutrients in the plants are diluted. When that happens, magnesium is often one of the deficient minerals.

“The best way to prevent tetany is to

increase the magnesium supplementation,” Wright says.

Magnesium supplements are available in a variety of forms, including magnesium mineral blocks, salt mixtures and liquids and can be added to protein supplements, silage and even stock water.

Wright recommends consulting with a local livestock nutritionist on the type of supplement that is best-suited for the area.

Ron Lemenager, Purdue University Extension beef specialist, has a favorite on-farm mineral mix for controlling tetany that includes approximately 25% trace mineralized salt, 25% magnesium oxide, 25% dicalcium phosphate and 25% of something that increases the palatability, like ground corn or a dried molasses.

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Minerals Still Key to Steer Health *(from page 73)***Know your total sulfur**

Because sulfur is present in so many cattle feed ingredients, including DGs, Wright advocates testing anything going into an animal's mouth for background sulfur content, including water and all other feed sources.

Sulfuric acid is initially added in the dry

grind ethanol process to keep pH levels conducive to yeast cell growth and then to end the fermentation process. (Note: Higher sulfur content can also result from solutions used to clean the distillation system. As well as adding sulfur-based products during fermentation, both corn and yeast contain moderate amounts of

sulfur, which are concentrated by a factor of three in the fermentation and distillation process into the mash and solubles to a level on average of 0.33%.)

Wright warns that DGs can frequently contain as high as 0.9%-1% sulfur; however, the sulfur concentrations can vary significantly from plant to plant. As such, it is important for producers to know the sulfur concentration of the product(s) they

are using rather than relying on book values.

Sulfur is also produced by yeasts during fermentation.

"Distillers' grains are known to have high levels of sulfur," Wright says. "These might not be at toxic levels when fed with most poor-quality forages, but combined with high-sulfur water or other high-sulfur ingredients there could be a problem."

Very high levels of sulfur in a steer's diet can lead to sulfur-induced polioencephalomalacia (PEM), a potentially fatal neurological disorder caused by production of excessive amounts of hydrogen sulfide — a gas derived from rumen fermentation — which is belched and then rebreathed into the lungs and carried to the brain, resulting in the necrosis of the cerebrocortical region.

Wright adds that in addition to the direct toxicity of high levels of sulfur, the mineral can also cause a copper deficiency.

"If your sulfur levels are relatively high, you are very likely going to see some depression in copper absorption," he says. "In that case you need to supplement copper at a minimum level to meet 100% of the NRC requirement, and very likely at 1.5 to 2 times that requirement."

Copper deficiency is known to affect immune function in cattle. Besides directly affecting an animal's ability to resist infections in a feedlot environment, Wright sees additional problems arising when calves that have been supplemented high-sulfur DGs and suffer from a copper deficiency are vaccinated.

"Because of their deficiency, they may not be able to respond to the vaccine appropriately," he says. "Even though you have spent the money to give them a vaccination and a booster, they still may not have the immune capacity to fight off an infection."

If in doubt, test

Finally, Wright has the following advice for those calf producers who have access to lower-cost, local grain and forage and have decided to finish their cattle themselves rather than utilizing a feedlot.

"When you grow any type of plant in a given environment, its mineral concentration is going to be reflective of the mineral concentration of the soil it was grown in," he says. "For that reason I would encourage anyone backgrounding or finishing his steers to get what he is feeding tested. That includes a full mineral screen."

To Wright, that makes good financial sense for several reasons. A mineral screen on new feeds eliminates the guesswork when rebalancing mineral formulations so that they conform to established ratios, it reduces the risks associated with mineral toxicities or deficiencies and, in situations where feeds are naturally rich in specific minerals, beef producers can avoid spending money on supplementation that is not necessary.