

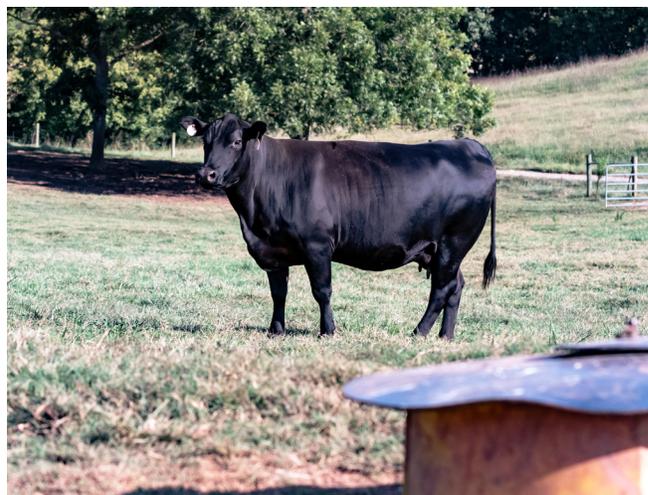
# Importance of Mineral Supplementation & Mineral Tags

► Understanding nutrition and mineral requirements and evaluating product ingredients and quality are steps toward selecting appropriate supplements for successful beef cattle operations.

Producers often have to make changes in their feed programs when production limitations, processing changes, demand, logistics, or even weather patterns cause feed ingredients to become less cost-effective. They must carefully evaluate the different aspects of nutrition, including forage resources and feed and mineral supplements, to maintain nutrition but not negatively affect the profitability of their cattle operations.

Mineral supplementation is often the first to be cut to reduce costs; however, the temptation to reduce mineral supplements must be weighed against potential long-term problems caused by under-supplementing. One way producers are known to lower mineral costs is to mix salt with a mineral product, but this dilutes the mineral and decreases its intake. Although this method is commonly used to control the over-consumption of minerals, it must still maintain the product intake per head per day to effectively supplement the daily requirements. Another method is to replace mineral products with either plain white salt or trace mineralized salt (96%+ salt), neither of which provides animals with the recommended daily allotment of supplemented minerals. Others may eliminate mineral supplementation altogether, leaving a potential gap in nutrients needed. These three methodologies may create animals that are borderline deficient in minerals, and in the event of a stressful period, these deficiencies could create widespread clinical problems.

One challenge with properly evaluating mineral supplementation is producers' lack of knowledge about minerals, including formulations, ratios, bioavailability, differences in marketing among products, and animal requirements. Measuring success is also challenging in beef operations because the most visible metrics used to measure success involve annual events such as pregnancy rate, calving rate, and weaning weight. A true evaluation requires a systematic approach as well as patience because of the time it takes to see the results of mineral supplementation and then make a proper assessment. This publication provides information for



evaluating mineral supplementation, including product tag requirements, animal requirements, mineral source bioavailability, and how to evaluate a mineral product tag.

## Product Tag Requirements

The Association of American Feed Control Officials (AAFCO) regulates the information included on feed tags and how it is presented. AAFCO publishes a manual that directs manufacturers to create a tag with specifics about the information to be included, the order of the information, and the font size on the tag. Most tags look very similar, with certain items appearing in the same order among manufacturers, making information easier for consumers to find and use for product comparisons.

The minimum information required by AAFCO for a cattle mineral tag includes the product and brand name, the purpose statement, the guaranteed analysis, the list of ingredients, the directions for use and precautionary statements, and manufacturer or distributor information.

**The product and brand name** are the first things on the tag and identify and differentiate the product in the marketplace. **The purpose statement** identifies the species and class of animal for which the supplement was created.

**The guaranteed analysis** offers the purchaser nutrient guarantees specific to the species listed in the purpose statement. Macronutrients are listed in percentages (%), and the micronutrients are listed as parts per million (ppm) (1 ppm = 1 mg/g; 1 ppm = 0.0001%). While the analysis lists the nutrient levels supplied, it does not define the bioavailability of the nutrient to the animal.

Required nutrient guarantees for beef cattle minerals are as follows:

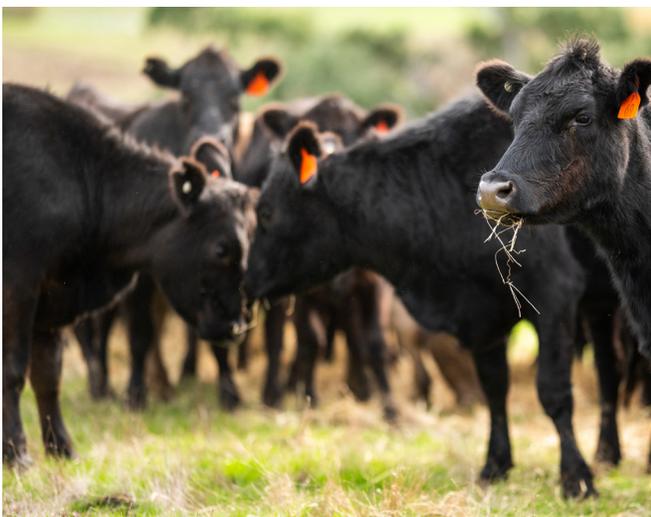
- Calcium (Ca) (min. & max)
- Phosphorus (P) (min), salt (min. & max. if added)
- Magnesium (Mg) (min)
- Potassium (K) (min.)
- Copper (Cu) (min.)
- Selenium (Se) (min.)
- Zinc (Zn) (min.)
- Vitamin A (min. if added)

The more guarantees listed on the tag, the more valuable the tag information is to the producer from a nutritional evaluation standpoint. If a mineral source is included but the mineral provided is not guaranteed, there is no way to know whether the level supplied is effective. This is also the case if multiple sources are used to supply the same mineral as is the case for chelated trace minerals and inorganic mineral compounds. Even if there is a guarantee for a specific mineral supplied by two or more sources, there is no way to know what percentage of each source is supplying the mineral and the respective bioavailability of the mineral supplied. This is where the list of ingredients can be helpful in some cases.



In most situations, the **list of ingredients** offers little added value for minerals other than identifying the ingredients or the collective term for ingredients. If you know what to look for, this list can help in assessing the true value of supplied nutrients. All ingredients included in the formulation are required to be listed but may not necessarily be guaranteed in the guaranteed analysis. This is one of the major challenges in attempting to discern the nutrient value of mineral formulas as there may be multiple sources of a specific nutrient. There is no way to know for certain which source makes up the major portion of the nutrient supplied. However, AAFCO does require that the ingredient list be arranged in descending order of predominance by weight in the product. This arrangement does allow the purchaser to make some assumptions as to the source that supplies the largest amount of the nutrient. This is still just an assumption because the weight of inclusion of some ingredients in a formula may not accurately indicate the amount of nutrient supplied by that source, but it is still the best option to analyze the predominant source of the mineral.

**Directions for use and precautionary statements** allow the purchaser to determine how the feed or supplement is designed to be used in a production setting. It may include instructions for mixing to create a complete feed or to determine daily intake to meet production requirements. Any feed additive, such as medication or nonprotein nitrogen, would be found here, with feeding directions to achieve a certain dosage of medication or level of additive. This is also where any precautionary statements, such as limitations in the use of the product for other species, are found—for example, copper sensitivity in sheep.



**Table 1. Trace Mineral Requirements and Maximum Tolerable Levels for Cattle (Beef Cattle NRC, 2016)**

Mineral	Units	Gestating Cows	Early Lactating Cows	Growing/ Finishing Cattle	Maximum Tolerable Level
Calcium	%	0.27	0.30	0.54	-
Cobalt	ppm	0.15	0.15	0.15	25
Copper	ppm	10	10	10	40
Iodine	ppm	0.50	0.50	0.50	50
Iron	ppm	50	50	50	500
Magnesium	%	0.12	0.20	0.10	.40
Manganese	ppm	40	40	20	1000
Phosphorus	%	0.17	0.20	0.26	-
Potassium	%	0.60	0.70	0.60	2
Selenium	ppm	0.10	0.10	0.10	5
Sodium	%	0.07	0.10	0.07	-
Sulfur	%	0.15	0.15	0.15	0.40
Zinc	ppm	30	30	30	500

The manufacturer or distributor information identifies the parties responsible for any claims or guarantees and provides the contact for comments or complaints. The net weight of the product is also included in this section.

### Beef Cattle Mineral Requirements

Beef cattle need specific minerals to carry out the body's physiological processes that sustain life, and these demands can create intermittent deficiencies within the body. The body stores most minerals in adequate amounts to overcome short periods of deficiency; however, some minerals are not stored in adequate amounts, or the body can lose stores of minerals rapidly in times of stress. In these situations, mineral supplements become vitally important.

Minerals needed in amounts greater than 100 ppm are macrominerals. Those required in amounts less than 100 ppm are microminerals or trace minerals. The macrominerals required by beef cattle are calcium, phosphorus, magnesium, potassium, sodium and chloride (salt), and sulfur. Animal requirements for macrominerals, as with other macronutrients such as protein and energy, fluctuate based on the animal's stage of production and age. Microminerals required include copper, zinc, manganese, cobalt, iodine,

selenium, chromium, iron, molybdenum, and nickel. Micromineral requirements do not fluctuate as much based on age or stage of production, except for possibly in stressed cattle. Table 1 shows mineral requirements for mature cows and growing calves and maximum tolerable levels of minerals for beef cattle.

The values in table 1 can be used to calculate the actual ppm mineral supplied in the diet. To make this calculation, the mineral requirements of the animal, the recommended intake of the mineral supplement, and the estimated intake of the complete diet must be known and all units be the same. The product label often shows the mineral feeding rate as ounces of consumption per head per day, whereas diet intake is in pounds fed per day. For a mineral formulated for 4 ounces per head daily intake, divide by 16 to convert from ounces to pounds:  $4/16 = 0.25$ -pound feeding rate. Dry, mature cows will eat, on a dry-matter basis, around 2 percent of their body weight in high forage-based diets. If a cow weighs 1,200 pounds, it should be eating about 24 pounds of dry matter per head per day. Using this information, the actual mineral level supplied through the daily portion of the mineral can be calculated. The following example shows the calculation of copper supplied to the cow in her diet from the mineral being evaluated.

In the example, the mineral product evaluated should supply 12.5 ppm of copper to the 1,200-pound cow. This exceeds her requirement of 10 ppm of copper per head per day as shown in table 1. This example can be used for any of the trace minerals to calculate supplied minerals to the cow from the mineral being evaluated. A logical question might be to ask why the supplement supplied more than the cow requires. Differences between forage species, management, and quality aspects that vary throughout the growing season make it difficult to predict the level of minerals supplied by the forages on a daily basis. Supplementation at levels close to the requirements of beef cattle provides the best opportunity to meet needs regardless of the forage used.

## Bioavailability of Mineral Sources

Mineral supplements can be formulated using several different compounds to supply the same nutrient. For example, several sources of copper compounds can be used to formulate a supplement that has 1,200 ppm copper. When that supplement is fed, each potential copper source could react differently in the gastrointestinal tract of the animal, creating varying levels of copper available to the animal. For example, if copper oxide is the copper source in the mineral example above, guaranteeing 1,200 ppm copper, it would effectively deliver 0 ppm to the animal due to the animal's inability to break it down to a usable form. In simple terms, the animal's ability to break down compounds into absorbable and usable forms is *bioavailability*. The bioavailability of the mineral source generally determines the price paid and the value received of a mineral supplement. Keep in mind that while oxides are generally considered to be lower in bioavailability, not all oxide molecules are 0 percent available as in the example above. Oxides tend to be cheaper than other sources and can be an economical way to supplement some nutrients.

### Example:

Copper (Cu) guaranteed on tag: 1,200 ppm

Mineral feeding rate: 4 ounces, or 0.25 lb

Total diet intake for 1,200 lb cow:  $1,200 \times 2\% = 24$  lb

[guarantee (ppm) x mineral intake (lb)] = (1,200 ppm x 0.25 lb)

Total diet intake (lb) 24 lb

= 12.5 ppm of Cu/head/day

## Additional Ingredients

The ingredient list often shows other ingredients that add value to a mineral supplement without adding to the actual mineral supplied directly. Preservatives, for example, increase the mineral shelf life. Some commonly used preservatives are sulfites, nitrites, and natural acids such as citric, formic, fumaric, and propionic acids, which reduce the pH of the mixture, thus reducing the growth of bacteria, fungi, and yeasts. Antioxidants, including tocopherols (vitamin E derivatives) and ascorbic acid (vitamin C), have physiological effects in the animals but may also be listed as preservatives. Synthetic or artificial preservatives such as Ethylenediaminetetraacetic acid (EDTA), butylated hydroxyanisole (BHA), butylated hydroxytoluene (BHT), tert-butyl hydroquinone (TBHQ), ethoxyquin, and propyl gallate may also be in the list of ingredients. These compounds are generally used to prevent the oxidation (spoilage) of fats and oils used in the supplement. There are mixed recommendations on the use of and overall benefit of these compounds. Other additives that may be used are vegetable oil, mineral oil, and flavoring. These are used for a range of reasons, some of which are to increase or decrease taste, or palatability, to control consumption, or to decrease the physical eroding of the supplement nutrients (leaching) by wind and rain (weatherization).

## Mineral Tags

When comparing mineral tags, keep the following in mind to ensure an equitable comparison.

- Because the tag does not indicate the particle size of the mineral or weatherization techniques used, these are important questions to ask the sales representative. Small particle size can create problems caused by wind erosion. Lumpy or large particles can increase intake. Excessive hardening caused by moisture can decrease intake.
- The formulated daily intake is often overlooked. Products are occasionally labeled as having high selenium or high copper. On closer inspection, the tag claiming the higher inclusion rate might have a lower intake, and the end result is a nutrient guarantee that seems higher at first glance. This is often the case with selenium. Selenium inclusion in mineral products is regulated by the Food and Drug Administration for cattle not to exceed 3 milligrams of selenium per head per day. Selenium is listed in the guaranteed analysis portion of the tag as ppm of the mineral. If the feeding rate of the mineral is lower, the tag will show a higher ppm inclusion, giving the appearance of a higher selenium level when, in fact, it delivers the same amount per head per day as minerals that have a higher feeding rate and lower inclusion ppm.
- When evaluating the economical differences in mineral products, remember to account for recommended feeding rates. For example, a mineral product with a 2-ounce feeding rate can be twice the price of a mineral product with a 4-ounce feeding rate and deliver the same value or cost per head day assuming delivered nutrients are equal between the two minerals.



## Summary

It is important to routinely evaluate different aspects of a beef cattle nutrition program as nutrition is the cornerstone that carries the weight of other facets such as health and productivity. Be careful not to reduce or eliminate parts of the program that may create challenges in the future. Evaluate mineral supplement product tags to understand the composition of the product and the quality provided. Remember that manufacturer's listing ingredients on the tag but not guaranteeing the mineral supplied offers little information about the supplement's effectiveness at supplying that mineral. Conversely, guaranteeing a nutrient level with multiple sources of the nutrient on the ingredient list can decrease the clarity of the information and require some assumptions to estimate the value of effectiveness in supplying that nutrient. Understanding animal requirements and evaluating product ingredients and quality are steps toward selecting appropriate minerals for beef cattle.



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