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Organic minerals allow for greater absorption

Trace minerals affect many aspects of an animal's health and performance. By investing in organic trace minerals, nutritionists and producers can help assure delivery of the essential nutrients from trace minerals.

By **JACK GARRETT***

TRACE minerals are essential nutrients for livestock. These inorganic elements play critical roles in the proper functioning of enzymes, hormones and cells. Deficiencies can result in performance issues such as compromised rates of gain, milk production and reproduction.

Trace mineral intake and absorption help livestock achieve optimal performance and their genetic potential, making trace mineral absorption integral to a successful herd management program. Toward that goal, nutritionists increasingly feed organic trace minerals to ensure their availability and absorption.

The essential role of organic trace minerals has been established for each animal species. For example, among the six feed additives that Mike Hutjens, a professor emeritus at the University of Illinois, recommends for everday use in every dairy ration are organic trace minerals. The other recommended additives are rumen buffers, yeast culture/yeast products, monensin, silage inoculants and biotin. Research has demonstrated the role of each additive in animal health and nutrition.

Preferences

Heightened interest in organic trace minerals has created greater acceptance and use of them as a replacement for inorganic trace minerals. Their greater bioavailability provides added value for livestock nutritionists and producers. Because they are complexed within organic matrices, they can be more than twice as bioavailable as inorganic trace minerals. In nature, the vast majority of trace minerals in feeds are bound and unavailable.

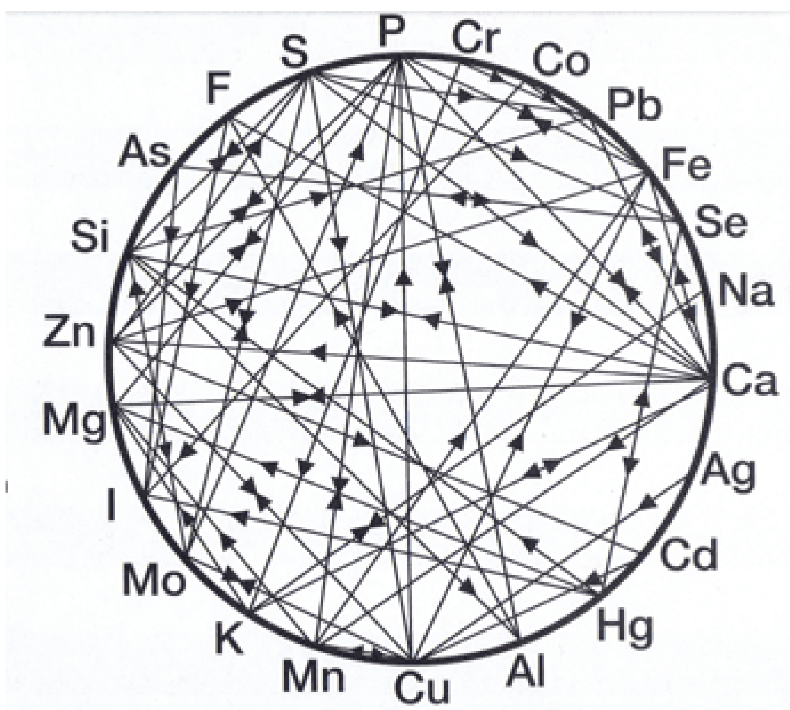
Commercially produced organic trace minerals are manufactured in such a way as to provide natural protection and are more likely to be absorbed and used. They do not interact with antagonists or vitamins. Inorganic trace minerals, however, can readily interact. These interactions leave inorganic trace minerals bound and unavailable to the animal (Figure 1).

In order for trace minerals to help keep an animal in good health and performing up to its genetic potential, they must be available for absorption in the small intestine; otherwise, the potential benefits they offer will be lost. For the most part, unused, unabsorbed minerals are excreted. The true value of the organic structure is its ability to protect these essential nutrients from antagonists in the diets and the water the animal consumes.

Antagonists include sulfates, oxides, fiber and many of the inorganic trace minerals themselves. They include the high sulfur content of dried distillers grains, iron contamination from dirt in corn silage and other fermented feeds and the minerals in hard water, notably sulfur and calcium.

Inorganic trace minerals often

1. Trace mineral interactions



Trace minerals readily interact with each other. Feeding an organic trace mineral, such as one with polysaccharide protection, prevents these interactions and prevents trace minerals from becoming bound and unavailable for absorption and use. Organic trace minerals remain available to assist animals in achieving and maintaining optimal performance levels.

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chemically react among themselves. High levels of one inorganic trace mineral can decrease the availability and use of another. Known mineral interactions include copper-molybdenum, sulfur-selenium, calcium-phosphorus, calcium-zinc, calcium-manganese, iron-manganese and potassium-magnesium.

Trace mineral absorption rates in older animals typically are lower than in younger animals.

Absorption modeling

Most recently, growing broiler chicks were used to model for trace mineral absorption in a research study (Sims and Garrett, 2010). The study's findings also relate to ruminants and other monogastrics.

The study fed diets of corn and soybean meal formulated to provide optimum nutrients to all birds throughout their growout period. Diets were supplemented with either a sulfate source of zinc, copper and manganese or with an organic zinc, copper and manganese. The study then introduced cottonseed hulls as an antagonist into one set of diets. Cottonseed hulls have been shown to reduce the bioavailability of zinc in poultry diets.

Research shows that some antagonists will affect certain minerals while showing no influence on others.

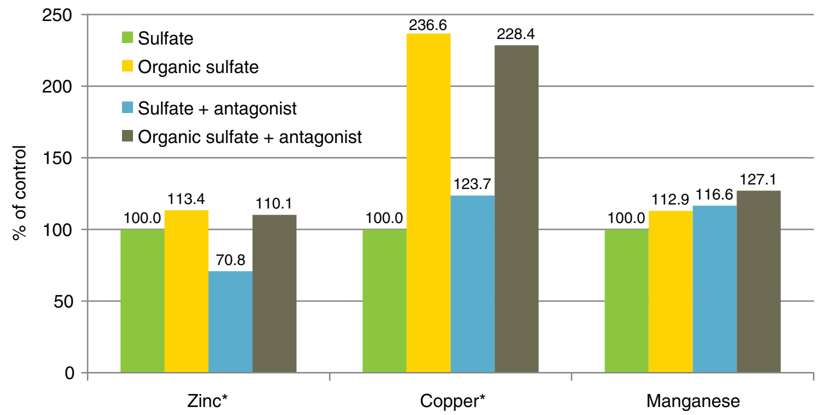
Researchers monitored overall performance during the 42-day growout phase and took interim measurements of digestibility and net absorption (final total bodies' trace mineral content).

Final bird weight favored the birds receiving the diets supplemented with organic trace minerals, although the increase in final weight was not significant. Feed efficiency, however, was significantly ($P < 0.01$) improved with the organic trace minerals: The average improvement was 2.55%. The cottonseed hulls had no influence on bird weight or feed efficiency.

An evaluation of interim digestibility showed a significant influence of the antagonistic cottonseed hulls on zinc. Zinc digestibility was reduced by 30% ($P < 0.01$) for zinc in the sulfate form, but the organic zinc avoided reduction (Figure 2). Also, digestibility of the organic zinc was more than 10% greater than the sulfate source.

The researchers anticipated that cottonseed hulls would have some influence on copper and manganese digestibility, but this wasn't the case. There did appear to be some other antagonist in the corn/soybean meal diet that reduced the overall digestibility of copper in this study. The organic copper was more than two times more digestible ($P < 0.01$) than copper from copper sulfate in this study. Manganese digestibility was not influenced by diet, antagonist or source in this study.

2. Effect of source and antagonist on mineral bioavailability in broilers



*Source effect: $P < 0.01$.

Source: **Sims and Garrett (2010).**

Net mineral retention favored the organic trace minerals. Total body zinc was significantly ($P < 0.06$) greater in birds supplemented with organic zinc; the bird retained 37% more zinc compared to sulfate-supplemented birds. Similarly, birds fed organic trace minerals showed 11% greater copper retention and 2.5% greater manganese retention.

The base diet fed in this study was typical of the industry and showed elements of naturally occurring, unknown antagonists. Some antagonists will affect certain minerals while having no effect on others. This study shows the effectiveness of organic trace minerals to protect against known and unknown antagonists that occur in animal diets.

Other studies confirm the effectiveness of organic trace minerals in protecting against antagonists. Feeding an organic trace mineral with a polysaccharide coating helps ensure that animals meet their nutritional requirements for trace minerals.

Several different brands of organic trace minerals are commercially available. While all are organic, inherent differences exist in their chemical structures due to how they are produced. Understanding the similarities and differences may be helpful when making ration recommendations.

The percentage of organic versus inorganic trace minerals fed in the ration has changed over time. Trace mineral guidelines are provided by the National Research Council, but guidelines on the use of organic versus inorganic trace minerals are not.

In practice, most nutritionists feed organic trace minerals to meet a minimum of 30-50% of trace mineral requirements. Situations also exist where positive responses have been seen when up to 100% of total mineral requirements are fed as organic trace minerals.

Conclusion

Trace minerals are essential nutrients for livestock. Organic trace minerals make more of the trace mineral bioavailable to the animal than inorganic trace minerals. They typically do not interact with antagonists.

Inorganic trace minerals do readily interact with any of a variety of potential antagonists. This interaction binds up the inorganics, leaving them unavailable for absorption in the small intestine.

By investing in organic trace minerals, nutritionists and producers can help assure delivery of the essential nutrients from trace minerals. Trace minerals affect many aspects of an animal's health and performance.

In beef and dairy cattle, this includes overall animal health, hoof health, immune function and reproductive performance such as first-service conception rates and days open.

In dairy cattle, optimizing trace mineral nutrition supports herd performance, as often seen in milk production.

In monogastrics, similar benefits are realized.

Reference

Sims, M.D., and J.E. Garrett. 2010. Net absorption, carcass concentration and performance responses of broiler chickens to organic (SQM) and inorganic zinc, copper and manganese. International Poultry Scientific Forum. Abstract M5. ■