

Micronutrients

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TBCC Notes

Technical Information for Users of *Micronutrients TBCC*[®]

Advantages in Beef and Dairy Cattle Diets

Micronutrients TBCC[®] (TBCC) is an improved source of nutritional copper for animal feed that offers particular advantages in beef and dairy cattle. These advantages include improved physical handling properties, uniformity of distribution in a mixture and reduced losses of vitamins. However, the most important advantage is that TBCC facilitates more consistent and reliable maintenance of optimal copper status in the cattle, and therefore improves overall animal performance.

Both copper deficiency (hypocuprosis) and toxicity can be serious problems in ruminants. As a result, nutritionists face a constant challenge to maintain copper status. Different dietary sources affect copper absorption and therefore change the level of copper supplementation needed to maintain healthy performance. Copper absorption will be different for cattle consuming cereals, grasses, forage crops and silage (Suttle, 1996). More importantly, both sulfur and molybdenum are antagonistic to copper absorption, requiring a sophisticated approach to supplementation based on analysis of dietary source(s) and adjustment when shifts occur (Suttle, 1996).

One practical illustration of the challenge was shown in a copper supplementation project conducted by six cow/calf producers in southeastern Ohio from July, 1994 through September, 1996 (Vollborn, 1997). Mineral premix copper levels were raised to overcome forage which contained low copper as well as high molybdenum and sulfur. Positive responses during the two-year trial included improved overall performance, improved calf weaning weight and less problems with weak cows at calving.

Predictable Bioavailability

Repeated testing in monogastric species has shown TBCC to be inherently highly bioavailable - 104 to 125% compared to copper sulfate (Miles, et al, 1998), (Cromwell, et al, 1998), (Hooge, et al, 2000). The challenge in ruminants is to avoid antagonistic reactions in the rumen that interfere with subsequent absorption. Highly water soluble sources, such as copper sulfate and many organic complexes, expose the copper to competitive reactions in the rumen. Copper sulfate is particularly ineffective since it contributes enough sulfur to chemically bind the copper (Berger, 1999). Since TBCC is insoluble in water, it successfully bypasses the neutral pH environment in the rumen and is therefore available for the extractive reactions in the abomasum and subsequent downstream absorption.

When using a water soluble copper source, the nutritionist must frequently overdose with the supplementation program to allow for the impact of the primary dietary source on absorption. If the diet shifts toward reduced antagonism, there is a distinct possibility of copper toxicity impacting performance. TBCC allows far less manipulation to hit the window between toxicity and deficiency.

A study conducted by Dr. Jerry W. Spears at the Department of Animal Science of North Carolina State University consisted of two parts. Experiment I determined TBCC's bioavailability relative to copper sulfate at 121% based on plasma copper or 118% based on plasma ceruloplasmin in steers fed diets high in molybdenum and sulfur. Experiment II showed TBCC's bioavailability relative to copper sulfate was 107 or 116% on the same basis when supplemented to steers deficient in copper. Dr. Spears concluded that because of its "low solubility in water, (basic) copper chloride may interact with molybdenum to a lesser extent in the rumen and this in turn could explain the higher copper bioavailability."

Thus, in practice TBCC provides cattle nutritionists with a much wider window of safety when setting supplementation levels. This raises the statistical probability of achieving optimal animal performance and therefore economic returns.

Physical Advantages

The physical characteristics of TBCC provide a number of benefits. TBCC is a highly concentrated, neutral mineral salt and therefore is required in smaller quantities, handles easily and safely and distributes more uniformly throughout the feed.

<u>TBCC Characteristic</u>	<u>Benefit</u>
Non-hygroscopic	No clumping or hardening
Small particle size	Uniform distribution in feed
Uniform particle size	Improved flowability
Neutral mineral salt	No burning or stinging
High Cu concentration	Less bag handling and disposal

TBCC's neutrality, stability and lower reactivity make it ideal for creating stable, reliable mineral premixes.

Vitamin Stability

Several studies at the University of Florida showed that TBCC has less prooxidant activity than copper sulfate. One study found TBCC to have significantly less oxidation/reduction potential than copper sulfate. Another study evaluated samples of complete feed for the rate and intensity of oxidation reactions and showed that TBCC is clearly a less active compound than copper sulfate.

A 1997 study at the PARC Institute showed that losses during pelleting of Vitamins A, E and Riboflavin (measured in feed) are all reduced (6, 10 and 5% less loss respectively) when a high level of TBCC was added to the diet. Similarly, 30% more Vitamin E was measured in the livers of chickens on the high-TBCC diet than on the low-copper control diet. Another study completed in 1999 at PARC indicates that high copper from either copper sulfate or TBCC improved the level of Vitamin E reaching the liver. This seems to imply that copper's antimicrobial activity may be an important factor in reducing vitamin losses during or after pelleting. However, TBCC gave a higher vitamin sparing effect at ALL levels of copper in the diets as measured in feed, blood and liver samples. This difference seems likely to be related to TBCC's fundamentally lower prooxidant activity.

TBCC's lower reactivity and resulting sparing effect on numerous important vitamins contributes to better health. More vitamins improve the elimination of free radicals, aid the functioning of the animal's own immune system and facilitates overall good health.

References

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