



Copper Chloride Versus Copper Sulfate In Vigortone 3V Free-Choice Mineral

Why does Vigortone use copper chloride (CuCl) rather than copper sulfate (CuS) as the copper source in **Vigortone 3V range minerals**? The answer relates to copper bioavailability in the presence of antagonists in forage and water. The major antagonists that prevent or severely impair copper utilization by the beef cow are iron, sulfur, and molybdenum.

Copper is a critical trace element in the beef cow diet. Copper deficiencies often arise, resulting in poor reproduction, low weaning weights, compromised herd health, and soundness issues. We often assume copper problems occur in the beef herd due to a low concentration in the forage. It is becoming commonly accepted the presence of antagonists is a major contributor to copper deficiency in the beef herd.

According to a USDA survey of forages across 18 states (Figure 1), 30% contain levels of iron high enough to interfere with copper absorption by the brood cow. Sixty percent contain antagonistic levels of molybdenum. In Vigortone's own forage database of several thousand samples, a very high percentage contained excessive, antagonistic concentrations of sulfur as well.

Why Copper Chloride Versus Copper Sulfate?

Dr. Jerry Spears, a nationally-recognized authority on trace mineral nutrition at North Carolina State University stated the following about copper chloride versus copper sulfate as a source of supplemental copper in beef cow diets:

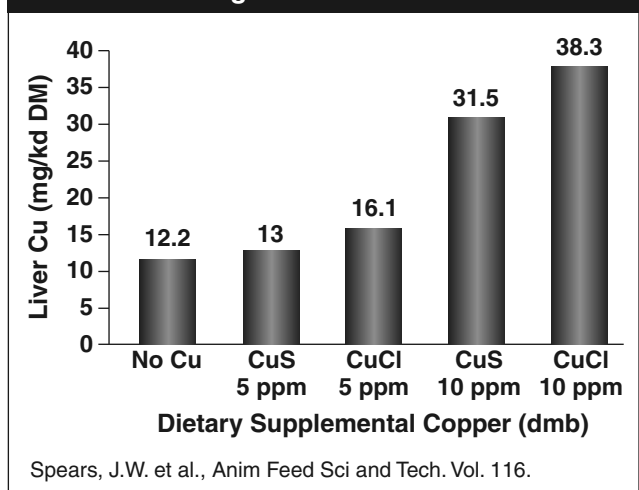
"In the presence of antagonists such as molybdenum and sulfur, copper from basic copper chloride appears to be more bioavailable than copper sulfate."

Dr. Spears' quote is based on his years of research in this field. An example of that research involves a 100 day trial conducted with 560 lb growing calves fed forage diets formulated to contain antagonistic levels of sulfur and molybdenum. The calves were supplemented with either copper sulfate or copper chloride at 0, 5, or 10 parts per million (ppm) in the diet dry matter. Liver and plasma levels in the calves were evaluated at the end of the trial. Results were typical of other trials conducted by Dr. Spears.

Throughout the trial, the high concentrations of sulfur and molybdenum in the diets caused liver and plasma copper to decrease. Both the sulfate and chloride forms were effective relative to control diets in preventing severe deficiency levels to develop.

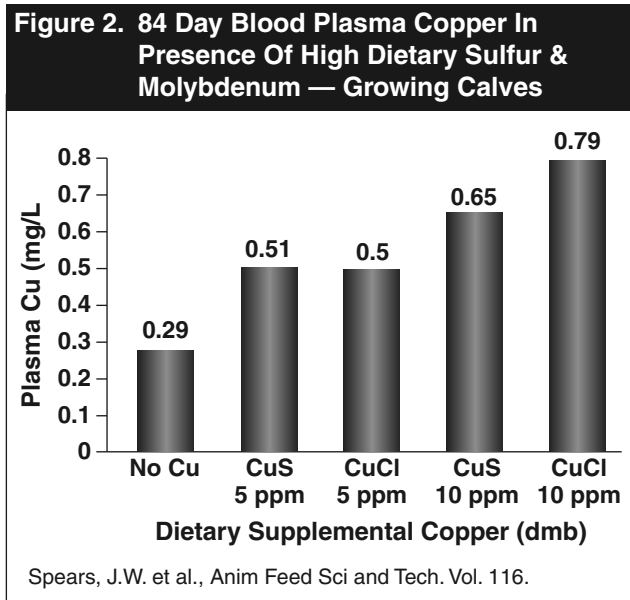
Calves receiving 10 ppm supplemental copper had higher ending liver concentrations at the end of the trial, with copper chloride being superior to copper sulfate (38.3 versus 31.5 mg/kg).

Figure 1. 100 Day Liver Copper In Presence Of High Dietary Sulfur & Molybdenum — Growing Calves



(continued)

Blood plasma copper was equal between the sulfate and chloride forms at 5 ppm of supplemental copper. However, at 10 ppm copper supplementation, the chloride form was superior to the sulfate form (0.79 versus 0.65 mg/L).



As a matter of note, Vigortone 3V minerals provide 18 to 20 ppm of supplemental copper in the diet dry matter for beef cows.

In conclusion, in the absence of dietary antagonists, copper chloride is equal to slightly superior to copper sulfate as a source of supplemental copper for the beef cow. However, when excessive levels of antagonists such iron, sulfur, and molybdenum occur, copper chloride is far superior in copper availability to copper sulfate.

Copper chloride is also used in Vigortone 3V free-choice formulations to reduce the overall sulfur content in the formula. This improves stability of the formula and enhances nutrient availability both from the mineral and the producer's own feedstuffs.