

# Micronutrients

A division of Heritage  
Technologies, LLC  
ISO 9002 Registered

1550 Research Way  
Indianapolis, IN 46231  
Phone: 317.486.5880  
Fax: 317.486.5888

## TBCC Notes

### Technical Information for Users of *Micronutrients TBCC*<sup>®</sup>

#### **Copper Toxicity in Sheep** (Also relevant to goat and llama feeds)

It is well known that sheep are extremely sensitive to copper. They will suffer from hypocuposis (copper deficiency disease) if not receiving adequate amounts in the diet or if antagonists interfere with copper metabolism even when nominally appropriate dietary levels are present. Excess levels of zinc, iron, sulfur and molybdenum can each interfere and cause deficiencies<sup>1</sup>.

On the other hand, sheep are also unusually intolerant of higher levels of copper and can be killed by levels routinely added as beneficial to the diets of swine and poultry.

Nutritionists must strike a difficult balance because many feedstuffs contain enough sulfur and molybdenum to antagonize copper metabolism. In such cases, it may be necessary to provide copper as much as several fold higher than the nominal nutritional level to avoid deficiency disease<sup>2</sup>. The difficulty occurs because such copper levels can be dangerously high if the level of antagonists is misjudged or changes over time.

#### **TBCC in Sheep Feed**

*Micronutrients TBCC*<sup>®</sup> (TBCC) offers an advantage in ruminants because it is less reactive with sulfur and molybdenum in the rumen<sup>3</sup> and therefore provides a more stable, predictable level to the animal as these antagonists vary in the diet. This is particularly important when the animals are grazing since the dose levels of the antagonists are more variable. Thus, TBCC helps avoid the dual problems of copper toxicity and deficiency.

#### **Issues in Manufacturing Sheep Feed**

There are several issues which must be considered in the feed mill to avoid copper toxicity.

##### **1. Batch Sequencing**

To the extent possible, a batch of sheep feed should never be made following a concentrated feed mix. If such sequence is unavoidable, the copper salt should not be the last ingredient added to the concentrated feed and all equipment should be thoroughly “flushed” with an inert ingredient prior to starting the sheep feed. These same precautions should actually be used when making a complete feed for any species.

##### **2. Copper Assay of TBCC**

TBCC has a copper concentration 2.3 times higher than copper sulfate (58% vs. 25%). This is an important advantage since it reduces freight and labor costs to handle the product and it provides more “space” in a mix for other ingredients. Any inadvertent carryover in feed manufacturing could have a correspondingly higher impact, just as it would with copper oxide. Thus, good mill practice is particularly important.

### **3. Particle Size**

The particle size of an ingredient can impact carryover in feed mill equipment. This effect is only significant for particles smaller than 20 micron. Below this size, many materials behave as dusty powders and can carry an electrostatic charge which causes them to cling to equipment surfaces.

TBCC is a fine grained material which is advantageous for blending and handling, but virtually none of the mass of the material is below the 20 micron threshold. Conversely, many other feed grade sources of copper contain an appreciable amount of fines or dust below this size which can be electrostatically charged. In fact, users of TBCC report that avoidance of copper sulfate dust is one of the benefits of using the product.

Therefore, caution and good mill practice are essential with all sources of copper.

### **Summary**

TBCC is a preferred source of copper for sheep since it helps with the nutritional challenge of staying in the target window between copper deficiency and toxicity.

Multi-purpose mills should take great care to avoid carryover of copper (and other minerals) when making sheep feed - regardless of the copper source being used. Four suggestions are:

- Flush or clean all equipment thoroughly before making a batch of sheep feed.
- Adjust batch sequences to avoid making sheep feed immediately after a high-copper feed.
- Avoid running copper or a mineral premix through conveying equipment as the last ingredient in a batch, especially when the next batch will be sheep feed.
- Because of the criticality of copper in sheep, each batch of sheep feed should be assayed before release.

### **References Cited**

1. Clarence B. Ammerman and Pamela R. Henry, presented at the Copper and Health in Ruminants Symposium organized by the Pacific Northwest Chapter of the American Registry of Professional Animal Scientists, and held in Seattle, WA on May 25,1996.
2. “Copper Deficiency Overview with Particular Reference to Copper-Molybdenum-Sulfur (Cu x Mo x S) Interaction in Ruminants”, N. F. Suttle, presented at the Copper and Health in Ruminants Symposium organized by the Pacific Northwest Chapter of the American Registry of Professional Animal Scientists, and held in Seattle, WA on May 25,1996.
3. “Bioavailability of Copper from Copper Chloride in Cattle”, an unpublished report on a cattle feeding study done by Jerry W. Spears at North Carolina State University.