

# Micronutrients

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## TBCC Notes

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

### Copper Improves Poultry Production At Various Levels of Stress

These three experiments represent a series with progressively increasing challenge to the immune systems of the broilers. Since they were done at different times and with different strains of birds, these confounding factors prevent direct performance comparisons between the tests. Nevertheless, the patterns in copper source x level interaction and their impact on bird performance within the studies are likely to be affected primarily by the degree to which immune system challenges were present.

#### Low Stress – Trial 99-MIC-04a-BB

In this trial, the Ross x Cobb birds were on wire. Three levels of copper (125, 188 and 250 ppm) were added from each source above the basal nutritional level provided to the control birds by the mineral premix.

On TBCC, all elevated levels of copper gave significantly better results ( $P < 0.05$ ) than the controls and than copper sulfate at corresponding levels. 188 ppm was better than the lower and higher levels, but differences between the three were small.

On copper sulfate, those receiving 125 ppm copper performed better than the control birds, but the two higher levels progressively deteriorated performance until it was not different than the controls.

#### Medium Stress – Trial 97-MIC-07-B

These Ross x HiY birds were grown on previously used litter, presumably giving a higher level of ingestion of pathogenic microorganisms, including *Eimeria* oocysts. Three levels of copper (125, 188 and 250 ppm) were added from each source.

For TBCC, performance at 188 ppm was again better than the low and high levels, and was also better than copper sulfate at any level.

On copper sulfate, performance at 125 ppm was not different than controls. There was a progressive improvement with higher copper levels, indicating that, under this disease challenge, 250 ppm is needed to get best performance.

#### High Stress – Trial 99-MIC-03-BB

Cobb x Cobb birds were raised on previously used litter and inoculated on Day 3 with both coccidia and *Candida albicans* to induce crop mycosis. Two levels of copper (125 and 250 ppm) were added from each source above the basal nutritional level provided to the control birds by the mineral premix. Both levels of copper from both sources were better than controls. 250 ppm gave better performance than 125 ppm for both sources.

## **Discussion of Results**

This work shows that the best economic performance level for copper depends on the extent to which birds are exposed to immune system challenge. This may help explain the range of practical experience within the industry on a desirable level of copper utilization. In this series of trials, Trial 97-MIC-07-B is the closest approximation of field conditions in the industry (healthy chicks on built-up litter). Under these conditions, **the optimum level of copper appears to be 188 ppm from TBCC or 250 ppm from copper sulfate.**

Use of 125 ppm copper from copper sulfate gives little or no improvement over negative controls on built-up litter or with a high level of immune system challenge. Conversely, use of 250 ppm from that source is no better than negative controls with a low challenge. The use of 188 ppm copper from that source is a compromise that gives up considerable performance under both low and high stress levels.

TBCC gives consistently good performance at 188 ppm copper at low to medium stress levels. Data are not available for that copper concentration with high stress, but interpolation of the trends indicates it would be at least as good at 188 ppm as copper sulfate at 250 ppm copper.

In general commercial practice, copper is not used as a growth promotant for birds grown on wire (such as replacement pullets), since copper is often regarded as a means to counteract the potentially negative effects of litter. This work shows that there would be economic benefit to using 125 ppm of copper from TBCC in such situations.

## **Presumed Mode of Action**

TBCC is virtually insoluble in water. When used at high dietary levels, it does not have sufficient time to completely dissolve in the acidic environment of the stomach. In the intestine, undissolved TBCC will continue to slowly solubilize due to the action of natural organic complexing agents in digestive fluids. Thus it displays a form of controlled release, giving effectiveness over a long path-length of the intestine.

Copper sulfate is highly water soluble. Any copper not quickly absorbed across intestinal membranes will be precipitated in the neutral environment of the intestine as hydroxide and/or sulfide salts. Both of these chemical forms of copper are considerably less reactive than TBCC, giving less downstream effectiveness against pathogenic organisms.

In healthy birds, the high soluble copper level provided by copper sulfate actually reduces rate of gain and feed conversion efficiency at levels above 125 ppm. The slow release provided by TBCC minimizes this negative effect in unstressed birds.

Under moderate immune stress typical of commercial conditions, higher copper is helpful, but the high solubility of copper sulfate means that 33% more copper must be fed to achieve the same effect as TBCC.