

Bioavailability of Copper from Tribasic Copper Chloride (TBCC™) Compared to Copper Sulfate Pentahydrate in Broiler Chicken Diets

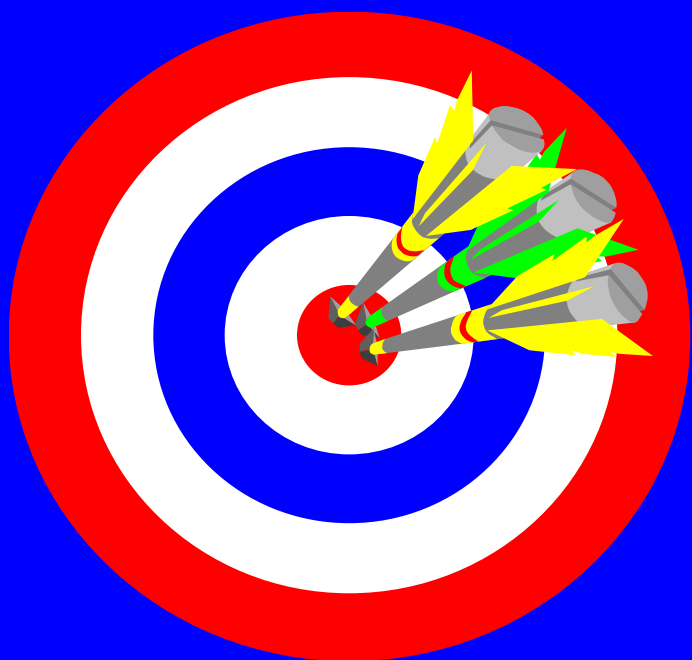
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2. Micronutrients

Division of Heritage Technologies, LLC

3. PARC Institute, Inc.



Brief Information About TBCC™

- TBCC™ is $\text{Cu}_2(\text{OH})_3\text{Cl}$ with 58% Cu versus 25.2% in $\text{CuSO}_4 \cdot 5\text{H}_2\text{O}$.
- Manufactured form of natural mineral called Atacamite
- Soluble in acidic solution; insoluble in water. Copper sulfate is very water soluble.
- Highly bioavailable copper relative to copper sulfate.

TBCC™ Information Continued

- Less environmental copper in manure.
- Less product inventory in warehouse.
- Free-flowing small granular form has low dust and disperses uniformly.
- Better vitamin stability in feeds during steam pelleting and storage.
- Low chloride content (16%).

Review of Previous Research

- Miles et al. (1998; Poultry Sci. 77:416-425)
 - Experiment 1 – TBCC vs Cu Sulfate
 - Ross x Ross in battery brooders
 - 150, 300, 450 mg added Cu/kg feed
 - TBCC Cu bioavailability 106%
 - Experiment 2 – TBCC vs Cu Sulfate
 - New litter; 200, 400, 600 mg Cu/kg
 - TBCC Cu bioavailability 112%

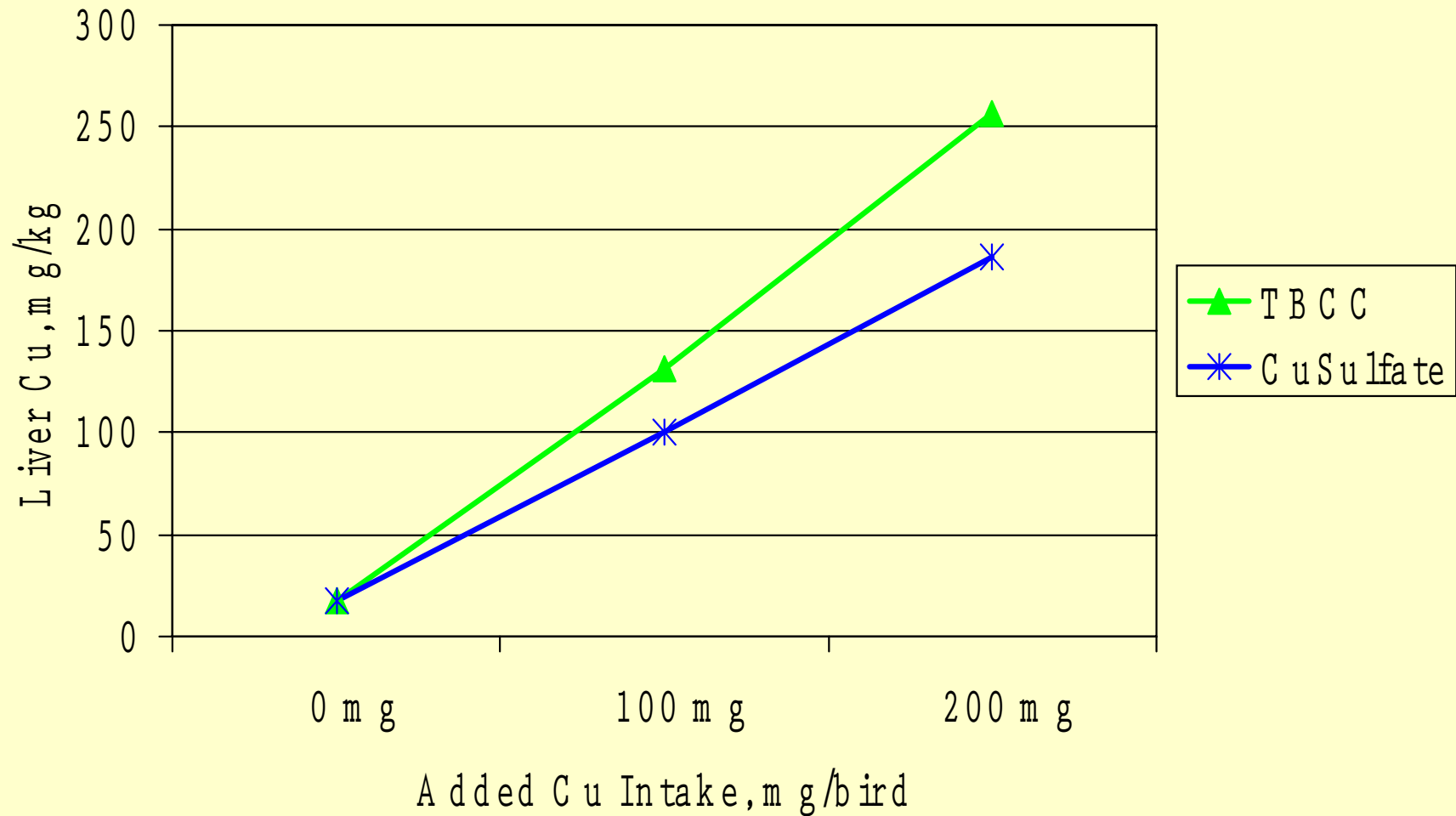
Experiment 1 – Cobb x Cobb Chicks

- Equal mixed sexes
- Used litter pens
- Candida albicans 3d
- Coccidia (3 spp) 7d
- TBCC vs CuSulfate
- 0, 125, or 250 Cu mg/kg each source
- 5 Pens of 10 chicks each per treatment
- Liver Cu regressed on added Cu intake
- Common intercept m-linear regression

21-Day Cu Intakes and Liver Cu (Litter)

	Added Cu Intake, mg	Liver Cu, mg/kg
-Control	0 c	19.6 d
+Control	0 c	18.0 d
TBCC 125	92.0 b	103.5 c
TBCC 250	190.9 a	254.6 a
Cu Sulfate 125	90.0 b	85.3 c
Cu Sulfate 250	188.7 a	185.6 b

Common Intercept ML Regression: 21-d Liver Cu by Added Cu Intake



Equation, Slope Ratio, Bioavailability

- CI, ML Regression Equation:

$$\text{Liver Cu}_{10}, \text{ mg/kg} = 1.33453 + 0.00592 \text{ TBCC} \\ \text{Cu (mg)} + 0.00522 \text{ CuSulfate Cu (mg)}$$

$$r^2 = 0.864 \quad \text{Regression } P < 0.001$$

- Slope Ratio = $(0.00592 / 0.00522) \times 100 =$
Relative Bioavailability = 113.4%

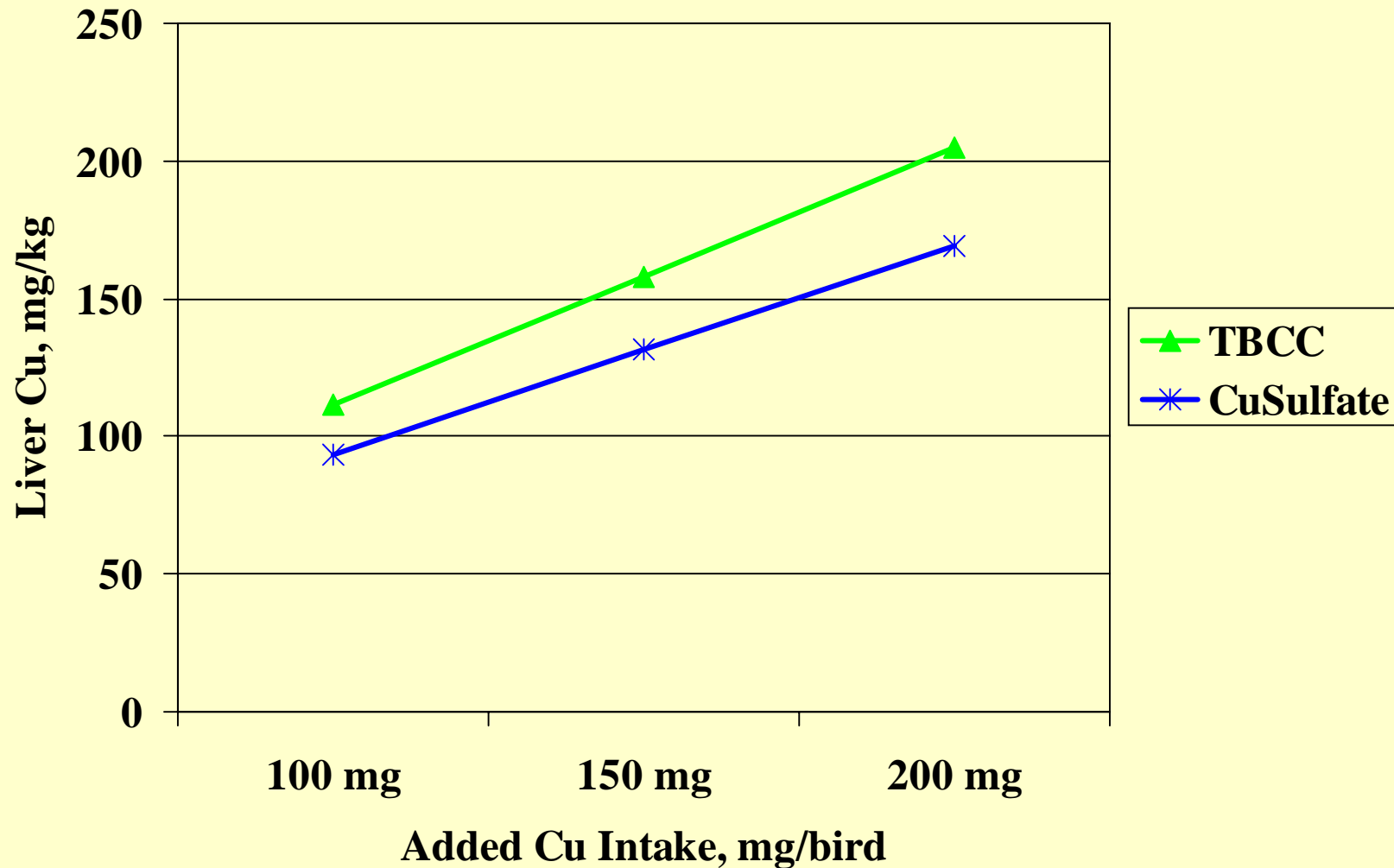
Experiment 2 – Ross x Cobb Chicks

- All males
- Battery brooders
- High health status
- TBCC vs Cu Sulfate
- 0, 125, 188, 250 Cu mg/kg each source
- 8 Pens of 10 chicks each / treatment
- 21-d Performance
- 2 Separate linear regression lines; 3 nonzero levels

21-d Cu Intakes and Liver Cu (Battery)

	Added Cu Intake, mg	Liver Cu, mg/kg
TBCC 125	115.0 c	94.8 e
TBCC 188	174.3 b	181.0 c
TBCC 250	224.9 a	243.9 a
CuSul 125	114.4 c	95.8 e
CuSul 188	169.4 b	129.0 d
CuSul 250	217.2 a	199.9 b

Separate Linear Regressions: 21-d Liver Cu on Added Cu Intake



Equations, Slope Ratio, Bioavailability

- Liver Cu₁₀, mg/kg = 1.56239 + 0.00376
TBCCu, mg/bird (r²=0.924; P<0.001)
- Liver Cu₁₀, mg/kg = 1.61528 + 0.00309
Cu Sulf Cu, mg/bird (r²=0.940; P<0.001)
- Slope Ratio = (0.00376 / 0.00309) x 100 =
Bioavailability = 121.7%

Summary and Conclusions

- Miles *et al.* (1998; Poultry Sci. 77:416) found TBCC had Cu bioavailability of 106% in battery brooders and 112% on litter vs. $\text{CuSO}_4 \cdot 5\text{H}_2\text{O}$ for chicks.
- Present experiments: Cu bioavailability for TBCC with chicks, 113% on used litter and 122% in battery brooders.

Summary and Conclusions

- Based on the results of four separate studies [Miles *et al.* (1998) and the present experiments], TBCC has a higher copper bioavailability (106 - 122%) than copper sulfate (100%) and the RBV can be estimated at 113%.

Summary and Conclusions

- TBCC is an effective alternative to copper sulfate for broiler chicks and is economically attractive based on TBCC's *bioavailability* (113%) and its *Cu content* (58%) versus Cu Sulfate (100% relative bioavailability and 25.2% Cu)