

**EVALUATION OF TRIBASIC COPPER CHLORIDE (TBCC) AND COPPER SULFATE  
IN DIETS UPON THE PERFORMANCE OF COMMERCIAL CHICKEN BROILERS**

**STUDY NUMBER:** PARC TRIAL NUMBER: 97-SEM-07-B

**SIGNATURES:**

**Approved by:**

**SPONSOR:**

\_\_\_\_\_  
Fred Steward  
Micronutrients, Inc.  
Indianapolis, IN 46231-3350  
Telephone: (317) 486-5882  
Fax: (317) 486-5888

Date: \_\_\_\_\_

**Acknowledged by:**

**STUDY**

**DIRECTOR:**

\_\_\_\_\_  
James L. McNaughton, Ph.D.  
Director Of Research  
PARC Institute, Inc.

Date: \_\_\_\_\_

**Monitored by:**

**STUDY MONITOR:**

\_\_\_\_\_  
Jon Nelson  
Executive Vice President  
Southeastern Minerals, Inc.

Date: \_\_\_\_\_

### **OBJECTIVE, INTRODUCTION AND STUDY OVERVIEW:**

- **OBJECTIVES:** The objective of this study is evaluate the effect of feeding various copper sources (TBCC and feed grade copper sulfates) upon the performance of commercial chicken broilers.
- **INTRODUCTION:** Copper is an essential mineral for broilers. Historically (at least 50% of all broiler feeds), in addition to the normal level of added copper in trace mineral premixes, copper sulfate has been added at 1 to 2 pounds per ton for an additional benefit of mold reduction and for prevention of crop mycosis. This study will be conducted to explore the different effects on weight gain and feed conversion of two sources of copper at different levels of inclusion in feed formulations.
- **STUDY OVERVIEW:** The test period will begin on Trial Day 0 (day of hatch of chicks). Animals will be fed one of seven different ration formulations (see design), each of which will be fed in a commercial-type CRUMBLED (starter feed after pelleting) feed during the 0-7 week period. Each of the seven test groups will contain 448 mixed-sex broilers randomly assigned into 8 replicates per group containing 56 broilers per replicate for a total number of 3136 animals on study. Any deaths which occur during the first 7 days will be replaced with a hatchmate of the same sex. The chicks will be observed at least twice daily for signs of health problems. Body weights and food consumption will be measured during weeks 3 and 7. Body weight and mortality will also be evaluated.

## SPONSOR, TESTING FACILITY AND TEST SITES

<b>LOCATION</b>	<b>COMPANY (Individual)</b>	<b>ADDRESS</b>
<b>SPONSOR:</b>	Micronutrient, Inc. Fred Steward	Micronutrient, Inc. 1550 Research Way Indianapolis, IN 46231-3350 Tel.: (317) 486-5882 Telefax: (317) 486-5888
<b>INVESTIGATOR:</b>	James L. McNaughton, Ph.D. PARC Institute, Inc.	PO Box 1161 30 North Harrison Street Easton, Maryland 21601
<b>MONITOR</b>	Jon Nelson Southeastern Minerals, Inc.	Bainbridge, GA Tel.: (912)243-0170
<b>FARM LOCATION:</b>	PARC Farm #1	1701 Starr Road Queen Anne, MD 21657
<b>FEED MILL LOCATION:</b>	PARC Feeds, Inc.	PO Box 340 6202 Nagel Road (Harmony, MD) Preston, Maryland 21655
<b>RAW DATA AND FINAL REPORT:</b>	PARC Institute, Inc.	PO Box 1161 30 North Harrison Street Easton, Maryland 21601
<b>NUTRIENT ANALYSIS SITE (where required)</b>	Woodson-Tenet, Inc.	4207 Delaware Av. Des Moines, IA 50313 (Attention: Marilyn Nair)

### PROPOSED STUDY DATES:

- Animal Receipt: To be determined (document in final report)
- Initiation of Dosing: Day 0 to Day 21.
- Schedule: A detailed schedule is contained in Attachment A.

### STUDY PERSONNEL

- Study Director: James L. McNaughton, Ph.D. (phone: 410-820-5661 and fax: 410-822-0429)
- Study Veterinarian and Pathologist: Ed Odor, DVM
- Operations Manager: William J. Graves
- Study Assistants: Cliff Harris and Rick Salter

**TEST SYSTEM**

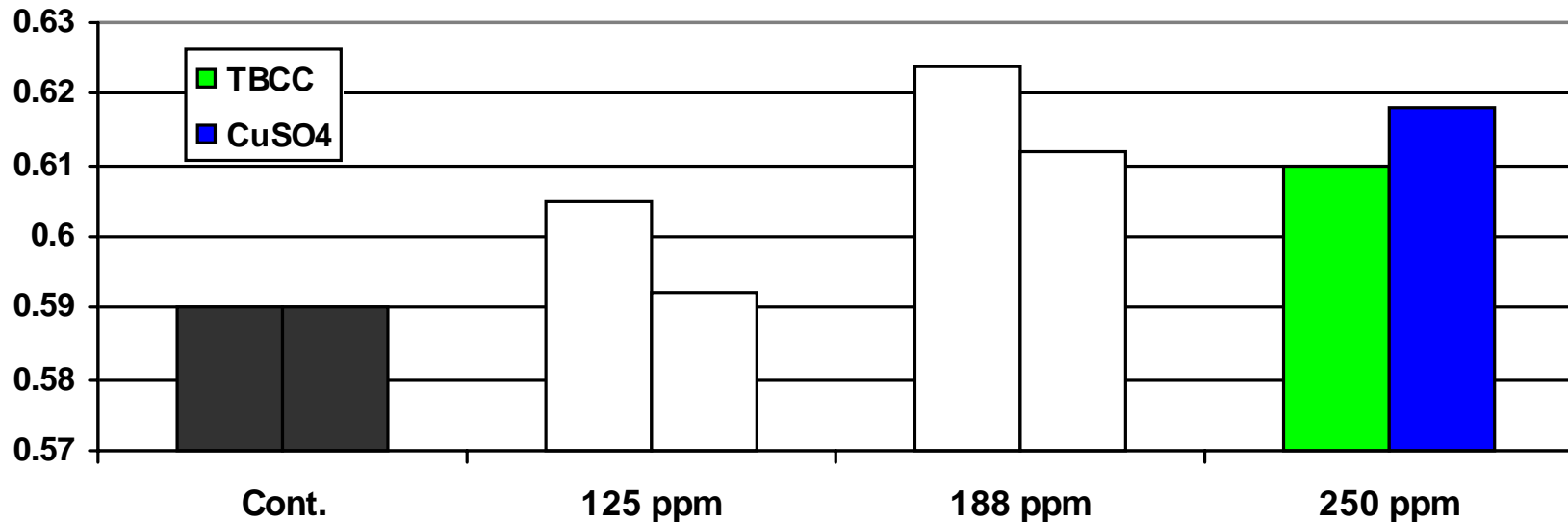
<b>TREATMENT</b>	<b>TEST MATERIAL</b>	<b>COPPER SOURCE Lb/ton (ppm)</b>
1.	BASAL FEED FORMULATION	0
2.	TBCC	0.43(125)
3.	TBCC	0.645(188)
4.	TBCC	0.86(250)
5.	Copper Sulfate	1.0(125)
6.	Copper Sulfate	1.5(188)
7.	Copper Sulfate	2.0(250)

NOTE: All diets will contain SaCox 60g/ton + BMD 50g/ton.

# Body Weight

Copper Source	Level (#/ton)	Body Weight (KG)	
		Mean	Stat1
Control Basal	None	0.591	D
TBCC	0.43	0.605	C
TBCC	0.64	0.624	A
TBCC	0.86	0.610	BC
Copper Sulfate	1.00	0.592	D
Copper Sulfate	1.50	0.612	BC
Copper Sulfate	2.00	0.618	AB

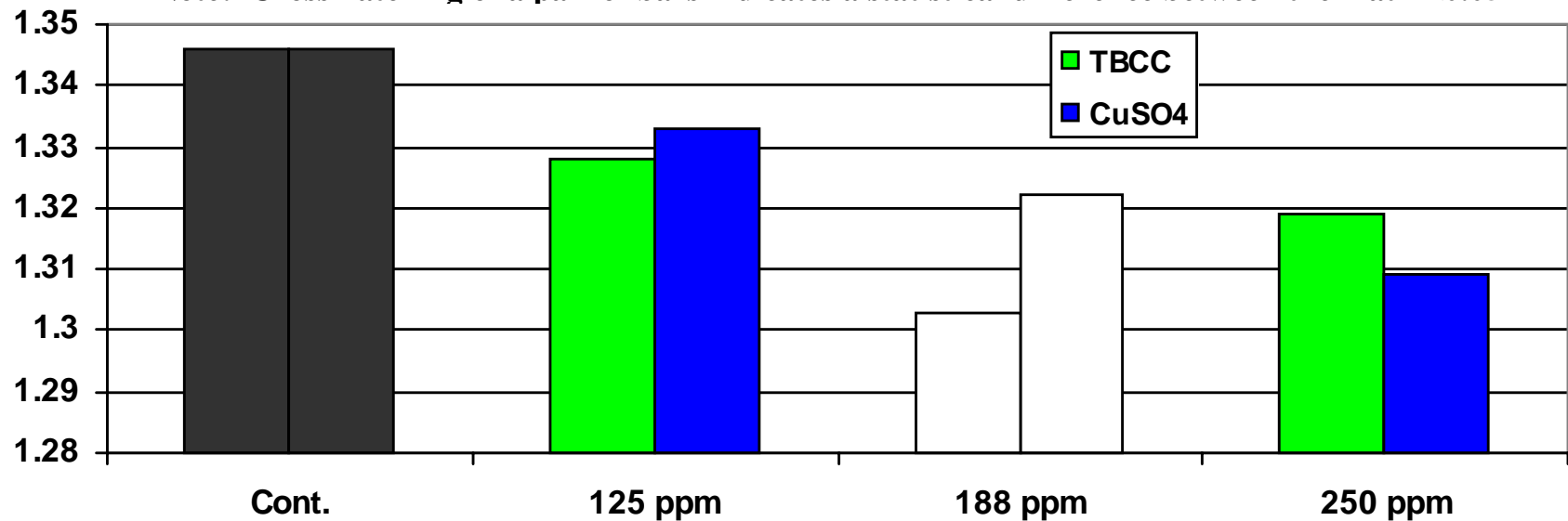
Note: Cross hatching of a pair of bars indicates a statistical difference between them at  $P < 0.05$



# Feed Conversion

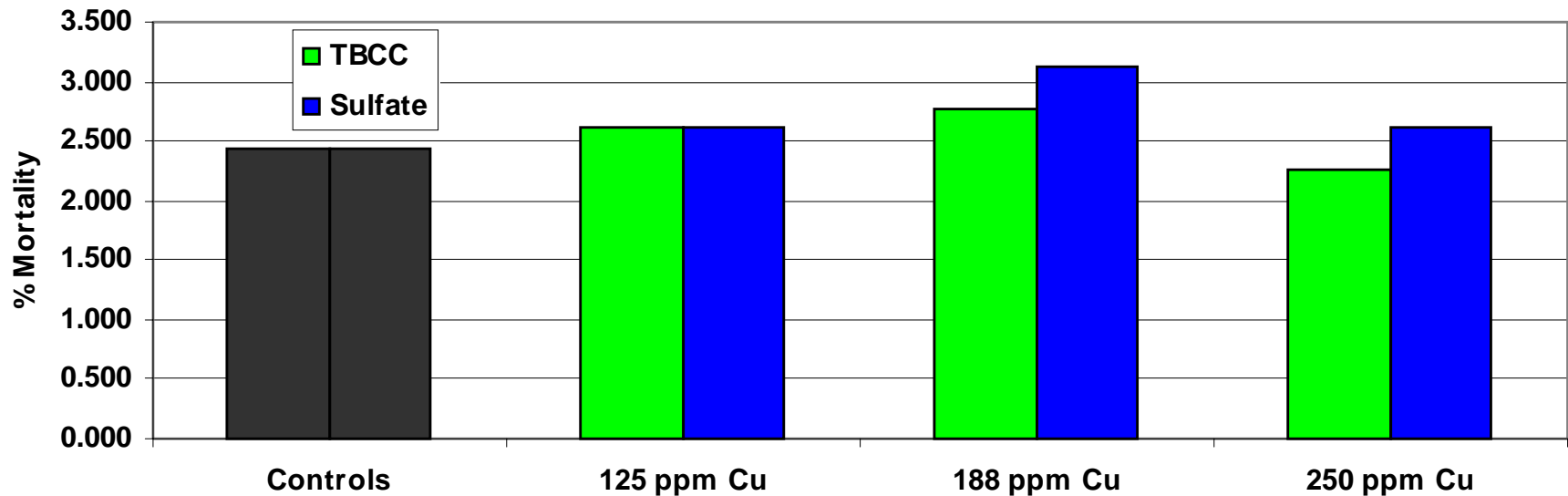
Copper Source	Level (#/ton)	Feed:Gain	
		Mean	Stat1
Control Basal	None	1.346	D
TBCC	0.43	1.328	CD
TBCC	0.64	1.303	A
TBCC	0.86	1.319	ABC
Copper Sulfate	1.00	1.333	CD
Copper Sulfate	1.50	1.322	BC
Copper Sulfate	2.00	1.309	AB

Note: Cross hatching of a pair of bars indicates a statistical difference between them at  $P < 0.05$



# Mortality

Copper Source	Level (#/ton)	Mortality	
		Mean	Stat1
Control Basal	None	2.431	A
TBCC	0.43	2.604	A
TBCC	0.64	2.778	A
TBCC	0.86	2.257	A
Copper Sulfate	1.00	2.604	A
Copper Sulfate	1.50	3.125	A
Copper Sulfate	2.00	2.604	A



## **Conclusions**

- **Adding copper improved bird performance.** Weight gain and feed efficiency were better at all three levels of added copper. The improvements were significant at 188 and 250 ppm Cu. At 188 ppm Cu, TBCC reduced Feed:Gain by 4.3 points while increasing weight gain by 0.07 lb. (5.5%), compared to untreated controls.
- **TBCC gave more improvement at lower copper levels.** Broiler performance was enhanced by TBCC up to the 188 ppm level of addition, while higher levels of Cu from copper sulfate were required to achieve a similar improvement:
  1. Regarding weight gain, TBCC performed significantly better than copper sulfate at both 125 ppm and 188 ppm added copper; and
  2. Regarding feed conversion, TBCC performed significantly better than copper sulfate at 188 ppm added copper.
  3. By both measures, TBCC gave as much improvement over untreated controls at 188 ppm Cu as did copper sulfate at 250 ppm Cu.