

# In vivo and in vitro assessment of two copper sources for broilers

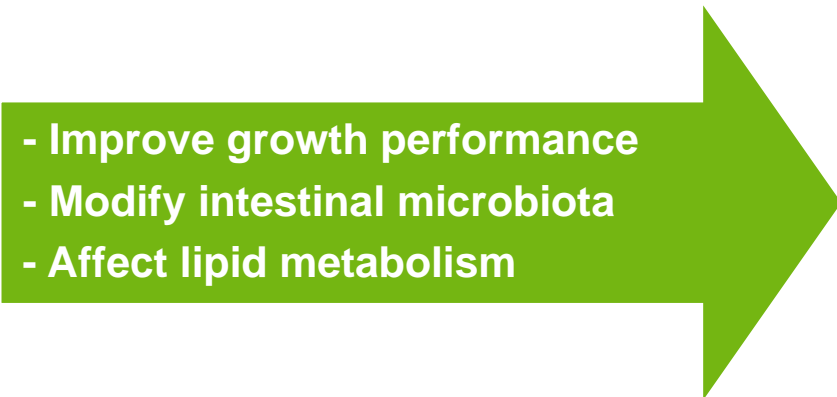
M. Hamdi, D. Solà-Oriol, R. Franco-Rosselló, **A. Romeo\***, and J.F. Perez



## EAAP 2016

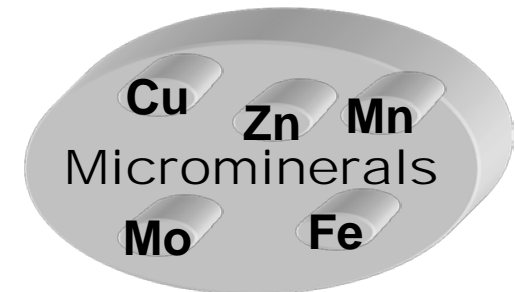
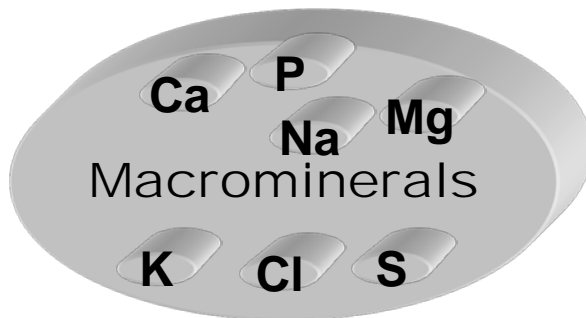
67th Annual Meeting of the European  
Federation of Animal Science  
Belfast UK, 29 Aug – 2 Sept 2016

# High copper supplementation levels (125 to 250 mg Cu / kg)

- 
- Improve growth performance
  - Modify intestinal microbiota
  - Affect lipid metabolism

- 
- Degrade growth performance
  - Close from toxicity
  - Environmental concern

- Evaluation of the safety of a new source of copper
- Measurements of effects of Cu doses and sources on performance and biological mechanisms
- Studying a possible interactions with other minerals

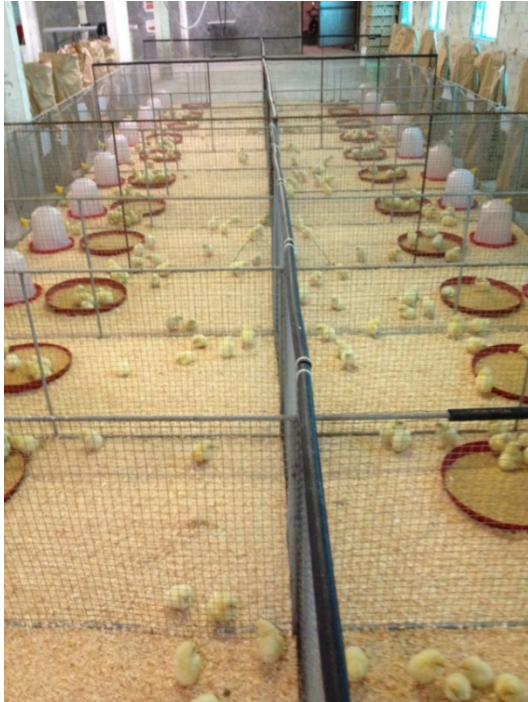


## Objectives of the experiments:

- *In vivo* : to compare the effects of a new feed grade source of copper ( $\text{Cu}_2\text{O}$ , CoRouge<sup>®</sup>, Animine) to copper sulphate ( $\text{CuSO}_4$ ) at different levels of inclusion on broiler performance and Cu accumulation in different organs.
- *In vitro* : to determine the possible interactions between copper and phytic phosphorus (PP).

# A. Trial *in Vivo*

## Material and Methods



- 576 males broiler (Ross 308)
- 48 cages (8 cages x 6 trt)
- 12 animals / cage





## Experimental treatments

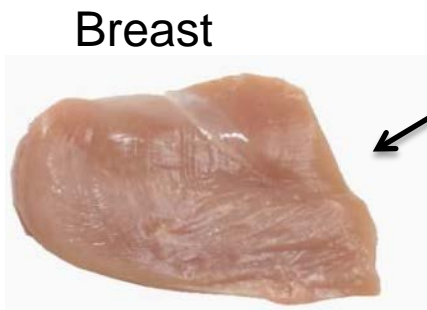
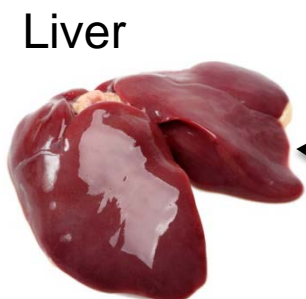
Trt	Cu sources	Cu (ppm)
T1	CuSO <sub>4</sub>	15
T2		150
T3		300
T4	Cu <sub>2</sub> O*	15
T5		150
T6		300

\*CoRouge®, Animine

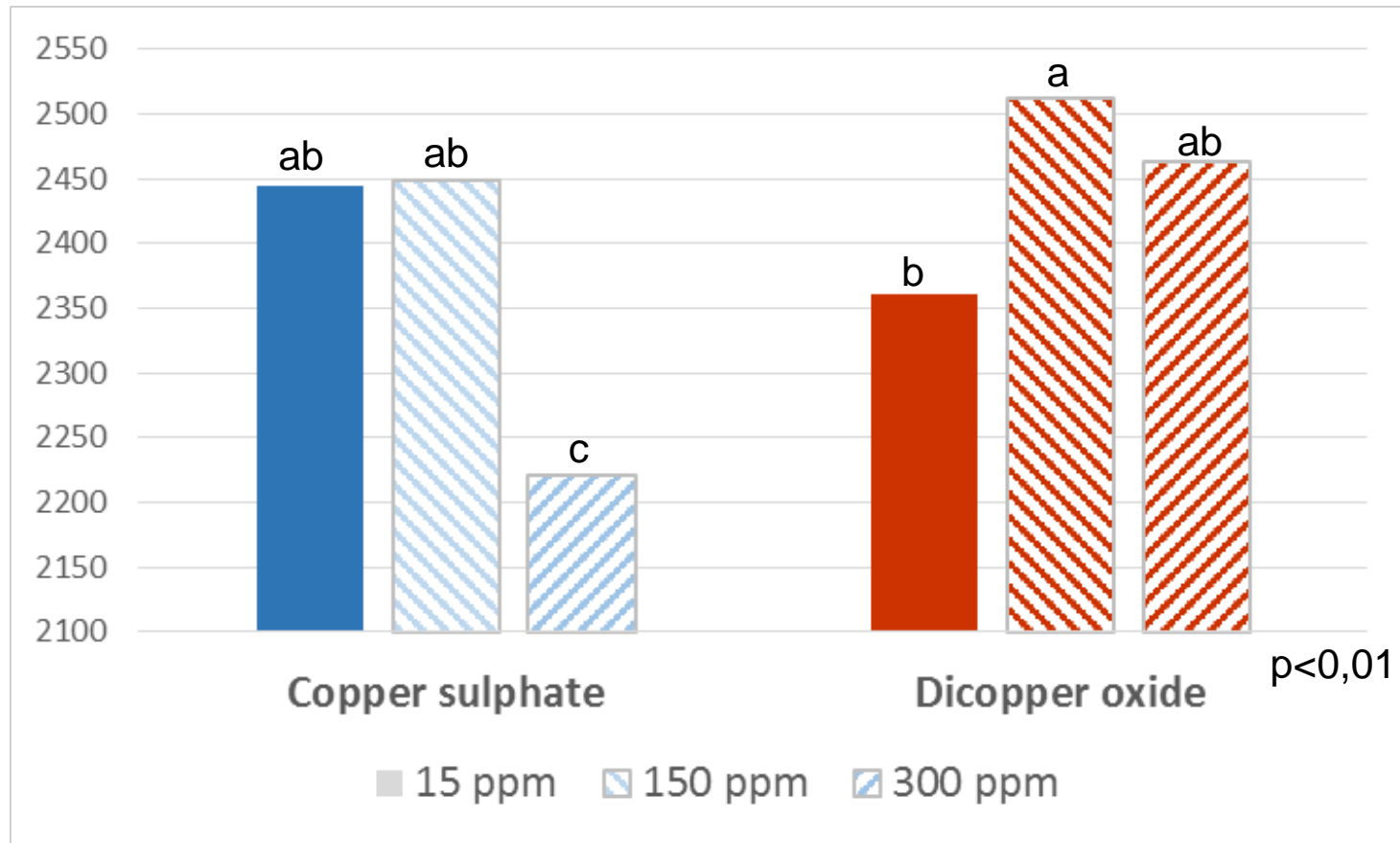


## Measurements :

- BW (0,14, 28 and 35d)
- ADFI, ADG, FCR

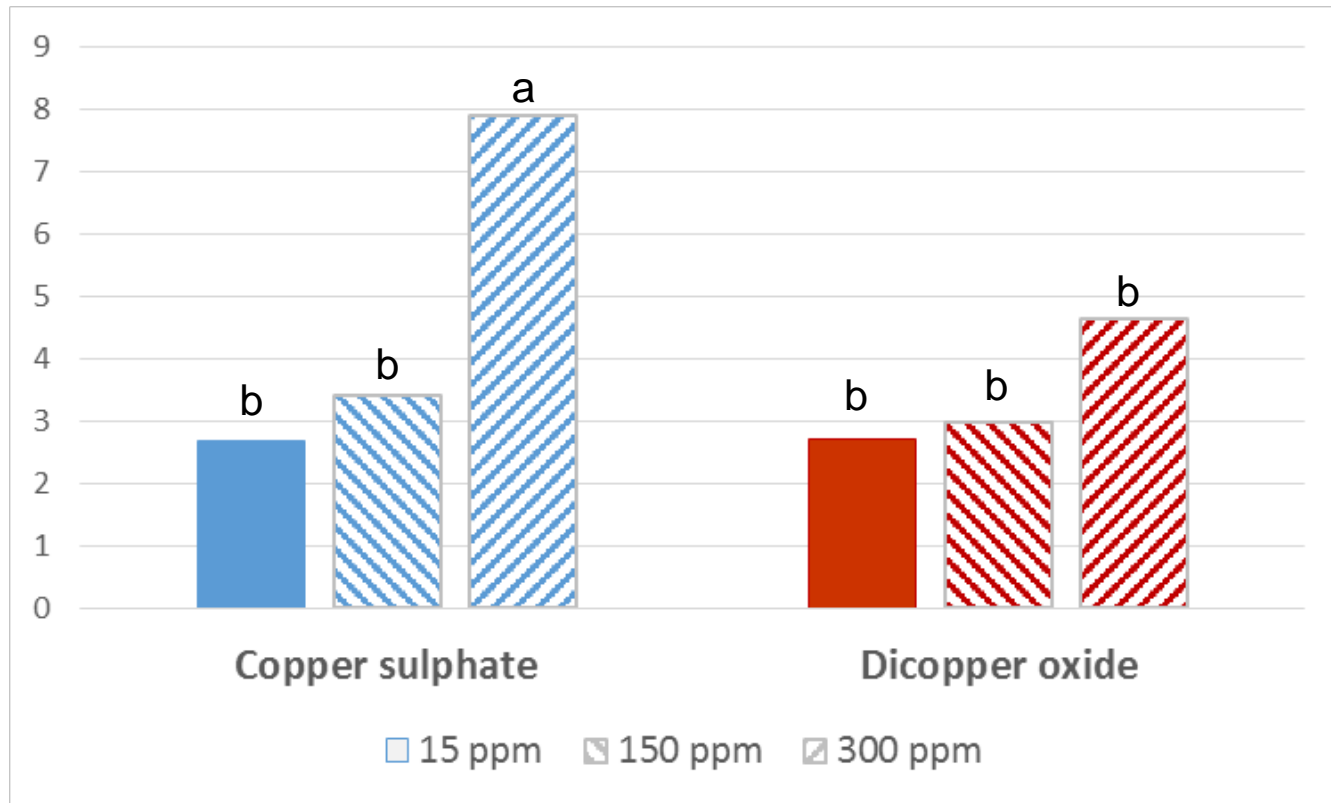


# Body weights at 35 days (g)





# Copper liver concentrations (mg/kg)

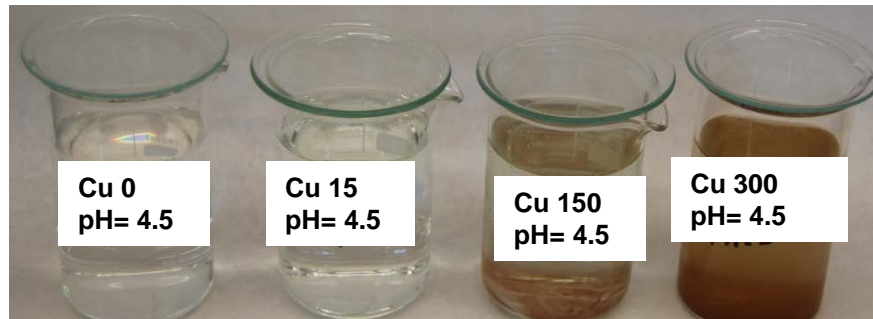
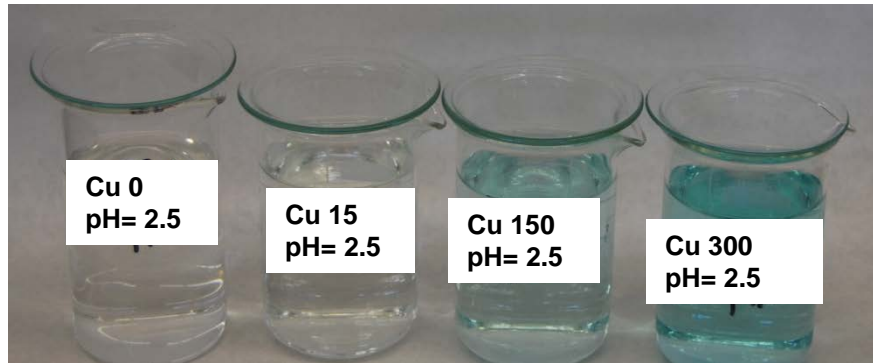


## Conclusion from the *in vivo* experiment :

- Growth performance of broilers fed copper sulphate was either equivalent at 150 mg/kg or degraded at 300 mg/kg
- Growth performance of broilers fed dicopper oxide was either significantly improved at 150 mg/kg or numerically improved at 300 mg/kg
- At the highest (300 mg/kg) supplementation level, copper from CuSO<sub>4</sub> accumulated in the liver, inducing possible toxicity signs.

## B. Trials *in Vitro*

# Solubility of copper and phytate phosphorous



(+) or (-) phytic phosphorus  
41°C during 60 min

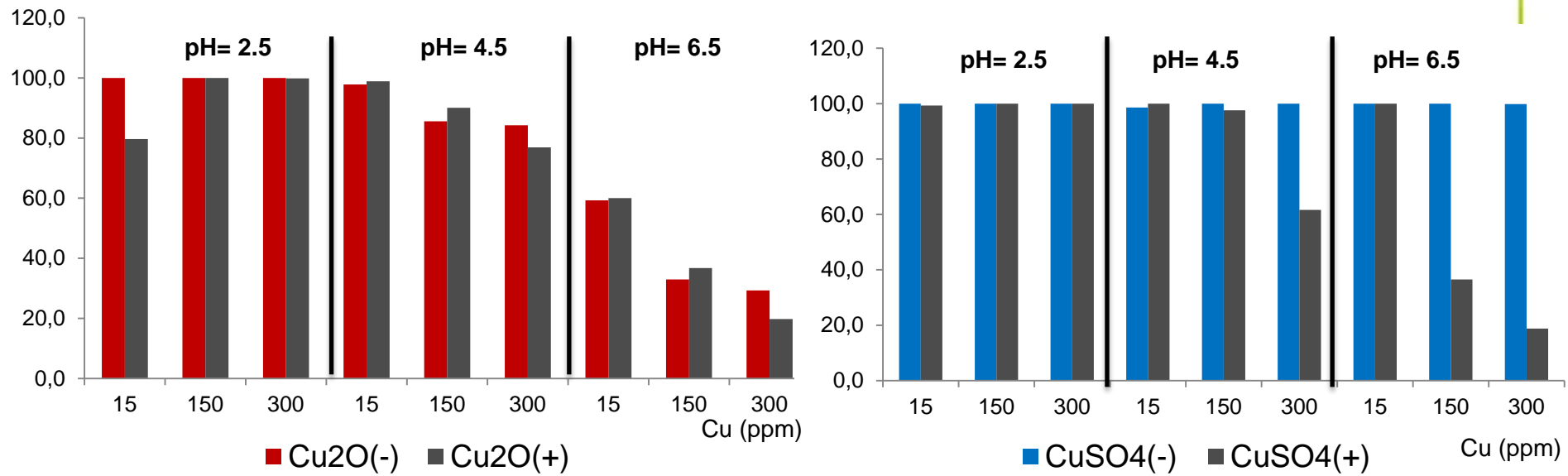


Solubility (%) =  
 $(\text{Soluble Cu} / \text{total Cu}) \times 100$

Solubility (%) =  
 $(\text{Soluble PP} / \text{total PP}) \times 100$

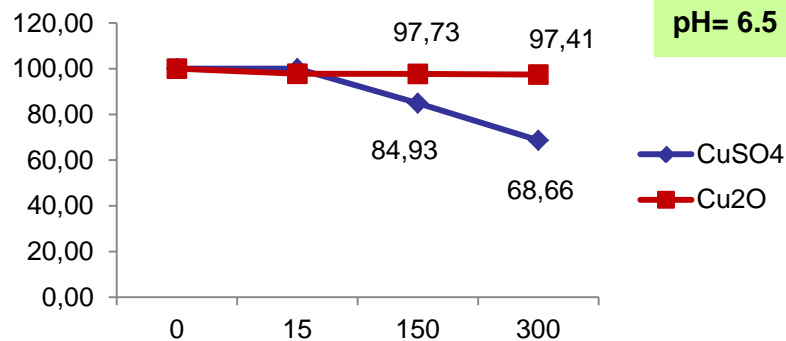
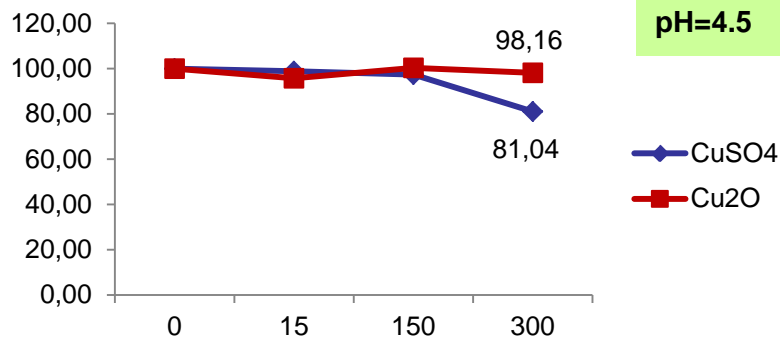
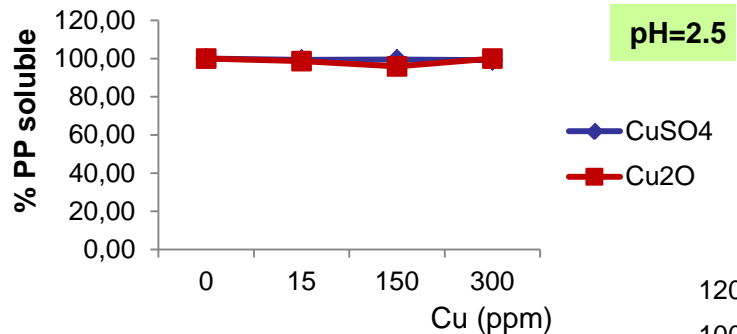


# Effect of phytate phosphorous on relative copper solubility





# Effect of copper dose/source on relative phytate phosphorous solubility



Soluble PP is expressed as a percentage relative to the soluble PP when Cu was not added to the mixture .

# Effect of Cu on the hydrolysis of PP by phytase



Prepare for each source of Cu:

- 4 solutions concentrations (0,15,150,300 ppm Cu) + PP (phytic phosphorus)
- pH= 2.5; 4.5; 6.5

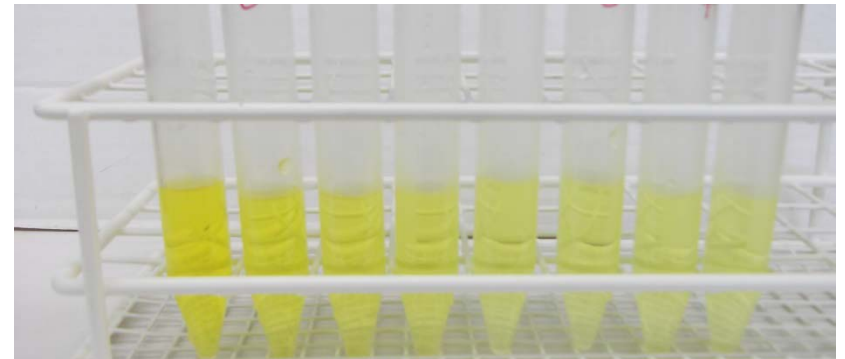




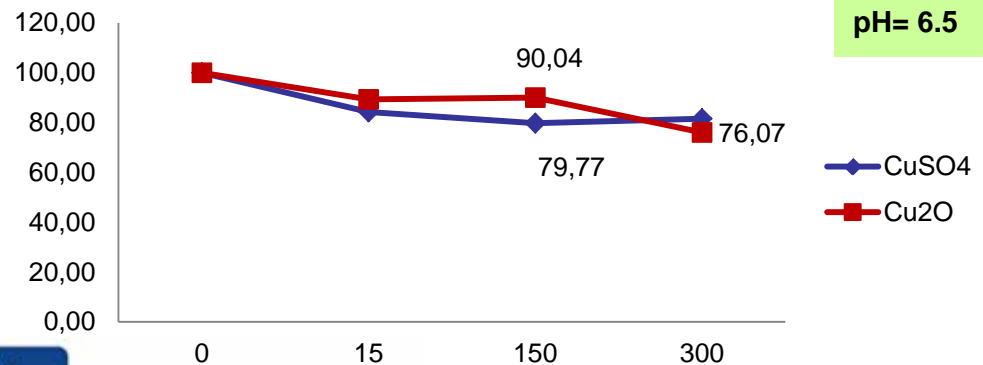
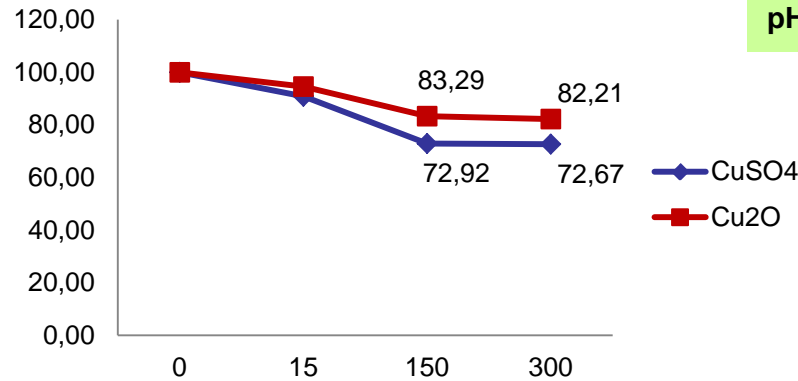
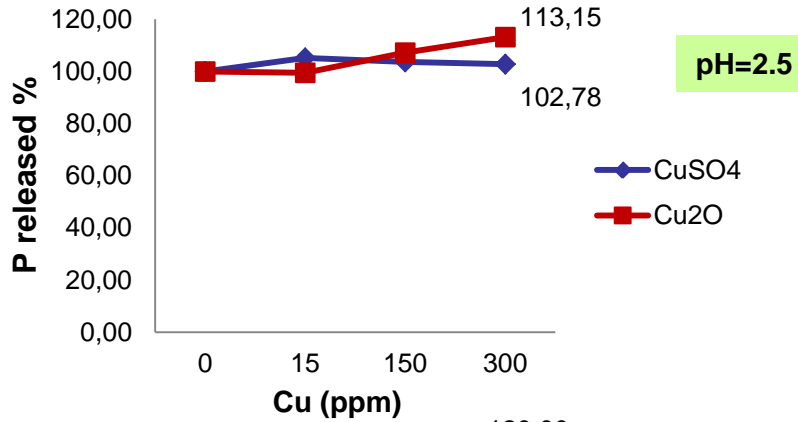
3 ml from the Cu Solution with 2.9 mM (PP)  
0.1 ml solution of phytase (at the same pH)



60 min at 41°C  
STOP solution



# Effect of copper on the hydrolysis of PP by phytase



P released is expressed as a percentage relative to the P when Cu is not added to the mixture .

## Conclusions from *in vitro* experiments :

- Copper binds to phytate phosphorous
- At growth promoting levels, copper supplementation may interfere with the hydrolysis of phytate phosphorous by phytase
- This antagonism seems exacerbated with water soluble Cu sources
- Further experiments are needed.



