

Phyto-toxicological Effects of Copper Nanoparticles in Bell Pepper (*Capsicum annuum*) plants

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Structure of the presentation

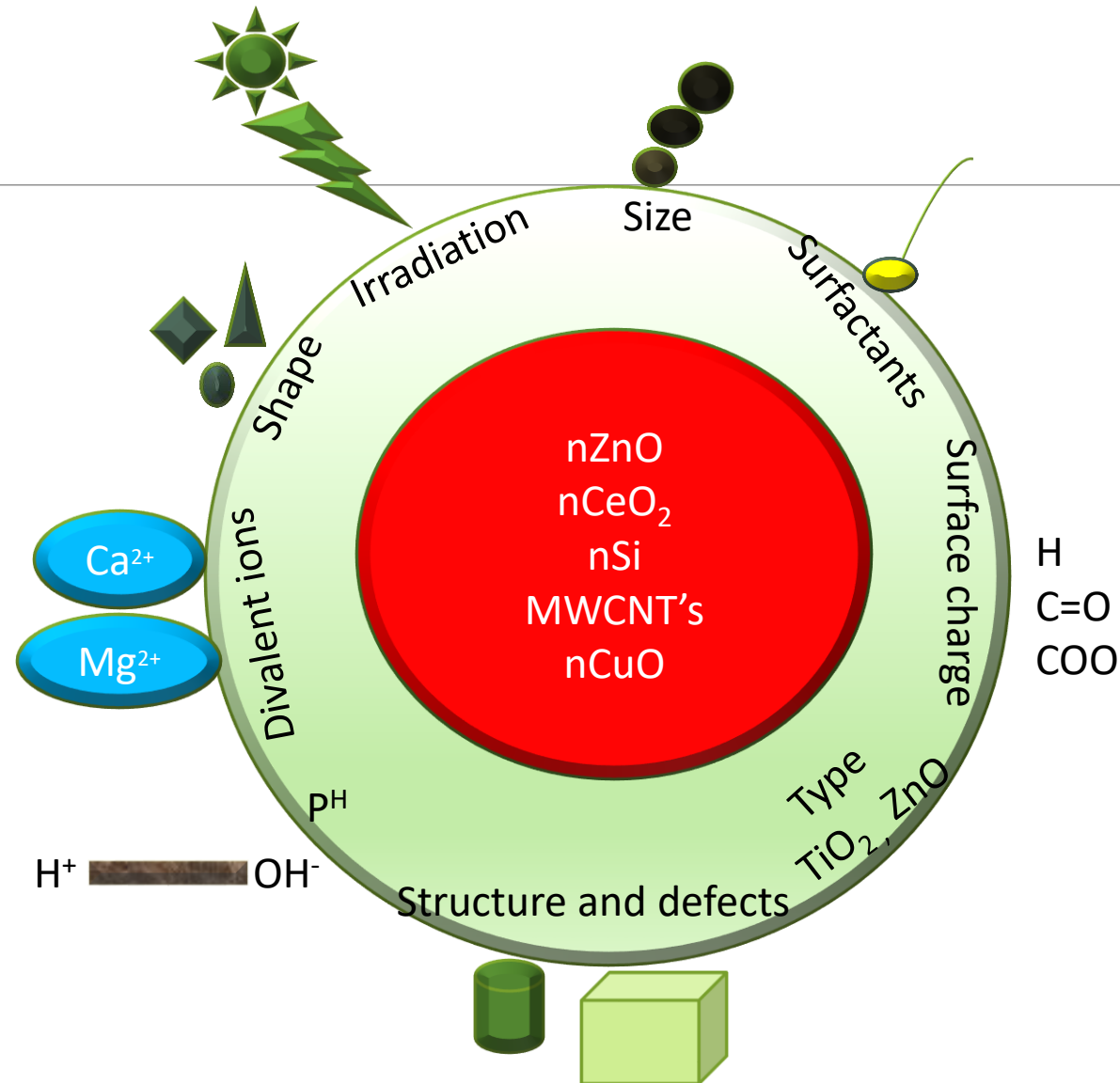


- Introduction
 - Nanoparticles
 - Bell pepper plants
- Methodology
- Results
- Conclusions

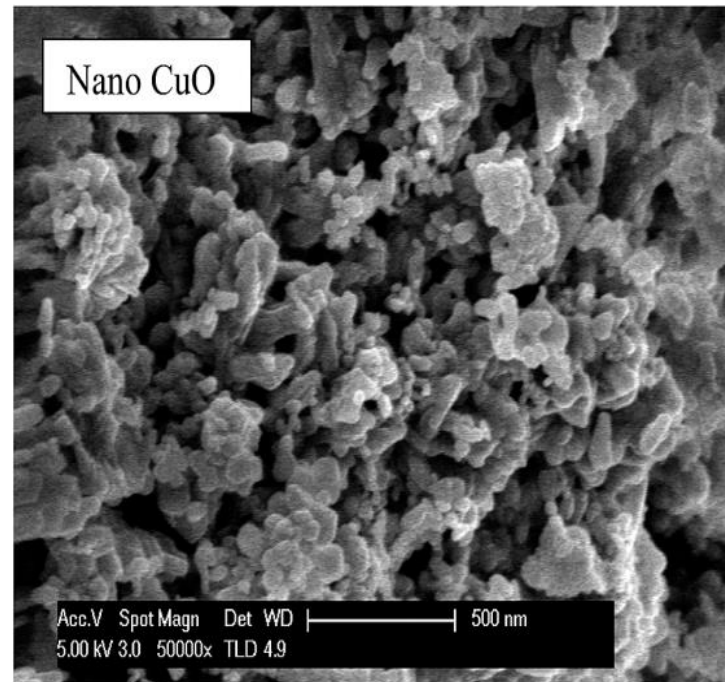


Introduction



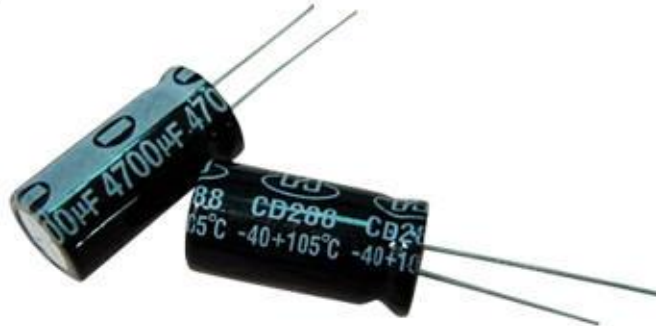
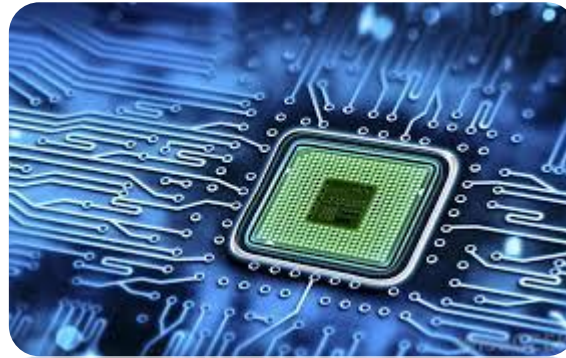
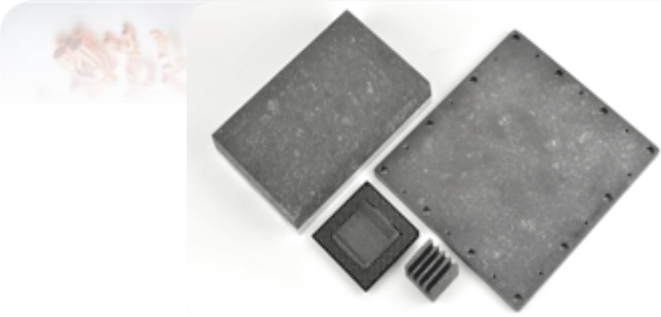


Copper Nanoparticles (NPs)

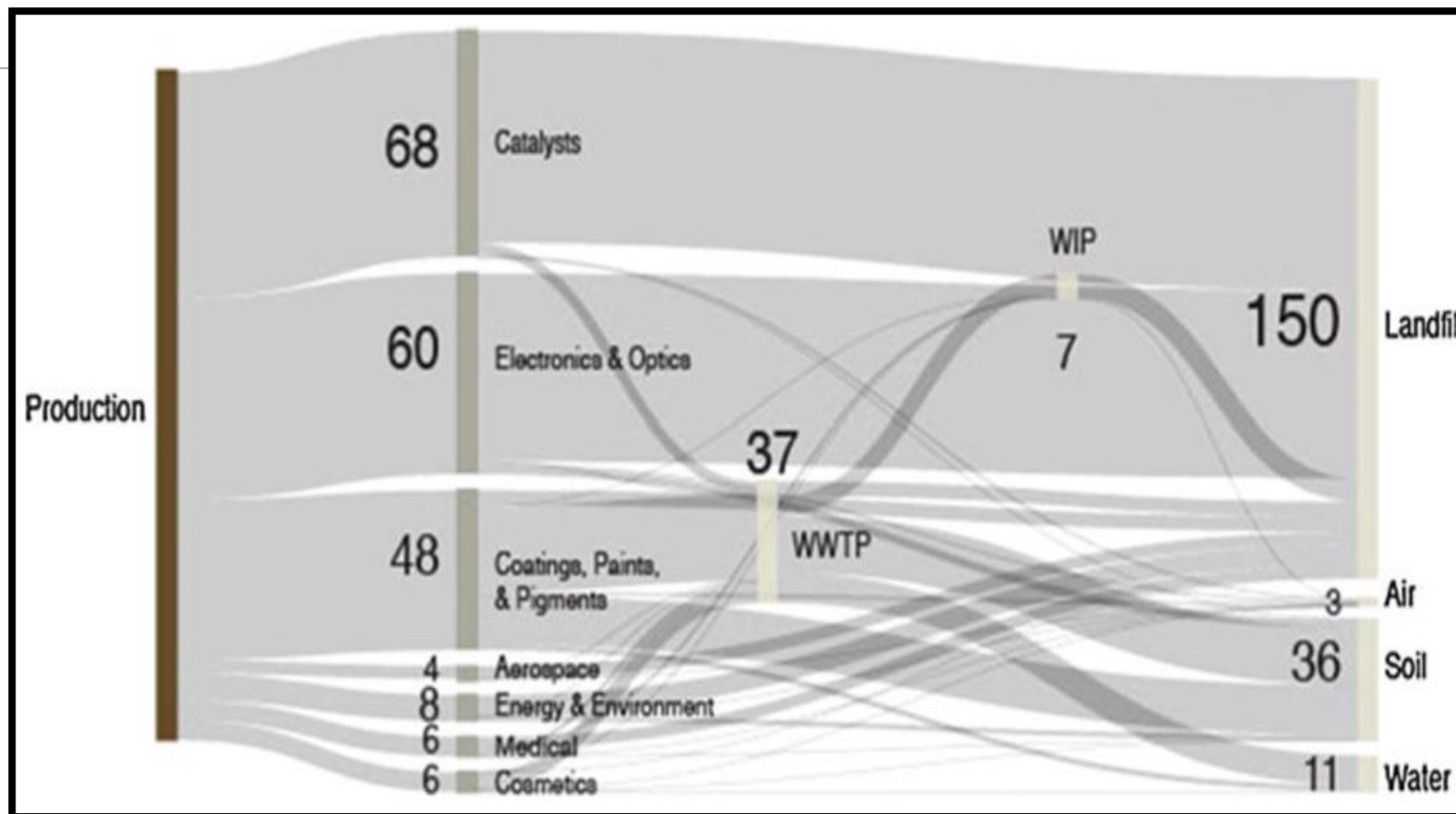


SEM Micrographs of copper nanoparticles

Applications of Copper NPs



Global flows for Cu and oxides of Cu (metric tons/yr) in 2010



Bell pepper plants *Capsicum annuum*

- Rich in anti-oxidants like carotenoid, sugars, vitamin C.
- Fruit is 92% water, rest are carbohydrates and small amount of protein and fat



<https://authoritynutrition.com/foods/bell-peppers>



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Methodology



Soil

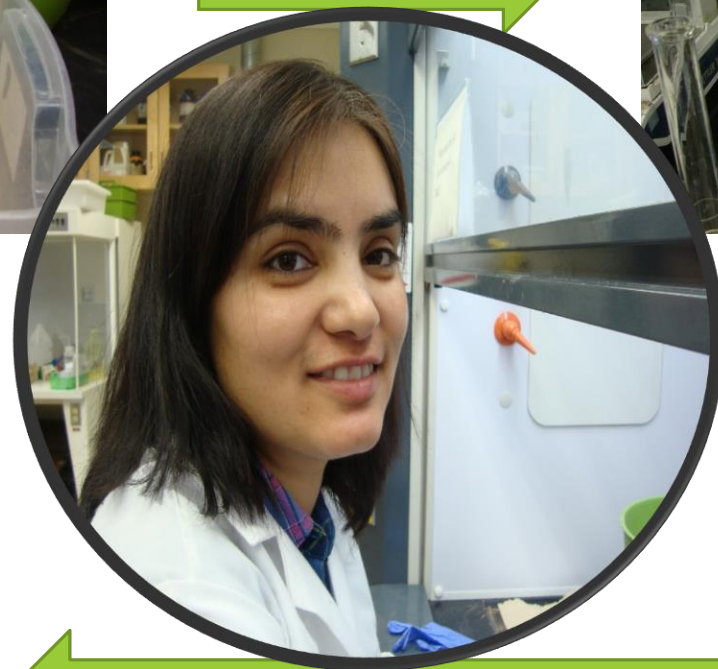
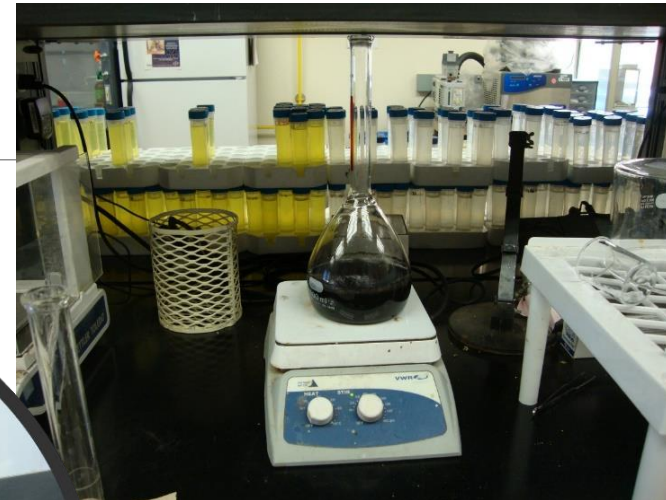
- Soil collected on the east side of El Paso, TX.
- Soil characterization conducted on Malvern Mastersizer Hybrid 2000G
 - Sand : 19.7 %
 - Silt : 64.92 %
 - Clay : 15.38 %
- Natural soil : silt loam



Sowing seeds at the green house for seedling transplantation



Preparing pots in the lab





Plant growth stages : full growth cycle 90 days

Seedlings growing

Seedlings ready for
transplantation



Plants 10 days post
transplantation

Freshly transplanted
seedlings





Plant growth stages : full growth cycle 90 days

Plants 30 days post transplantation

Fully matured plants, 90 days post transplantation

Plants 45 days post transplantation, flowering



Plants 60 days post transplantation, fruiting



Conditions at the green house

- Controlled environment, temperature, relative humidity, and light intensity
 - Average light 10.1 mol/m²/d
 - Average day temperature 27.2±1.6°C
 - Average night temperature 25±2.1°C
- Water every other day, or as need be with fertilizer solution, 15-5-15 ratio of N-P₂O₅-K₂O, pH: 5.8, EC: 1.00 mS/cm
- Abamectin, Avid 0.15 EC , to treat aphids or white fly



Harvesting

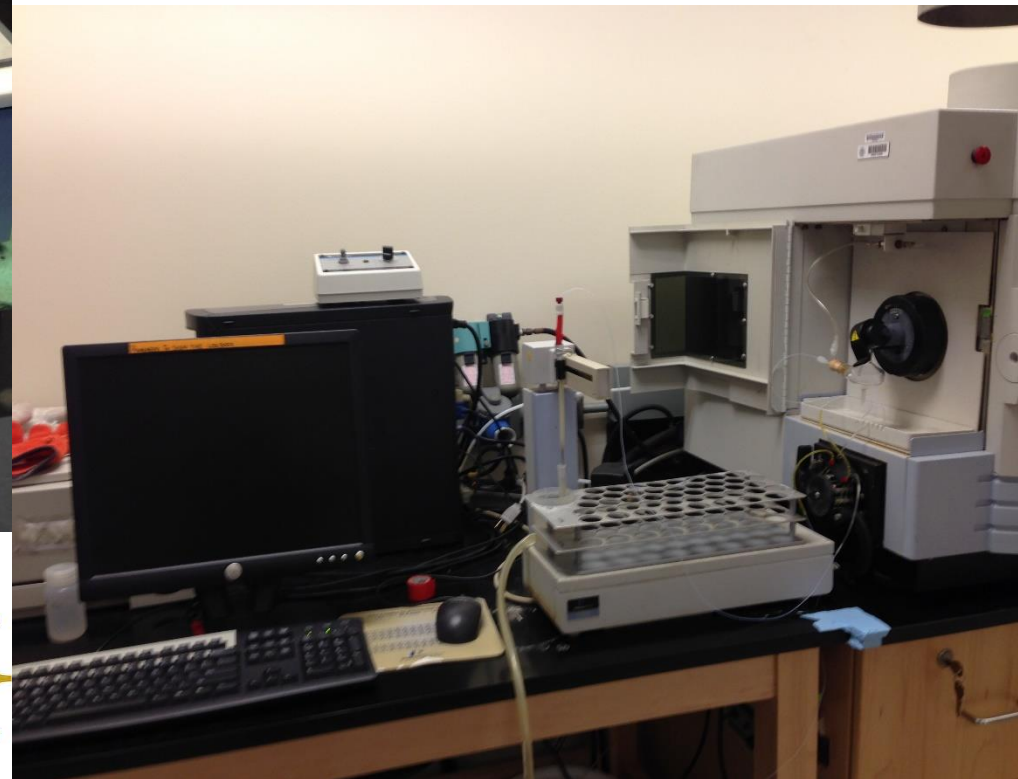
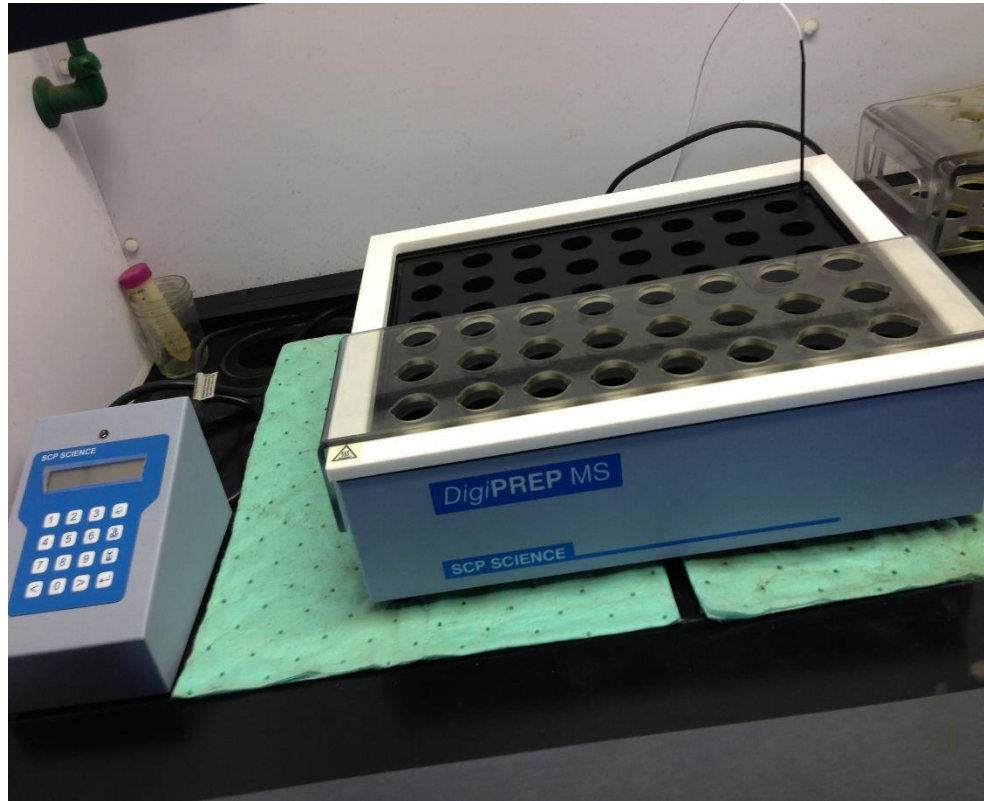


Gas exchange measurement: LI-6400XT portable photosynthesis system





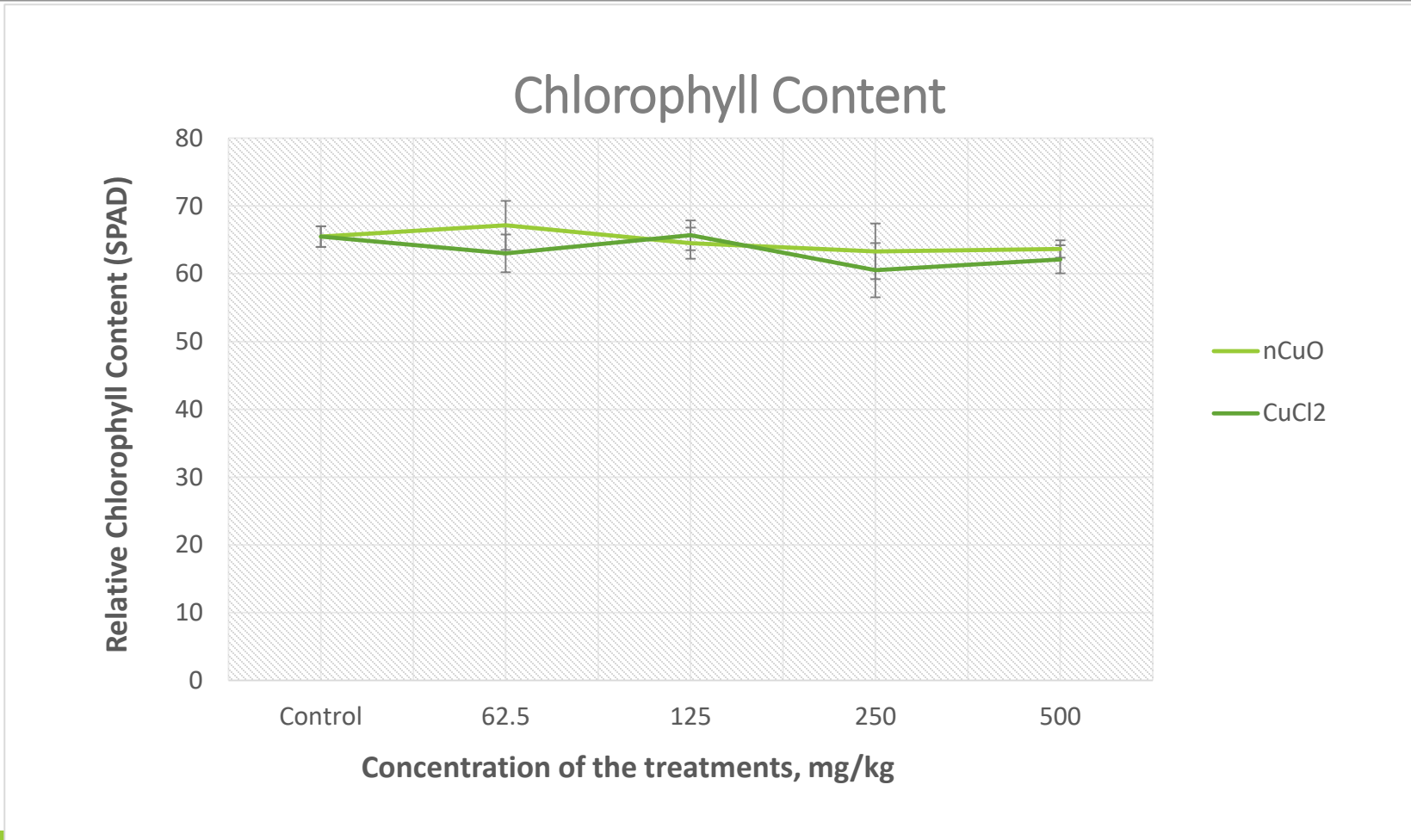
Acid digestion and sample analysis on the ICP-OES



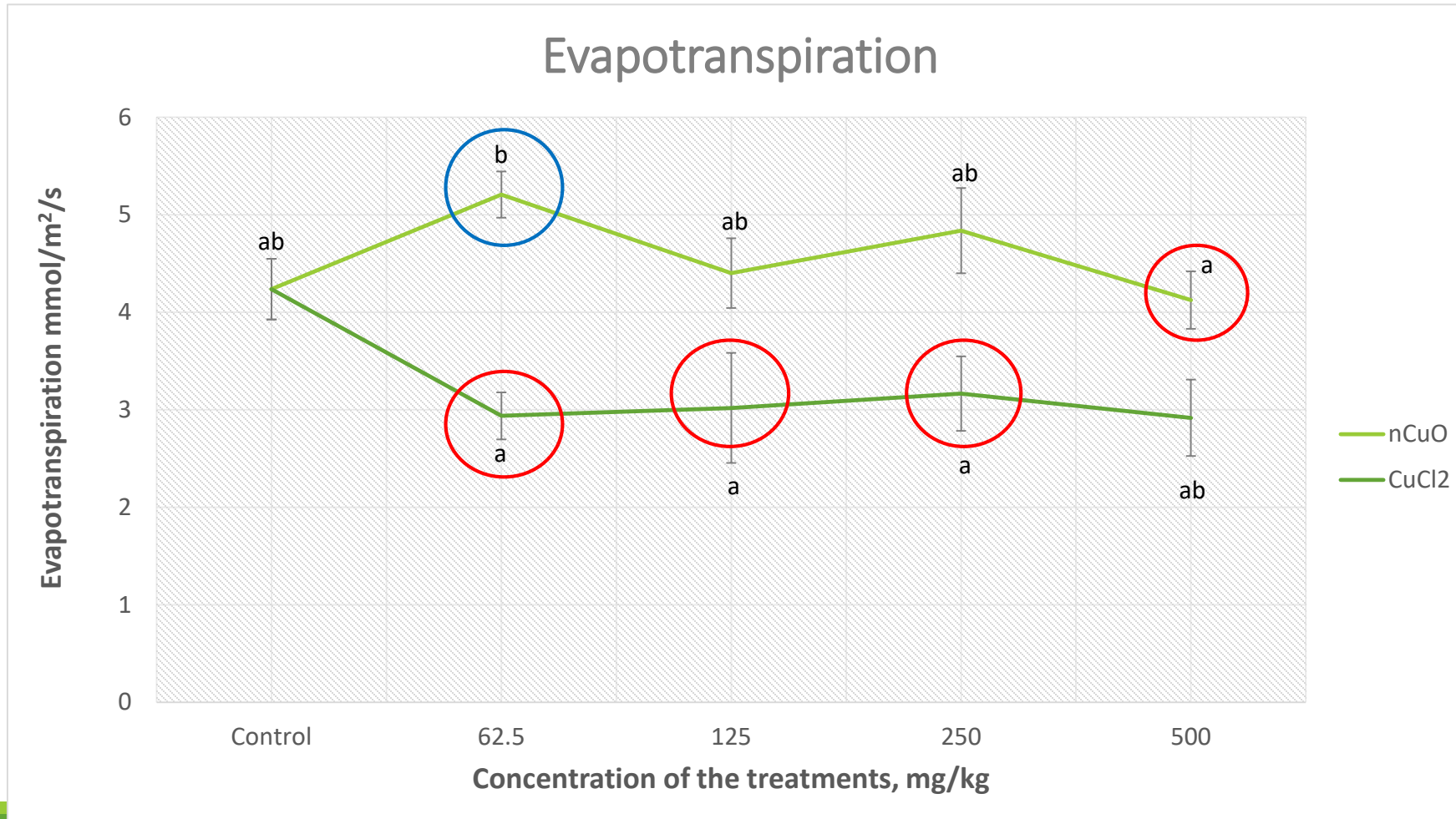
Results



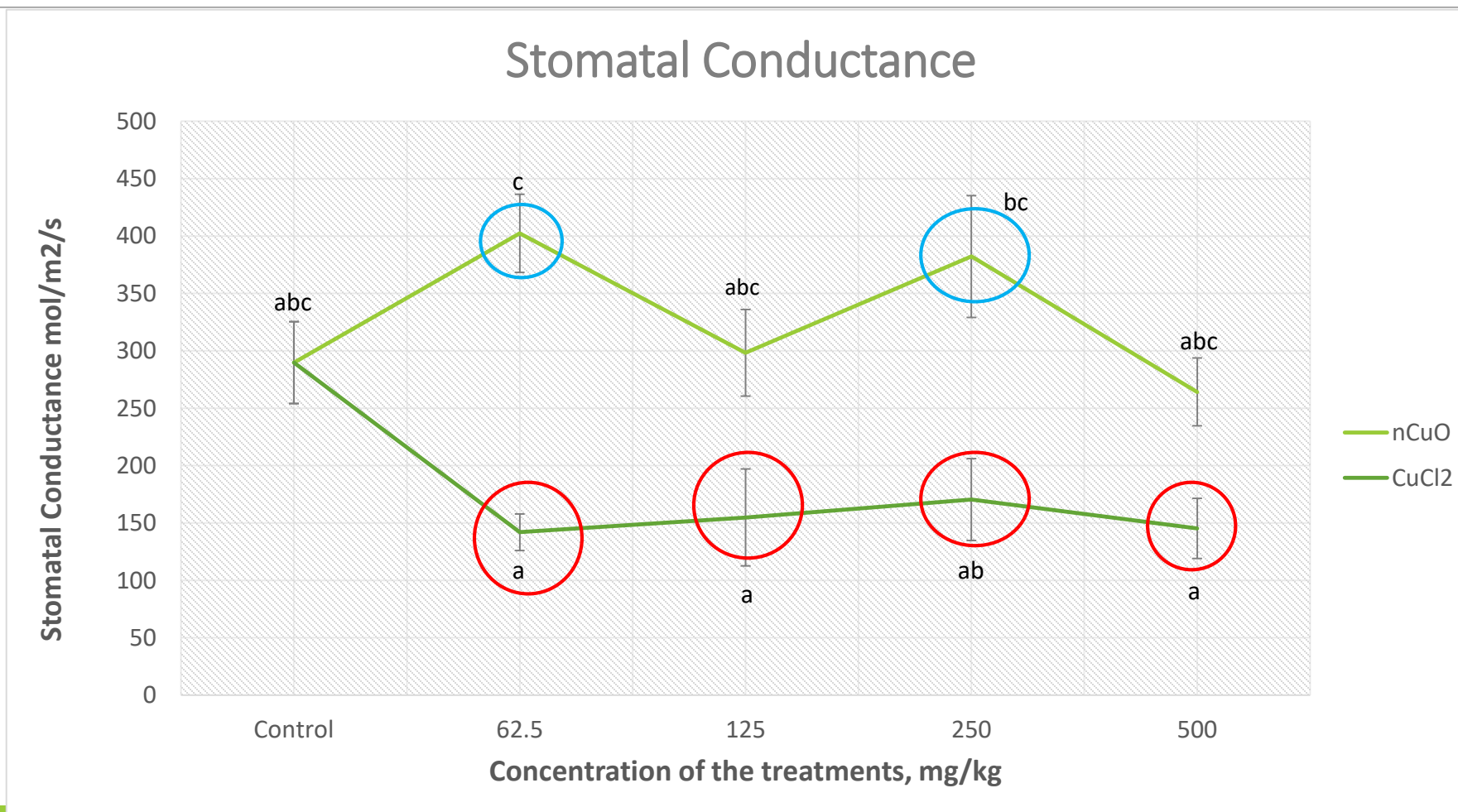
Chlorophyll content, nCuO vs ionic copper treatments



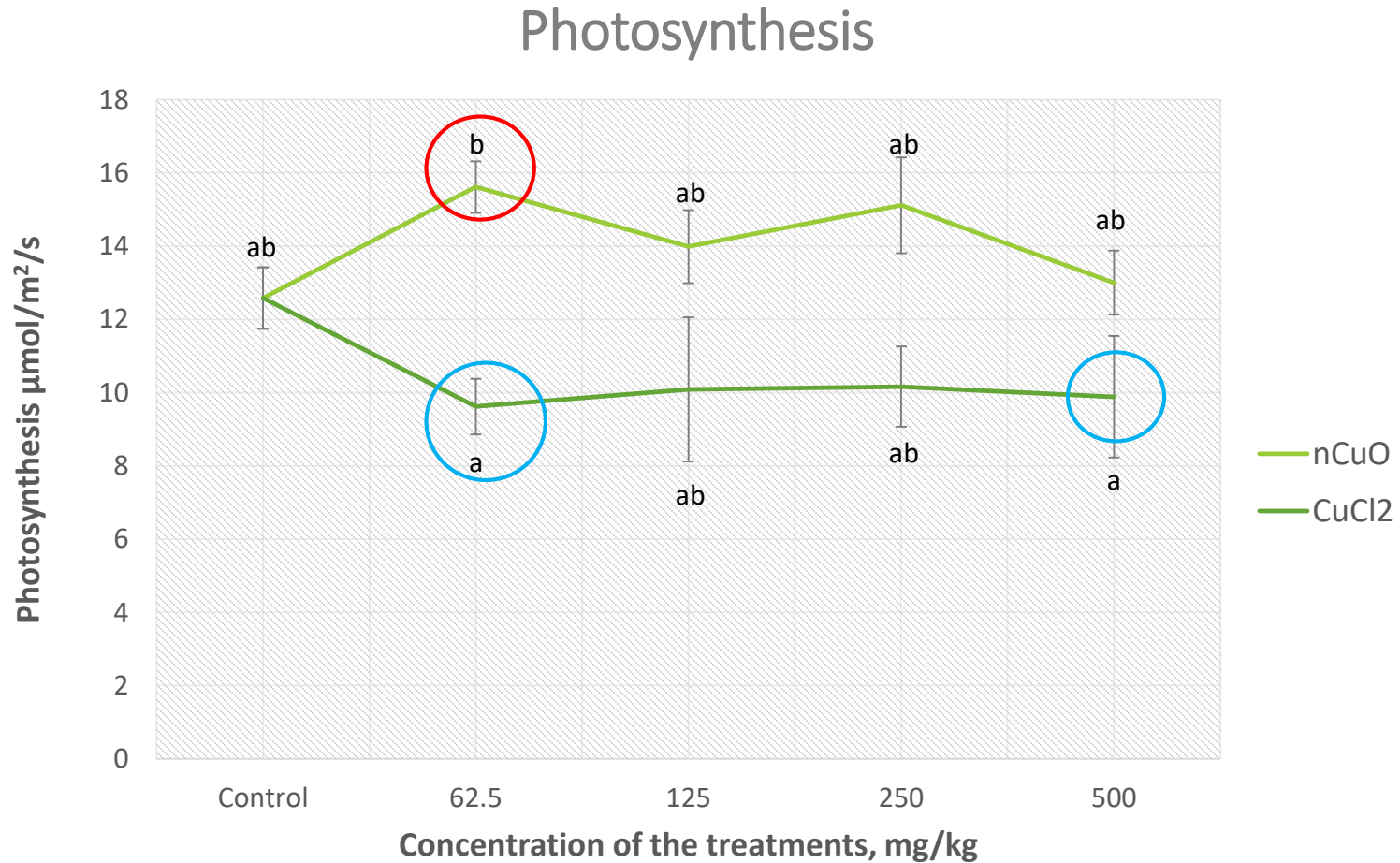
Gas Exchange : Evapotranspiration, nCuO vs ionic copper treatments



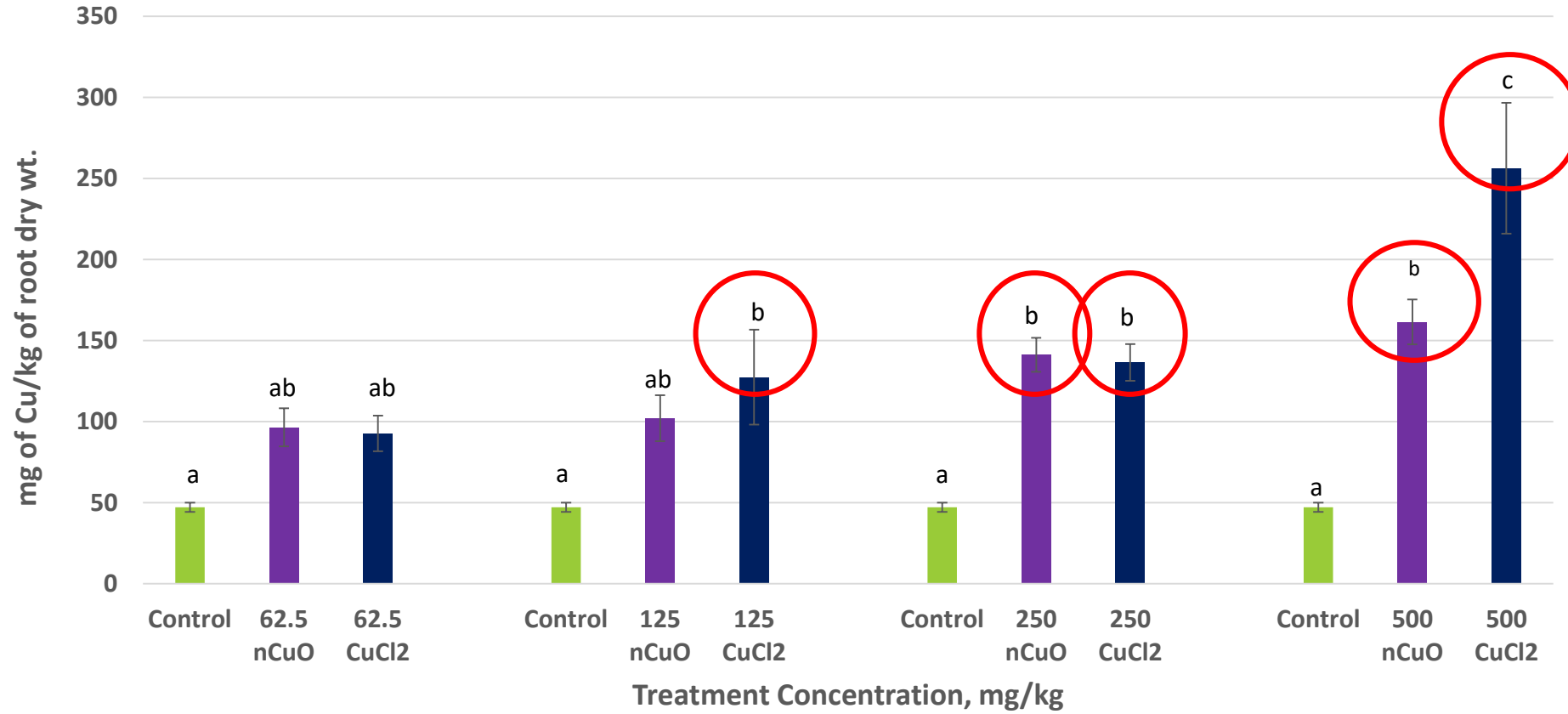
Gas Exchange: Stomatal conductance, nCuO vs ionic copper treatments



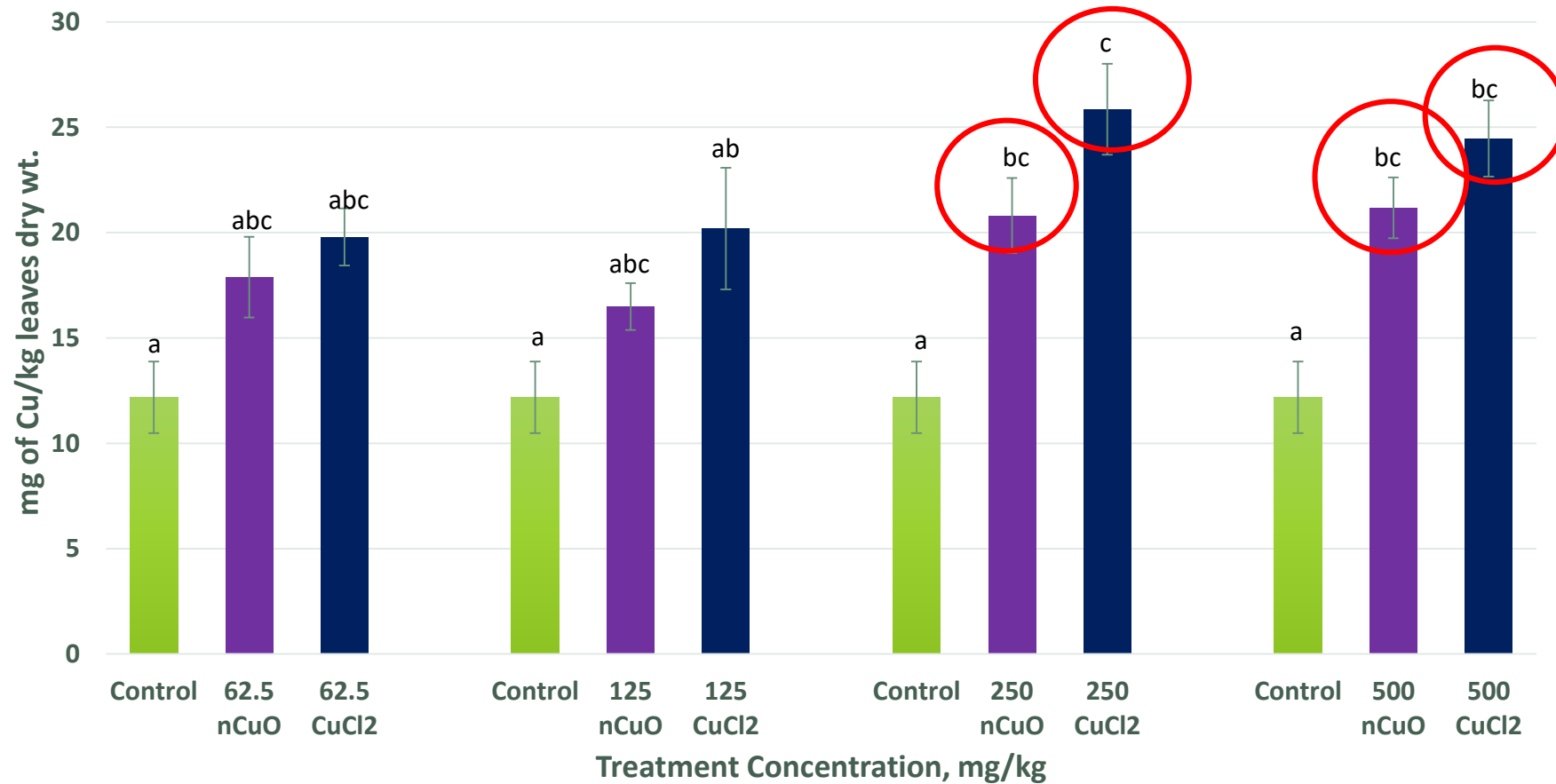
Gas exchange : Photosynthesis, nCuO vs ionic copper treatments



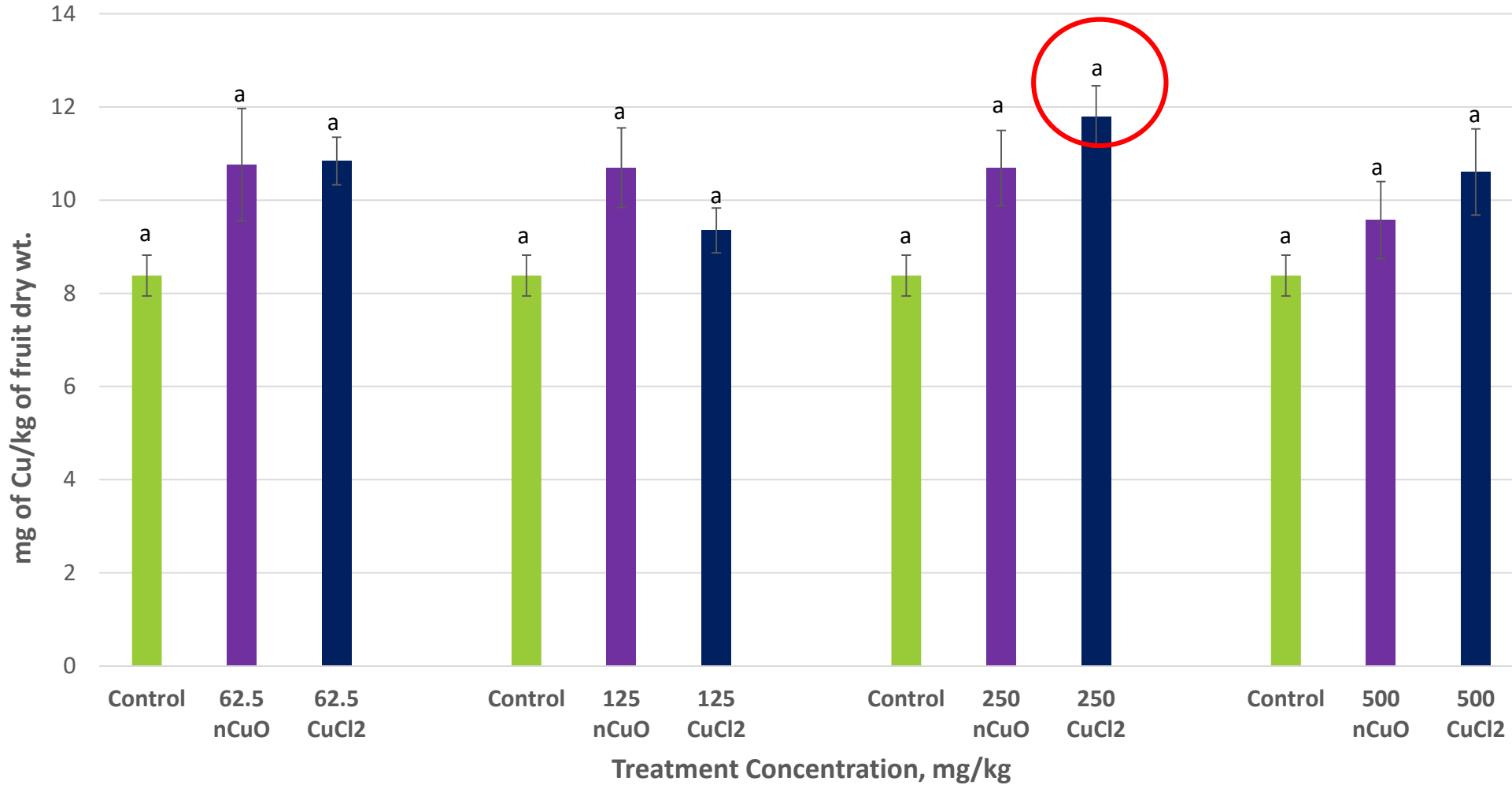
Elemental analysis of root samples, copper



Elemental analysis of leaves samples, copper



Elemental analysis of fruit samples, copper



Conclusions

- Gas exchange : evapotranspiration, stomatal conductance, and photosynthesis were not significantly different with respect to the control but were statistically different with respect to each other at the different concentrations of nCuO and CuCl₂.
- The copper content in root samples was significantly increased at 125 mg/kg CuCl₂ , 250 mg/kg nCuO and CuCl₂, and at 500 mg/kg nCuO and CuCl₂ wrt the control. The two treatments were significantly different at the highest concentration.
- The leaf samples found significantly higher amount of copper at 250 mg/kg and 500 mg/kg concentration of both the compounds wrt the control.
- Significantly higher amount of copper was found in the fruit samples at 125 mg/kg ionic treatment.



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References

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Thank You! Questions ?



**Dr. Gardea's Research Group
Fall 2015**