Copper nanoparticles are an effective tool to increase endogenous nitric oxide and have beneficial effects on lettuce seedlings

Reference	Presenter	Authors (Institution)	Abstract
01-133	Camila Neves Lange	Lange, C.N. (Universidade Federal do ABC); Pelegrino, M.T. (Universidade Federal do ABC); Kohatsu, M.Y. (Universidade Federal do ABC); Seabra, A.B.(Federal University of ABC); Batista, B.L. (Universidade Federal do ABC); Monteiro, L.R. (Instituto de Pesquisas Energéticas e Nucleares); Urzedo, A.L. (Universidade Federal do ABC); Jesus, T.A. (Universidade Federal do ABC); Gomes, D.G. (Universidade Estadual de Londrina); Oliveira, H.C. (Universidade Estadual de Londrina);	Copper oxide nanoparticles (CuO NPs) have been investigated as a solution for agriculture worldwide problems. CuO NPs are efficiently to inhibit several pathogens and they are been commercially used as nanopesticide. In addition, CuO NPs might be promising for plant growth, development and recovery of degraded soils. The molecular pathway leading to these remarkable features of CuO NPs administration may be related to nitric oxide (NO) signaling. NO is a molecular messenger related to abiotic and biotic stress responses. CuO NPs may increase copper ion in plant. The increase of copper ions is well known to decompose S-nitrosothiols (RSNO) and generate NO. Our purpose in this study was to investigate the effect of CuO NPs on lettuce (Lactuca sativa L.) seedlings and the role of NO in its process. CuO NPs were synthesized using green tea extract as the reductor agent. They showed an average size diameter of 6.6 ± 0.2 nm, as assessed by transmission electron microscopy (TEM). The lettuce seedlings were exposed to a wide CuO NPs concentration range of 0.2 to 300 µg mL-1 and the germination rate and radicle elongation were analyzed. CuO NPs concentrations under 40 µg mL-1 showed no phytotoxic behavior to lettuce seedling whereas concentrations equal or above 80 µg mL-1 showed moderate to strong phytotoxic behavior. The optimum concentration was found to be at 20 µg mL-1 which showed an enhancement of germination and radicle growth of lettuce seedling. To evaluate the overall oxidative stress of plant, the enzymes catalase (CAT), ascorbate peroxidase (APX), peroxidase activity (POD) and superoxide dismutase (SOD) were analyzed. SOD levels significantly decreased with the increase of CuO NPs concentration. The SOD enzyme is correlated to decrease reactive oxygen species (ROS), thus the observed toxicity in concentration above 80 µg mL-1 may be linked with higher levels of ROS. In addition, we quantified RSNO and nitrite (NO2-), measured by amperometric analysis, which are indicators of NO presence. RSNO and NO2- levels significantly increased with the increase of CuO NPs concentration. CuO NPs administration was effective to increase NO formation in plant. Low levels of RSNO and NO2- were observed to have beneficial effects

to lettuce seedlings. Thus, CuO NPs concentration is a crucial factor to assurance its beneficial effect and the NO signaling pathway may have an important role underling this process.

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