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Influence of CeO_2 nanoparticles on growth and physiology of sorghum

Linlin Mu (1), Wei-zhen Liang (1), Erin Kinsey (1), Bradley Rauh (2), Stephen Kresovich (2), and Christophe Darnault (1)

(1) Department of Environmental Engineering and Earth Sciences, Laboratory of Hydrogeoscience and Biological Engineering, L.G. Rich Environmental Laboratory, Clemson University, Clemson, SC, USA, (2) Department of Genetics and Biochemistry, Institute for Translational Genomics and College of Agriculture, Forestry and Life Sciences, Clemson University, Clemson, SC, USA

Cerium oxide nanoparticles (CeO_2 NPs) are commonly used as polishing agents for industry and fuel additives to decrease the particulate matter emissions. CeO_2 NPs may be encountered in the soil and water environment through their life cycle or accidental releases, and have potential phytotoxicity effects. Therefore, it is critical to assess the potential effects of CeO_2 NPs in soil on plant growth and physiology. The objective of this research is to determine the physiological responses of three sorghums (Grassl, BtX623 and Rio) to the effect of CeO_2 nanoparticles in potting soil environment. Sorghums were germinated and grown in potting soil in the greenhouse for three weeks cultivation with treatments of 0, 100, 500, 1000 mg CeO_2 NPs per kg soil. Plant parameters, such as length, weight, and biomass of root and leaves were measured in each treatment with 12 replications. After three weeks germination, the sorghum plants were dig out and the roots were examined and scanned by the Silverfast SE Plus scanner to compare and analyze their dimensions and shapes. To further study the growth and physiological changes in plants due to the presence of CeO_2 NPs in soil, one selected type of sorghum (Grassl) was grown under the four different CeO_2 NPs concentration treatments for six months until plant maturity, and was also cut and harvested three times to study CeO_2 NPs effect on plant re-growth. At the end of each growing period, above ground vegetative tissues were air-dried, grounded to 2mm particle size and compositional traits were estimated by using near-infrared spectroscopy. The influence of nanoparticles was observed on some of the plant traits. Preliminary results showed the influence of CeO_2 NPs on the roots growth, as Grassl and Btx623 in 100 $mgkg^{-1}$ treatment grew significantly faster than other concentrations; however no significant difference between control and 100 $mgkg^{-1}$ treatment in Rio. CeO_2 NPs concentration of 100 $mgkg^{-1}$ had no impact on sorghum growth, compared to the control treatment. Results of the six months growth and repetitive cutting experiments indicated that the different treatments, including the presence and/or concentrations of the nanoparticles, impacted some of the compositional traits of sorghum.