

## **Influence of Nanoparticle Properties on Bioavailability in Spring Wheat**

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Nanotechnology has many potential applications in agriculture as both fertilizers and pesticides. However, agricultural systems are complex and nanoparticle (NP) characteristics must be carefully selected to enable efficient delivery and uptake. In these studies we measure the effects of NP dissolution and coating on their bioavailability to Hard Red Spring Wheat. Synchrotron X-ray methods are used to correlate Cu speciation to bioavailability.

CuO NP dissolution rates will depend on soil pH (pH5-pH8). We hypothesize that dissolution is needed for Cu to be bioavailable to wheat. Extractable copper was measured with DTPA and CaCl<sub>2</sub> extraction methods in Lufa 2.2 standard soils with CuO NP and ionic copper amendments. The extractable concentrations in soils were corroborated with XAS analysis of Cu speciation [1]. Dissolution of CuO NPs in bulk amended soil was compared to rhizosphere soil surrounding wheat roots.

Au NPs were selected as a nondissolving control and were coated with an array of polymeric coatings to represent a range of surface charges and hydrophobicities. The relative affinity of NPs for soil particles was quantified via soil porewater extraction. Hyperspectral Microscopy was used to monitor changes to Au NP affinity for root tissues subject to the change in coating material. Soil and root affinity were compared to total Au uptake in soil grown wheat to identify coating materials optimizing plant targeting capability and uptake.

[1] Gao *et al.* (2017), *Environmental Science & Technology* **51**, 2226-2234.