

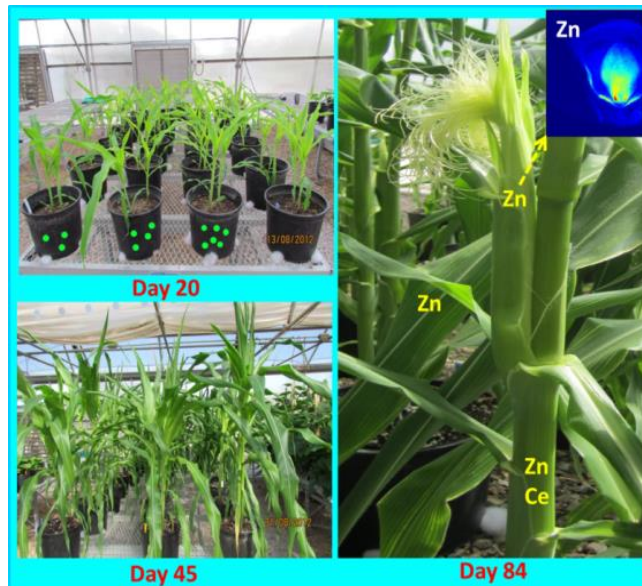
Impact of Nanoparticles on Food Crop Growth and Potential Health Hazard

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BACKGROUND

Engineered nanoparticles (NPs) may be defined as any intentionally produced particle that has a characteristic dimension from 1 to 100 nm and has properties that are not shared by non-nanoscale particles with the same chemical composition. NPs are used in a variety of products such as ceramics, paints, pigments, foods, batteries, and semi-conductors. They are also found in more than 300 sunscreen products currently in the market. Soil and sediments are the ultimate sink for a large portion of NPs through precipitation, irrigation, and sludge disposal. Once in the soil the engineered NPs may be absorbed by plants. If this occurs, plant growth and development in soils with NPs may be affected. Therefore it is important to study the fate and transport behavior of NPs in soils and plants in order to protect our environment and human health. This study investigated two NPs, cerium oxide (CeO_2) and zinc oxide (ZnO). CeO_2 is an oxide of the rare earth metal cerium. Cerium oxide nanoparticles appear in a brown to yellow powder form that are graded as harmful. ZnO is an inorganic compound with a vast array of applications, such as a gas sensor, chemical sensor, bio-sensor, in cosmetics and electrical devices.



Greenhouse study on the interaction between NPs and corn plants. Some uptake locations of Zn and Ce in corn are shown in yellow.

OBJECTIVES

- Determine the impact of CeO_2 and ZnO NPs on the growth and development of food crops.
- Investigate the fate and transport of NPs in plants and soil.
- Evaluate the potential bioaccumulation of these NPs in edible tissue of food crops and potential adverse effect on nutritional quality.

RESULTS AND BENEFITS

- Results of this study indicate neither CeO_2 nor ZnO NPs affected plant photosynthesis or vegetative growth of corn and cucumber plants. However crop yields of corn and cucumber were reduced.
- Significant Ce accumulation in cucumber fruits and Zn accumulation in corn grain and cucumber fruits were found, indicating potential threats in the food chain, in next generation plants and possibly human health.
- CeO_2 NPs did not affect the photosynthesis and vegetative growth of radish plants and mineral nutrients in radish tubers, but improved the antioxidant capacity of radish plants and increased abiotic stress tolerance.
- Knowledge on the fate of these NPs in soils and plants will contribute to the reduction of potential hazard.