# Wheat and barley exposure to nanoceria: Implications for agricultural productivity

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## Abstract

The impacts of man-made nanomaterials on agricultural productivity are not yet well understood. A soil microcosm study was performed to assess the physiological, phenological, and yield responses of wheat (*Triticum aestivum*) and barley (*Hordeum vulgare* L.) exposed to nanoceria (*n*$CeO_2$). The plants were cultivated in soil amended with *n*$CeO_2$ at 0, 125, 250, and 500 mg $kg^{-1}$ (control, *n*$CeO_2$-L, *n*$CeO_2$-M, and *n*$CeO_2$-H, respectively). The accumulation of Ce in leaves/grains and the effects on plant growth and productivity were recorded. Results revealed that Ce did not move to aerial tissues in wheat, but accumulated significantly in barley grains (294% increase in *n*$CeO_2$-M compared to control). Relative to the control, *n*$CeO_2$-H increased shoot biomass by 37% and 331% in wheat and barley, respectively. In the case of productivity, *n*$CeO_2$-H improved yield in wheat by 13%, compared to control, but completely halted grain formation in barley. Additionally, *n*$CeO_2$-M enhanced the concentration of the majority of the nutrient elements (K, P, Ca, Mg, S, Fe, Mn, Zn, and Cu) in barley grains, but only affected the concentration of S and Mn in wheat grains. These findings illustrate that nanoceria can induce either beneficial or harmful effects in wheat and barley, and this result has implications for agricultural production.