



Effects of different zinc nanoparticles on soil and ryegrass

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Zinc (Zn) nanoparticles (NPs) can enter soil environments via a number of routes, including the use of Zn NP-containing biosolids as fertilisers. Plants form the base of many terrestrial food webs and so Zn NP bioavailability in soils and toxicity to plants could have far reaching affects and impact wider ecosystems.

The objectives of this study were to compare the effects of ZnO NPs, ZnS NPs, Zn₃(PO₄)₂ particles and ZnSO₄ on the growth and Zn content of *Lolium perenne* (Dwarf ryegrass) and to evaluate whether the available Zn content of soil treated with the different Zn species was correlated with any observable effects on the plants growing on them.

Soils were spiked with these species at 3 different concentration levels and ryegrass grown on them for a total of 18 weeks. During this time, the grass was harvested 3 times. It was measured and weighed and the Zn content determined. The available Zn content of the soils was assessed weekly.

The results so far have shown that the Zn content of the grass and the available Zn content of the soils spiked with ZnO NPs and ionic Zn (ZnSO₄) are high and very similar to one another, whereas the results from the ZnS NPs and Zn₃(PO₄)₂ particles show significantly lower concentrations.

In recent years, a significant number of studies have looked into Zn NP bioaccumulation and phytotoxicity in a variety of different plant species, however, these studies all use ZnO NPs despite it having been confirmed that ZnS NPs and Zn₃(PO₄)₂ are the main species that are present in biosolids. The results of this study are currently showing that examining the effects of biosolid application using ZnO NPs is likely to give an over estimation of Zn NP dissolution, ionic Zn availability and Zn uptake in plants. There is a growing consensus that research into the release of NPs into the environment needs to begin to focus on realistic conditions and relevant aged species rather than “pristine, as-produced particles” as has often been the case in the past.