Applications of Fertilizer Cations Affect Cadmium and Zinc Concentrations in Soil Solutions and Uptake by Plants

A pot experiment was conducted to study changes over time of Cd and Zn in soil solution and in plants. Radish was grown in a soil which had been contaminated with heavy metals prior to 1961. Constant amounts of a fertilizer solution (NH₄NO₃, KN03) were added daily. Soil solution was obtained at intervals by displacement with water. The cumulative additions of small amounts of fertilizers were made equal to the plants' requirements at the final harvest but were found to exceed them during most of the experiment. Excess fertilizers caused substantial increases of major (K, Ca, Mg) and heavy-metal (Cd, Zn) ions in soil solutions and a decrease in soil pH, probably due to ion-exchange mechanisms and the dissolution of carbonates. Uptake of Cd and Zn into leaves was correlated with the mass flow of Cd (adjusted \( r^2 = 0.798 \)) and Zn (adjusted \( r^2 = 0.859 \)). Uptake of K, Ca and Mg by the plants was independent of their concentrations in solution. It is concluded that, in order to study effects of plants on heavy-metal availability and obtain soil solution that has not been altered by fertilizer ions, nutrients must be added according to the needs and growth of the plants. This could be achieved by linking fertilizer additions to the rate of transpiration, as nutrient uptake and transpiration were closely correlated in this experiment.

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