The acquisition mechanisms, efficiency and ecological impact of a $FePO_4$ nanofertilizer

Nanotechnology is among the most promising technologies being applied in agriculture and various other fields, based on the peculiar surface properties of nanoparticles. Nanofertilizers have been reported to release nutrients more gradually than the bulk equivalent, thereby reducing nutrient losses from soils, enhancing plant NUE and increasing crop yield. The development of a batch and continuous methods for the synthesis of $FePO_4$ nanoparticles offered the opportunity to explore their effects on plant growth and evaluate their attitude to produce a new generation of fertilizers. The ability to deliver Fe and P to maize and cucumber plants was firstly evaluated in hydroponics revealing a behaviour dependent on species-specific metabolic mechanisms. In addition, these nanoparticles displayed a low impact on soil enzymatic activities and bacterial community when tested as P fertilizer in soil and plant-soil system. Root transcriptome analyses carried out in maize and cucumber plants underlined that the impact of nanomaterials on plants depends not only on the characteristics of the nanoparticles but also on the physiological and metabolic specificity of the plant species under investigation, making it challenging to derive generalizable plant responses.