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Zinc and iron oxide nanoparticles improved the plant growth and reduced the oxidative stress and cadmium concentration in wheat

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Abstract

The effects of seed priming with zinc oxide (ZnO) and iron (Fe) nanoparticles (NPs) on the growth and cadmium (Cd) accumulation by wheat (*Triticum aestivum*) were investigated. Seeds of wheat were primed with different concentrations of either ZnO NPs (0, 25, 50, 75, and 100 mg L^{-1}) or Fe NPs (0, 5, 10, 15, and 20 mg L^{-1}) for 24 h by continuous aeration and then the seeds were sown in a soil which was contaminated with Cd due to long-term application of sewage water. Plants were grown till maturity under natural conditions with 60-70% moisture contents of total soil water holding capacity throughout the experiment. Plant height, spike length, and dry weights of shoots, roots, spikes, and grains were increased with NPs, in particular with the higher rates of NPs. The results depicted that NPs positively affected the photosynthesis of wheat as