

Bio-Inspired Synthesis of Nano-Nutrients for Crop Management and Targeted Delivery

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Fifty eight microorganisms responsive to nanoparticle production were developed. An ecofriendly low cost protocol for biosynthesis of nanoparticles (Patent no. 149/DEL/2012) was unfolded. A coating method has been invented for nano-fertilizer production which may be very useful for unstable particles. The bio-synthesized nanoparticles were characterized after using DLS, TEM, EDS, XRD, Zeta Potential, AFM, FTIR, and standardized the optimum concentration, size, shape of nanoparticles to be spread to plants for maximum benefit. Nano-Zn and Fe helps in more stress tolerance, prevention of membrane damage. Nano-Mg helps in more absorption of solar radiation by the plant leaves. In general, 12-54% improvement of grain yield and 18-39% dry matter yield of 11 different crops (cauliflower, tomato, wheat, capsicum, maize, pearl millet, castor, rice, clusterbean, mung bean, moth bean) was observed due to application of nano-nutrients. The nutrient use efficiency by the crops was increased at least three folds. There was 30% more nutrient mobilization in the rhizosphere compared to control. The beneficial enzyme activities in the rhizosphere increased between 18 and 283% due to foliar application of nano-nutrients. No adverse effect was observed on seed germination, soluble protein content, soil microbial population, total RNA in plant tissue, body weight and consumption rate of nano-food to mice and nanoparticle concentration in seeds with the application of standard doses of nano-nutrients. With the recommended doses of application no abnormal clinical signs, behavior activity etc. were observed in animals which received nanotreated test materials. Histopathological analysis for estimating toxicological effect showed no adverse effect on liver, kidney and spleen tissues due to intake of nano-foods.