

Effect of Zinc Oxide (ZnO) Nanoparticles and Biochar on Rice Plants Grown in Flooded Conditions in Buxar, Bihar †

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Abstract: Plants essentially require zinc (Zn) as a micronutrient since Zn is an integral component of several proteins and plays important role in metabolism. Large agricultural areas are Zn deficient, and prolonged flooding conditions further induce Zn deficiency in crops. Rice crops are grown in flooded condition making them prone to Zn deficiency. The goal of this study was to observe the effect of ZnO nanoparticles (NPs) and ZnO-NPs+ biochar on rice crops grown in flooded conditions. The study area was Chausa block in Buxar district, Bihar. Rice crops were treated with 80 mg/L of ZnO-NPs, and biochar was added to soil at a rate of 10 ton/hectare. ZnO-NPs were sprayed at the heading and jointing stage of crop development. Plant growth factors and enzyme activities were studied in control and treated conditions. The results showed a significant increase in plant biomass and total chlorophyll by 17% and 26% in ZnO-NPs and 59% and 42% in ZnO-NPs + biochar concerning control. The decline in electrolytic leakage and malondialdehyde (MDA) content was observed. The enzymes superoxide dismutase (SOD), ascorbate peroxidase (APX), guaiacol peroxidase (GPX), and catalase (CAT) had higher activity in treated crop plants than in control plants. The finding confirms that ZnO-NPs and their combined use with biochar in flooded regions can help to improve the growth of rice crops.

Keywords: ZnO nanoparticles; biochar; chlorophyll; electrolytic leakage; superoxide dismutase; malondialdehyde.

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Conflicts of Interest

The authors declare no conflict of interest.