Copper Oxide Nano-Particles Effects on Plant Growth

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The utilization of nanoparticles in agriculture has gained signiýcant attention due to their potential to enhance plant growth and productivity. Among nanoparticles, copper oxide nanoparticles (CuO NPs) have emerged as a promising candidate for agricultural applications due to their unique physicochemical properties and biocompatibility. In this study, we investigated the e ects of CuO NPs on plant growth, physiological responses, and biochemical parameters of various plant species. Through a series of controlled experiments, we evaluated the impact of CuO NPs on seed germination, seedling growth, root development, photosynthetic e ciency, antioxidant activity, and nutrient uptake in di erent plant species. Our results demonstrate that CuO NPs at appropriate concentrations can positively inþuence plant growth by stimulating seed germination, enhancing root elongation, and increasing biomass accumulation. Furthermore, CuO NPs were found to enhance photosynthetic activity, improve antioxidant defense mechanisms, and facilitate nutrient absorption in treated plants. However, the e ects of CuO NPs on plant growth were found to be dose-dependent, with high concentrations leading to phytotoxic e ects, including inhibition of germination, reduction in growth parameters, and oxidative stress. Therefore, careful optimization of CuO NP concentrations is necessary to harness their beneýcial e ects while minimizing potential adverse impacts on plant health. Overall, our ýndings highlight the potential of CuO NPs as a novel tool for enhancing plant growth and productivity in agriculture. Understanding the mechanisms underlying the interactions between CuO NPs and plants is essential for the safe and e ective utilization of nanotechnology in sustainable crop production systems. Further research is needed to elucidate the long-term e ects, environmental fate, and safety considerations associated with the application of CuO NPs in agricultural settings.

Key ord :

In od c ion

Me hod and Ma erial

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