CHARACTERIZATION AND GERMINATION PERFORMANCE OF LETTUCE SATIVA BY IRON OXIDE NANOPARTICLES SEED PRIMING

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ABSTRACT

The main objective of this research is to characterise the synthesis of chemical iron oxide nanoparticles and investigate the germination performance of *Lactuca sativa (lettuce)*. Fe is important for various processes in plants, such as photosynthesis. One of the problems in this study is that the other methods to synthesise the FeNPs, except the chemical method, have their own disadvantages, such as being difficult to control the size and shape, high cost, and requiring high energy. Hence, the chemical method was chosen to synthesise the nanoparticles in this study. The chemical method reduces the overall cost, has a high yield, and is safe for the environment. The physical and morphological characteristics of FeNPs give them the potential to improve seed germination performance and yield. In this experiment, two salt solutions were chosen as the reducing agents for the chemical method. The other problem is that the higher the concentration of this chemical, the more toxic it is to the plant. Based on the previous studies, the range of concentrations of FeNPs applied to salad is less than 10 ppm.

The transmission electron microscopy characterizations demonstrated that the co-precipitation FeNPs were mainly spherical in shape, with a diameter of 4–21 nm, and the mean diameter was 11.74 nm. The effect of seed priming with different concentrations of FeNPs (1, 2, 4, 6, 8, and 10 ppm) on seedling growth parameters such as germination rate and average shoot and root length varieties was studied on the fifth and eighth days of seedling development. Seed priming with FeNPs increased the germination rate more than control at all studied concentrations. As a result, among the 5 different concentrations, 1 ppm shows the germination rate, average length of root and shoot better than the others. The germination rate of 1 ppm is 80%, compared to control at 70%. 1 ppm FeNPs solution concentration can affect the increase in root and shoot length of *Lactuca sativa (lettuce)* seeds.

Seed priming with FeNPs was nontoxic in comparison to the control, but it decreased chlorophyll content and can be used sustainably to increase nonenzymatic antioxidant capacity during the early phases of *Lactuca sativa (lettuce)* seedling development. Additional research is required to assess the stability of this unique FeNPs priming response during the later phases of plant growth and development in *Lactuca sativa (lettuce)*, as well as the role of FeNPs in the development of resistance to varied biotic and abiotic stimuli. Overall, this study suggests that using FeNPs to prime the seeds of Lactuca sativa (lettuce) can increase crop production and help keep the demand for food production stable.