sciforum-116497: Application of Iron Oxide Nanoparticles and Indole-3-Acetic Acid in Synthetic Seed Technology: Effects on Chrysanthemum Generative Growth, Metabolism, and Genetic Stability

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The increasing role of nanoparticles (NPs) in horticulture is transforming agricultural practices by enhancing plant growth, improving nutrient absorption, and enabling the precise delivery of agrochemicals. However, little is known about the use of NPs in the production of synthetic seeds, a propagation technique particularly valuable for seedless species. This research studied the impact of pure iron oxide nanoparticles (Fe_3O_4 NPs), citrate-stabilized iron oxide nanoparticles (Fe_3O_4CA NPs), and indole-3-acetic acid (IAA) on the genetic stability and metabolic activity of *Chrysanthemum* × *morifolium* (Ramat.) Hemsl. plants obtained from synthetic seeds. For this purpose, axillary buds of chrysanthemum 'Richmond' were embedded in 3% calcium alginate supplemented with NPs and IAA, either singularly or in combination. Next, the synthetic seeds were either stored at 4°C in the dark (for eight weeks) or directly cultured in vitro on an agar–water medium at room temperature for 30 or 60 days. Next, the germinated seeds were transplanted to the greenhouse until the full flowering of the plants. The content of total polyphenols was determined in the leaves and inflorescences of the plants. Moreover, the content of anthocyanins was measured in the inflorescences. RAPD markers were used to assess the genetic stability of plants. It was found that NPs and IAA significantly affected the content of total polyphenols (TCPs) in the leaves of chrysanthemum. Most treatments stimulated the accumulation of these compounds but in a time-dependent manner. No decline in the value of this parameter was reported compared with the untreated control. Conversely, Fe_3O_4NPs and IAA + Fe_3O_4CA NPs stimulated the biosynthesis of polyphenols and anthocyanins in the inflorescences after 30 days of treatment; however, a decline in the content of these compounds was reported after 60 days in most experimental objects, except for Fe_3O_4CA NPs and IAA + Fe_3O_4CA NPs. RAPD analyses confirmed the genetic stability of the resulting plants. This study expands the knowledge on the application of nanoparticles in plant biotechnology.