

Role of Endophytes in Phytoremediation of Heavy Metals: Sustainable Agriculture

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Abstract

Heavy metal stress is also one of the most serious environmental stress which can occur through anthropogenic activities such as mining, smelting of metals, electroplating, gas exhaust, energy and fuel production, fertilizer, sewage and pesticide application, municipal waste generation increased the concentrations of heavy metals in the soils, significantly undermines crop productivity, food safety, and ecosystem health. The heavy metals such as Cd, Cu, Pb, Cr, Zn and Ni are the most common pollutants in the environment, form metal complexes in the soil which cause severe effects on plant life by means of cytotoxicity, mutagenicity and carcinogenicity inhibit the growth and yields of plants. The excessive concentration of these heavy metals significantly affects cellular organelles and damages the components of cell process, disturb the DNA, cell damage and repair functions and also other metabolic functions in the plants. Phytoremediation, a green and sustainable remediation strategy leveraging plants to extract, stabilize, or transform heavy metals in contaminated soils, has emerged as a promising alternative to conventional physiochemical approaches that are often costly, disruptive, and environmentally unsustainable. A new technique for cleaning up a variety of