GANDHIAN YOUNG TECHNOLOGICAL INNOVATION AWARDS

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CONTENTS:

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Nano based soil conditioner for agricultural application

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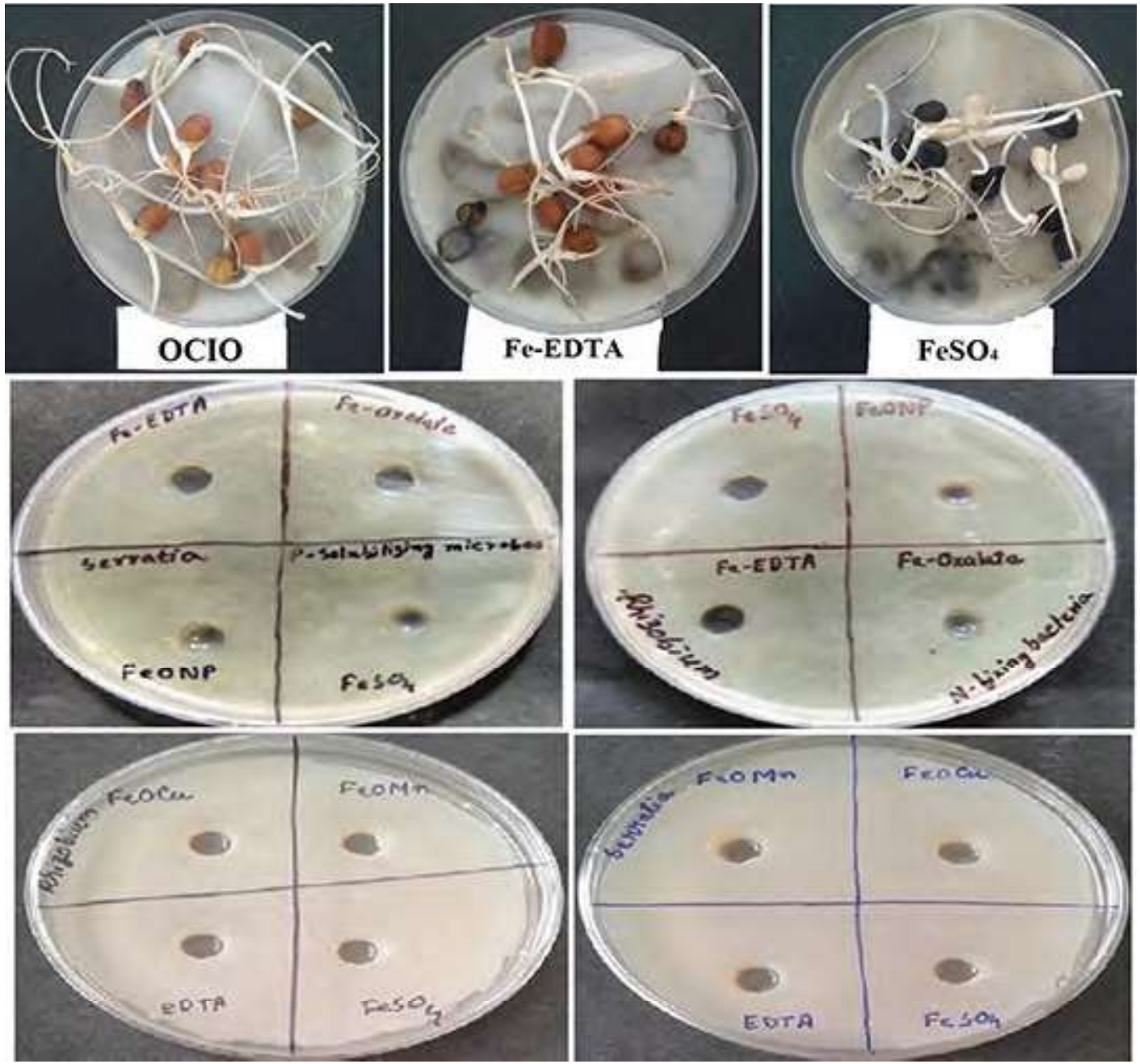
Available forms of iron, copper, and manganese in soil are scarce especially in arid regions where the soil pH varies from neutral to alkaline range, leading to acute deficiency of these micronutrients. Crop production in such soils is severely hindered. Iron salts such as ferrous sulphate has routinely been used to treat Fe deficient soil that greatly affects phosphorous availability and results in soil acidification in the long run. We developed easy, novel, and large-scale synthetic routes (1.5 Kg to 15 Kg in a single batch) to manufacture iron(oxalate) capped metal oxide [Fe(ox)-Fe3O4 (OCIO), Fe(ox)Fe-MnOx (OCIMn), and Fe(ox)Fe-CuOx (OCICu)] nanomaterials that are wonderful soil conditioners for increasing micronutrient availability to plants with least toxicity (Patent application no. 201631010727). Their Moderate (10 ppm) exposure improved seed germination and they were harmless to beneficial soil bacteria. We also recorded negligible oxidative stress in plants up to 50 ppm exposure levels of the nanomaterials. OCIO, OCICu, and OCIMn balance the soil pH; sustain Fe, Cu, and Mn availability without increasing soil acidity thereby promoting release of NPK through benefitting soil microbial health. These nanomaterials corrected micronutrient deficiency in soil and significantly augmented tomato production in farmer's field by upregulation of vital genes responsible for root growth, photosynthesis, and N-assimilation (RSL4, MATE8, Ferredoxin, GS2, GOGAT, and NR). The crop yield was 2.3-3.4 folds greater in OCIO with 10 folds lower dose (2 kg/ha) than Fe-EDTA and FeSO4 (20 kg/ha). Moreover, the quality and storage longevity of the produce was remarkably superior in plants treated with the synthesized materials than conventionally used micronutrient salts (FeSO4, MnSO4, and CuSO4).


OClO
Fe-EDTA
FeSO4
Fe-EDTA
Fe-oxalate
Serratia
P-solubilizing microbes
FeONP
FeSO4
FeSO4
FeONP
Fe-EDTA
Fe-Oxalate
Rhizobium
N-fixing bacteria
FeOCu
FeOMn
EDTA
FeSO4
FeOMn
FeOCu
EDTA
FeSO4