

Supporting document for

**Enhancement in growth rate and productivity of spinach grown in
hydroponics with iron oxide nanoparticles**

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S1. Hydroponic growth of spinach in presence of Fe₂O₃ at different concentrations.

Spinach (*Spinacea oleracea*) seeds were obtained from the market at Madurai, India. Initially the seeds were placed on a solid hydroponic medium consisting of sawdust and coco peat in an artificial chamber and adequate amount of water was added over the solid hydroponic medium to maintain moist condition which is necessary for seed germination³³. After three days, four uniform seedlings selected were anchored by thermocol and transferred into a wide mouth plastic container containing 1000 mL of Hoagland medium. In this study, Fe-EDTA is not used in the Hoagland's medium. The level of the liquid medium is adjusted daily upto a 1000 mL inside the vessel, so that the roots of the plant and solid hydroponic medium are always in contact with the liquid. The spinach grown in hydroponic medium in the absence of Fe₂O₃ nanoparticles was used as control. Similar strategy was used to grow spinach in Hoagland's medium containing different concentrations of Fe₂O₃ nanoparticles such as 100, 150, 200 mg were suspended as micronutrients. Irrespective of the medium, all the plants were kept in the open atmosphere and it was maintained on 11h light/13h dark cycle at ~30°C. The difference in the growth rate was monitored by measuring the root and shoot height once in 15 days upto 45 days.

Table S1: Composition of Hoagland's solution [1,2]

Nutrients	To use mL/L of water
1M $\text{NH}_4\text{H}_2\text{PO}_4$	1mL/L
1M KNO_3	6mL/L
1M $\text{Ca}(\text{NO}_3)_2$	4mL/L
1M MgSO_4	2mL/L
Micronutrients [H_3BO_3 (0.0268g), MnCl_2 (0.0181g), ZnSO_4 (0.0022g) and CuSO_4 (0.0008g)]	2.5 mL/L



Fig. S1 (a) Hydroponic system containing liquid medium with thermocol support and (b) Root emerging out of the perforation.

Ref:

1. D.R. Hoagland and D.I. Arnon. The water-culture method of growing plants without soil. Calif. Agr. Expt. Sta. Circ. 347. 1950.
2. Hydroponics: A Practical Guide for the Soilless Grower