## **Supporting Information:**

## Exploring the chelation-based plant strategy for iron oxide nanoparticle uptake in garden cress (*Lepidium sativum*) using magnetic particle spectrometry

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**Fig. S1**. Zeta potential measurement results for the IONP<sub>10</sub>-EDTA and IONP<sub>20</sub>-EDTA samples.



**Fig. S2.** Photographs of garden cress plants harvested after commercial Fe-EDTA fertilizer treatment with: (a) 500 mg/L, and (b) 5000 mg/L total Fe in hydroponic media, respectively. (c) Comparison of average length (shoot+root) of the treated garden cress plants with n=10 plants per treatment.



**Fig. S3**. Representative photographs of plants before and after  $IONP_{20}$ -EDTA application for 8day (a) and 5-day (b) incubation time periods, and the corresponding plot comparing the average number of resulting matured garden cress plants under different  $IONP_{20}$ -EDTA application time points (c) with n=5 at 10 seeds per pot.



**Fig. S4.** Chlorophyll extraction: (a) leaf samples collected from garden cress from the control, Fe-EDTA,  $IONP_{10}$ -EDTA and  $IONP_{20}$ -EDTA treated groups, respectively; (b) representative photograph of leaves after chlorophyll extraction; (c) chlorophyll samples for absorbance analysis.



**Fig. S5.** Measured MPS signals of the  $IONP_{10}$ -EDTA and  $IONP_{20}$ -EDTA samples in hydroponic media over the course a 1-day and 5-day observation window, demonstrating particle stability during the incubation period adapted in the plant studies.



**Fig. S6.** MPS data collected upon exposure of 5-day old garden cress plants to different sized IONP-EDTA samples containing 500 mg/L Fe: (a) MPS monitoring in hydroponic media over the 5-day incubation period, and (b) daily change in MPS signal for the IONP-EDTA samples in hydroponic media. The error bars were obtained with n= 5 and the insets are enlargements of the low-lying data points.



**Fig. S7.** AAS data collected upon exposure of 5-day old garden cress plants to commercial Fe-EDTA fertilizer and different sized IONP-EDTA samples each containing 500 mg/L Fe. The error bars were obtained with n=5 and the insets are enlargements of the low-lying data points.



**Fig. S8.** Comparison of the MPS signal obtained from the IONP<sub>20</sub>-EDTA sample at different sample matrices. (a) Representative MPS signal of IONP<sub>20</sub>-EDTA samples with 500 mg/L Fe in hydroponic media and 3% agarose gel matrices, respectively, with the 3% gel serving as the MPS sample blank. (b) Corresponding calibration curves for the IONP<sub>20</sub>-EDTA samples in the two different matrices averaged over 3 measurements.

IONP	Average	IONP	Density of	Mass of	Moles of	Moles of Fe	Mass of
Sample	Diameter	Volume	magnetite	magnetite	magnetite	(mol)	Fe/NP (g)
	(nm)	(m³)	(kg/m³)	(kg)	(mol)		
IONP <sub>10</sub> -EDTA	9.9	5.08 x 10 <sup>-25</sup>	5170	2.63 x 10 <sup>-21</sup>	1.12 x 10 <sup>-20</sup>	3.37 x 10 <sup>-20</sup>	1.88 x 10 <sup>-18</sup>
IONP <sub>20</sub> -EDTA	19.5	3.88 x 10 <sup>-24</sup>	5170	2.01 x 10 <sup>-20</sup>	8.59 x 10 <sup>-20</sup>	2.58 x 10 <sup>-19</sup>	1.44 x 10 <sup>-17</sup>

 Table S1:
 Estimated
 mass of Fe for each IONP-EDTA sample.