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_{10}-EDTA and IONP_{20}-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 IONP20-EDTA application for 8-day (a) and 5-day (b) incubation time periods, and the corresponding plot comparing the average number of resulting matured garden cress plants under different IONP20-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\textsubscript{20}-EDTA sample at different sample matrices. (a) Representative MPS signal of IONP\textsubscript{20}-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\textsubscript{20}-EDTA samples in the two different matrices averaged over 3 measurements.
**Table S1:** Estimated mass of Fe for each IONP-EDTA sample.

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