

## Studies into the uptake and distribution of metal oxide nanoparticles in plants

"The collaboration has allowed us to apply expertise in mass spectrometry to an industrially relevant area in seed enhancement, springboarding further research into the area of nutrient delivery." Croda Europe

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**OUTCOMES:** Two samples of barley seeds coated with zinc oxide particles and different seed treatments were prepared by Croda. Seeds from each sample were germinated at Sheffield Hallam University and harvested at different growth points. The selected germinated seeds were embedded in gelatin, cryosectioned and then analysed by LA-ICP-MS. Untreated, germinated seeds were used as the control. The results provide a two-dimensional 'map' (figure) showing the location of the zinc within the seed at different time points throughout its germination. The results clearly show that as the seed is germinated the zinc is transported from the coating applied to the surface and into the shoot of the seedling. The results are being used by Croda to assess the effectiveness of their products that are used in commercial seed coatings, including surfactants, adjuvants and formulation aids, on the uptake of metals by plants

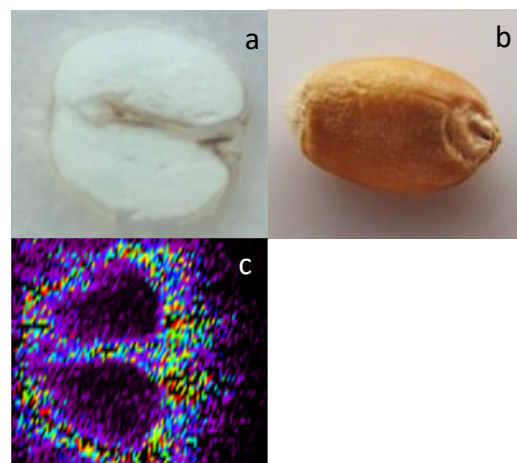


Image of (a) un-germinated seed, (b) section of treated seed tissue, and (c) LA-ICP-MS image showing distribution of zinc in seed tissue.

**INITIAL AIMS:** The uptake of metals is essential for the growth and development of healthy plants. Plants obtain the metals they need from soil or from fertilizers applied to the growing plant. One of the most important metals is zinc, which is found in many metalloenzymes. Zinc is also essential for humans who gain it from dietary grains and vegetables. In this project we will study the effect of zinc, in the form of a formulation containing zinc oxide, on the growth of plants and use a new analytical tool — known as laser ablation-Inductively coupled plasma-mass spectrometry (LA-ICP-MS) — to study the uptake and distribution of zinc in plants.

- Results used by Croda to assess the effectiveness of products used in commercial seed coatings on the uptake of metals by plants
- Innovate UK funding won to advance the work
- Croda awarded a BBSRC iCase studentship to continue the work