

Mass spectroscopy imaging of plant - fungi interactions: Understanding symbiosis for sustainable crop production

Supervisory team:

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Submit applications for this project to Rothamsted Research

Project description:

A major limitation to plant growth is restricted access to nutrients in the soil. To improve nutrient acquisition, most land plants enter a beneficial symbiosis with arbuscular mycorrhizal (AM) fungi. In return for mineral nutrients, plants deliver fixed carbon to the obligate biotrophic fungus. Nutrient exchange takes place through highly branched hyphal structures called arbuscules that form in the inner cortical cells of the root. Incomplete understanding of the mechanism underlying this symbiosis makes it difficult to exploit for plant crop improvement. Accommodating fungal hyphae requires the extensive transcriptional reprogramming of root cells. Lipids are transferred from the plant to the mycorrhizal fungi, which are fatty acid auxotrophs. Lipids are a major source of organic carbon delivered to the fungus, accumulating as lipid droplets, however the spatial localization of this exchange currently is lacking. Using high spatial-resolution mass spectrometry imaging (MSI), the identity and spatial localisation of lipids in plant root cortical cells and in fungal hyphae will be revealed. A recent discovery made at Rothamsted Research that plants supply lipids to arbuscular mycorrhiza was a paradigm shift. MSI will now provide a complete spatial understanding of lipid exchange by comparing wild type and mutant plants and allow us learn how to facilitate this process for agricultural benefit.