Microbial Solutions for Tackling Herbicide-Resistant Weeds

Supervisory team:
Rothamsted supervisor: Dr Dana MacGregor (Rothamsted Research)
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Host institution: Rothamsted Research (Harpenden)
Submit applications to this project to University of Bath

Project description:
As a formidable threat to food security, herbicide-resistant weeds demand a ground-breaking response. At Rothamsted Research, we are exploring novel and sustainable approaches to managing herbicide resistant weeds. This project centres around the potential to use soil microbes as a sustainable alternative to conventional methods, asking if they are able to specifically hinder the growth of the weed without harming the crop. Although knowing they can inhibit growth is useful, uncovering the molecular mechanisms of how they do it is the ultimate goal for this project. To accomplish these tasks, you will use established protocols and pipelines in our state-of-the-art molecular laboratories and plant growth facilities challenging panels of soil microbes against two types of plants, field-collected populations of the agricultural weed black-grass and Multiparent Advanced Generation Inter-Cross (MAGIC) Arabidopsis lines. Once effective combinations are identified, you will then explore the molecular mechanisms of both sides of the plant-microbe interaction; those that allow these microbes to alter plant growth and those that allow the plant to respond to the microbes.

The first rotation of this project tests which soil microbes from our collection would be useful as novel plant-growth inhibitors targeting the UK's most problematic herbicide-resistant weed, black-grass, but not the crop it grows in, wheat. Rothamsted has a comprehensive collection of wheat and black-grass that are already well characterised, providing an ideal panel of plants to use to test field-relevant efficacy of these microbes. The second rotation will be at the University of Bath where you will then test a select subset of microbes against the Arabidopsis MAGIC lines to identify quantitative trait loci (QTL) or quantitative trait nucleotides (QTN) that are correlated with growth inhibition. For the remainder of the project you will work at Rothamsted functionally validating the QTL/QTN identified in Arabidopsis and black-grass and studying the microbes themselves using established genomic and metabolomic pipelines to identify what is unique for the ones able to repress plant growth. This multidisciplinary project combines the expertise of each of the three supervisors to solve the real-world problem of herbicide resistance, one of the greatest threats to food security.

Our aim as the SWBio DTP is to support students from a range of backgrounds and circumstances. Where needed, we will work with you to take into consideration reasonable project adaptations (for example to support caring responsibilities, disabilities, other significant personal circumstances) as well as flexible working and part-time study requests, to enable greater access to a PhD. All our supervisors support us with this aim, so please feel comfortable in discussing further with the listed PhD project supervisor to see what is feasible.