PhD Project Advertisement

Project title: Developing drought resistance and building soil carbon through optimising root traits in oats
Project No: FBS2023-47-Rickson-ca

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Project description:

Lack of rainfall is a growing threat to global agricultural productivity, with droughts expected to increase in both frequency and severity in many parts of the world, including the UK. This represents a major threat to the food security of a growing global population. Attempts to mitigate drought through interventions such as irrigation, however, may have long-term sustainability problems. Developing crops with rooting traits which increase their ability to extract water from the soil under drought conditions, whether through changes in root architecture or the rhizosphere environment, has considerable potential as a tool for increasing crops' resistance to drought. These traits may also increase carbon inputs into the soil and therefore help to rebuild agricultural soil carbon stocks, an important target for achieving net zero carbon in agricultural and food systems. We do not, however, have a robust understanding of how to best use root traits to increase drought tolerance or soil carbon sequestration – or the impacts of these traits on other aspects of the wider crop-soil-water system, such as overall yields in both drought and normal growth conditions.

This project will use oats as a model cereal crop to increase our understanding of

a) which root traits can increase crop resistance to drought;
b) whether these traits can also increase soil carbon inputs; and
c) the trade-offs between traits for drought resistance and crop yield, under drought and normal growth scenarios.

A series of trials will test oat genotypes with different rooting traits for the potential to promote drought resistance and increase carbon inputs to the soil. A large-scale trial using controlled-environment facilities will compare the most promising genotypes with conventional oat varieties in both non-drought and drought-stressed scenarios. Cutting-edge multi-spectral scanning techniques will be used detect drought stress, coupled with measurements of physical and biochemical root traits, soil carbon inputs, and crop yields. The project outcomes will have important implications for how to best develop drought resistance in cereal cropping systems, alongside critical understanding regarding the broader impacts of traits for drought resistance across the crop-soil-water system.

Training opportunities:

This is a great opportunity to work at the intersection of crop and soil science, and gain experience in an area of growing importance to international food security. The student will develop skills essential for addressing problems involved in improving agricultural resilience in the face of abiotic stress, including the use of cutting-edge sensors to remotely detect signs of stress. They will be working alongside a leading oat breeding program and will develop skills in plant breeding and genetics, and will gain an understanding of the process of developing new oat varieties and identifying traits for breeding targets. Alongside this they will gain experience using a broad range of crop- and soil-science analytical techniques, in additional to training in statistical analyses. They will join over 50 PhD students in the Cranfield Environment and Agrifood Theme, including students from other UKRI-funded doctoral training centres, and will have access to a full range of training modules in research skills.

Student profile:

This studentship is available only to individuals who are eligible for UK/home student fees status. The project is ideal for a prospective student interested in plant-soil interactions and how to use these to promote drought resistance in agroecosystems, alongside a holistic systems approach to understanding the potential trade-offs and broader effects of these plant traits. It will explore cutting-edge questions in crop and soil sciences, and research outcomes may lead to practical improvements in drought resistance in oat (and wider crop) systems. We encourage applications from students with degrees in agronomy, biology, crop science, environmental science, plant science, soil science or other relevant disciplines, with a minimum 2:1 BSc honours degree.

Stipend (Salary):

FoodBioSystems DTP students receive an annual tax free stipend (salary) that is paid in instalments throughout the year. For 2023/24 this will be £18,622 and this will increase slightly each year at rate set by UKRI.

Equality Diversity and Inclusion:

The FoodBioSystems DTP is committed to equality, diversity and inclusion (EDI), to building a doctoral researcher (DR) and staff body that reflects the diversity of society, and to encourage applications from under-represented and disadvantaged groups. Our actions to promote diversity and inclusion are detailed on the FoodBioSystems DTP website.

In accordance with UKRI guidelines, our studentships are offered on a part time basis in addition to full time registration. The minimum registration is 50% FT and the studentship end date will be extended to reflect the part-time registration.

For up to date information on funding eligibility, studentship rates and part time registration, please visit the FoodBioSystems website.