

## PhD Project Advertisement

**Project title:** Seed microbiome engineering: a route to sustainable agriculture

**Project No:** FBS2024-052-Kourmpetli-ca

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### Project description:

Plant seeds are hosts to a diverse community of microorganisms, some of which are present within the seed tissues (endophytes) and others restricted to their surface (epiphytes). These microorganisms have evolved alongside their plant hosts and can be beneficial to the developing plant. In many cases specific plant-microbe associations have been shown to improve germination and establishment in the field as well as enhancing biotic and abiotic stress tolerance.

Commercial seed production systems and practices, however, generally involve steps to 'clean' the harvested seeds (e.g. using hot water treatments, or application of disinfectants). Although these steps are critical for eliminating key pathogenic microorganisms, they also eliminate potentially beneficial seed epiphytes too, making the developing plants more dependent on fertilizers and pesticides, and potentially more vulnerable to unfavourable environmental conditions. Harnessing the power of seed microbial communities to enhance seed germination and ensure vigorous early establishment could reduce the need for agrochemical inputs in agricultural systems, leading to a more sustainable food production.

The Aim of this project is to understand the role of seed microbial communities in enhancing germination and establishment of parsnip seeds and develop an 'enhanced microbiome' application for improved performance in the field.

Parsnip has been selected as an understudied crop of economic importance for the UK and the project's industrial partner.

The project will be delivered through four specific objectives:

**Objective 1.** Assessment of the diversity and abundance of bacteria and fungi present on the seed coat (epiphytes) and internal tissues (endophytes) of parsnip seeds using next generation sequencing technologies.

**Objective 2.** Evaluation of the effect of single microorganism applications on the germination and establishment of parsnip under favourable and water limiting conditions.

**Objective 3.** Evaluation of the effect of microorganism combinations on the germination and establishment of parsnip.

**Objective 4.** Testing of 'enhanced microbiome' seed applications under field conditions.

This is an exciting opportunity for a student interested in plant-microbe interactions that wants to be involved in shaping the future of seed treatments, as they will be working closely with the UK's leading independent seed specialists, Elsoms Seeds.

### Training opportunities:

The student will benefit from a 3-month placement at Elsoms Seeds, where they will receive training in all aspects of seed technology and seed production. At Cranfield they will receive training on seed physiology, microbiology, development of seed treatments, molecular biology (isolation and handling of DNA) and biochemistry (extraction and quantification of phytohormones). They will also have in-house training at Aberystwyth University to improve their bioinformatics analysis skills by attending specialised modules and workshops.

The student will also be able to attend relevant modules of the Agrifood MSc Programme at Cranfield, such as, 'Exploratory Data Analysis and Essential Statistics Using R', 'Technologies for Crop Protection and Seeds', 'Principles of Sustainability', and 'Agrifood Business Innovation'.

Emphasis will be given to personal development and core research skills training. Relevant courses are regularly provided by the Cranfield Doctoral Research Core Development programme. Examples include (but are not limited to) training on 'Research Ethics', 'Data Management', 'Communication Skills' and 'Time Management'.

They will also have the opportunity to develop their teaching and supervision skills by being involved in MSc laboratory practical demonstrations and the supervision of relevant MSc research projects.

### Student profile:

We are looking for an individual with a BSc or MSc in microbiology, plant sciences, crop sciences, biology or other closely related subject. The work will involve generating and managing large datasets, so good organizational skills and analytical ability would be essential. A strong interest in crop improvement and/or seed technology would also be required.

### Stipend (Salary):

FoodBioSystems DTP students receive an annual tax free stipend (salary) that is paid in instalments throughout the year. For 2023/24 this is £18,622 and it 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](#).**