PhD Project Advertisement

Project title: AI-BeanTech Unlock the Potential of Faba Beans in Sustainable Agriculture and Nutrition!
Project number: FBS2024-083-Doonan-ar

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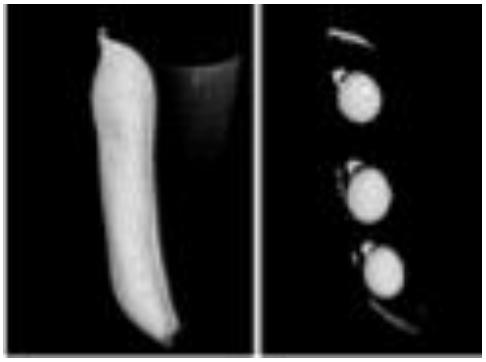
Project description:



Faba beans are a nutritional powerhouse, offering high protein benefits for both humans and animals. As a nitrogen-fixing legume suited for UK cultivation, they hold the key to more sustainable farming practices. The surge in demand for plant-based foods presents a unique opportunity to propel faba beans into the limelight as a staple in Western diets, reducing our reliance on meat and dairy products.

Our research focuses on seed-related traits, which are central to faba bean consumption. Nutritional composition, including protein, lipid, and carbohydrates, shapes the quality and end-use of these beans. However, many other factors influence the success of a faba bean variety as a commercial crop.

We've taken the first steps by creating a diverse faba bean collection in Reading, complete with genome sequencing (Jayakodi et al 2003). Harnessing the power of Artificial Intelligence, our project builds on breakthroughs from brassica seeds and cereal grains. State-of-the-art imaging technologies, like microCT scanning and hyperspectral imaging, allow us to explore the intricate details of seed tissues, rapidly unlocking the secrets of compositional variation.

Building on these technological advances, this project will utilize seeds and pods from ongoing research in Reading and Aberystwyth. We'll explore the overarching hypothesis that valuable variation exists within the diversity of faba beans and can be quantified efficiently using non-destructive, high-throughput methods. If you are an aspiring UK undergraduate biology student with a passion for sustainable agriculture and a desire to make a difference in the world of food systems, join our exciting PhD project, where you'll delve into the fascinating world of the faba bean!

Training opportunities:

1. **Machine Learning Tools**: Together we'll develop deep learning protocols, training neural networks to recognize and quantify features related to yield, quality, and compositional variation. These networks will provide a deeper understanding of bean traits.

2. **Co-registration Across Imaging Modalities**: To validate AI outputs, we'll use traditional methods to assess tissue dimensions and chemical composition. This involves CT scanning and hyperspectral imaging, combined with near-infrared spectroscopy to analyze seed protein content.

3. **Verification of Concept**: Establish whether novel traits are associated with genetic variation, will validate the approach and provide you with expertise in molecular genetics and breeding science.

Opportunities for exchange visits with our colleagues working on faba beans in Europe, China and the USA will occur during the project.

Student profile:

We are looking for highly motivated candidates who should have (or expect to achieve) a minimum of a 2.1 Honours degree in a relevant subject area related to biological sciences, computer science or agriculture, with an interest in working across disciplines. Other applications may be be considered providing they have significant relevant outputs/experience, such as publications.

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.**

References:

Jayakodi, et al (2023) The giant diploid faba genome unlocks variation in a global protein crop Nature 615, 652-659
Hughes et al. (2019) µCT trait analysis reveals morphometric differences between domesticated temperate small grain cereals and their wild relatives. Plant J. 99:98-111. doi: 10.1111/tpj.14312.

Hamidinekoo, et al., (2020) DeepPod: A Convolutional Neural Network Based Quantification of Fruit Number in Arabidopsis. GigaScience 9 (3), giaa012

Adamski et al. (2021) Ectopic expression of *Triticum polonicum VRT-A2* underlies elongated glumes and grains in hexaploid wheat in a dosage-dependent manner The Plant Cell 33 (7), 2296-2319

Google Scholar link for Doonan Lab. https://scholar.google.com/citations?user=6KcPHw8AAAAJ&hl=en

Google Scholar link for O'Sullivan Lab
https://scholar.google.com/citations?hl=en&user=ow2rxK8AAAAJ&view_op=list_works&sortby=pubdate

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