

FoodBioSystems DTP - PhD Project Advertisement Text

Project Title: FOODBIOSYSTEMS - Genetics of root vigour in tomato

Lead Supervisor: [Prof. Andrew Thompson](#), Soil and AgriFood Institute, Cranfield University

Email: a.j.thompson@cranfield.ac.uk

Co-Supervisors: [Prof. John Doonan](#), Aberystwyth University; [Dr Zoltan Kevei](#), Cranfield University; [Dr Fady Mohareb](#), Cranfield University

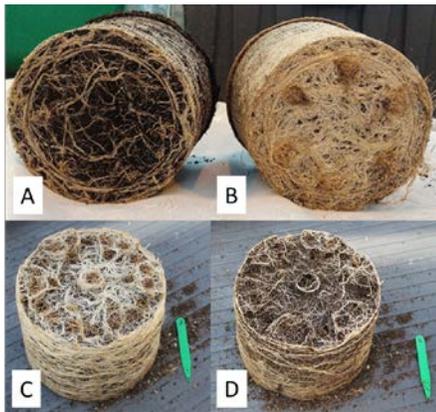
Research Group: FOODBIOSYSTEMS BBSRC DTP

Project ID: FBS2020-41

Application Deadline: 6 March 2020

Project Description:

Background. Crop root systems provide a new focus for breeding varieties with greater sustainability and resilience; roots function to capture nutrient and soil resources, and provide anchorage and resistance to multiple soil-borne diseases, they also sequester carbon into the soil profile. The ability to combine the best root traits into elite varieties is the key to reducing water and fertilizer inputs and to eliminating soil fumigation practices; the latter is often used by growers when disease pressure is high, but may have negative consequences for soil health. For fresh-market vegetable crops such as tomato, pepper and melon, breeding for root traits is more specialized because they are produced from plants where different scion and rootstock genotypes are grafted together to surgically combine useful shoot and root traits. Breeders select rootstocks genotypes visually based on high root vigour, and then combine other essential traits like disease resistance by crossing and selecting with DNA-based markers (Thompson et al. 2017). This process would be much easier if the genetic basis for root vigour was understood and markers for root vigour were available.



Root vigour of selected germplasm

A and B and parental lines: A, low vigour parent; B, high vigour parent; C and D are two individuals from an F2 population showing strong segregation for root vigour. The roots have been exposed from fruiting plants grown in 30 cm pots.

The aim of this studentship is to identify novel genetic loci and mechanisms for use in breeding enhanced root vigour in tomato. The project is divided into two parts. Firstly, the student will follow-up the recent exciting findings of a novel locus controlling root vigour that is related to carbohydrate partitioning in the roots, here we seek to understand the mechanism. Secondly, we will seek to discover other new genetic loci controlling root vigour with a forward genetic strategy exploiting pre-selected germplasm (see Figure) and the full power of

modern sequencing and genotyping technologies coupled with bioinformatics and root phenomics. The supervisory team provides internationally recognized expertise in tomato genetics, genomics and bioinformatics (Cranfield) and in plant phenomics (Aberystwyth).

Funding Notes: This project is part of the FoodBioSystems BBSRC Doctoral Training Partnership (DTP), it will be funded subject to a competition to identify the strongest applicants. Due to restrictions on the funding, this

studentship is only open to UK students and EU students who have lived in the UK for the past three years.

The FoodBioSystems DTP is a collaboration between the University of Reading, Cranfield University, Queen's University Belfast, Aberystwyth University, Surrey University and Brunel University London. Our vision is to develop the next generation of highly skilled UK Agri-Food bioscientists with expertise spanning the entire food value chain. We have over 60 Associate and Affiliate partners. To find out more about us and the training programme we offer all our postgraduate researchers please visit

<https://research.reading.ac.uk/foodbiosystems/>.

Training opportunities: The student will be trained in molecular biology, plant transformation, high-throughput genotyping and root trait phenotyping at Cranfield University. A six month visit to Aberystwyth University's [National Plant Phenomics Centre](#) will allow training in image-based root trait phenotyping. Comprehensive training will also be given in bioinformatics to enable next-generation sequencing analysis, e.g. for genotype-by-sequencing, genetic mapping and for the survey and assessment of genetic polymorphisms. This combination of laboratory and bioinformatics skills is highly sought by agricultural research organizations and seed businesses.

Student profile: BSc degree related to biological sciences with knowledge of molecular biology, genetics and statistics, and an interest in plant breeding. General practical experience in a laboratory environment would be an advantage. The student should have an aptitude for data analysis and computer programming, although full training will be given.

References:

[Thompson, A.J., Pico, B., Yetisir, H., Cohen, R., Bebeli \(2017\) Rootstock breeding: current practices and future technologies. Chapter 3 in Vegetable Grafting: Principle and Practices \(ed G. Colla, F. Perez-Alfocea and D. Schwarz\). CABI, Wallingford.](#)