FoodBioSystems DTP - PhD Project Advertisement

Project title:

FBS2021-70-Sakrabani: Evaluating the efficacy of novel green fertilisers using carbon capture and utilisation technology to improve soil health and grain quality.

Lead supervisor:
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Project description:

Carbon dioxide is one of the greenhouse gases, in addition to nitrous oxide and methane, which is contributing towards climate change. One way to mitigate the high levels of carbon dioxide in the atmosphere is to capture it into the terrestrial environment. This is the technology (known as carbon capture and utilisation) which will be deployed in this project, provided by a company known as CCm Technologies. In this project the carbon dioxide present in the atmosphere will be captured into organic waste material such as food waste, agriculture residues and water treatment. The reactions between the captured carbon dioxide into the organic waste converts it into a renewable source of fertiliser. Since chemical fertiliser production is highly energy intensive, generating greenhouse gas emissions, an alternative fertiliser source will provide a more sustainable option for agriculture.

This project offers a fantastic opportunity to a suitable candidate to evaluate the efficacy of this fertiliser building on an existing field trial site established in September 2020 at the Luton Hoo Estate in Bedfordshire where field scale plots are being evaluated to meet nutrient demand of winter wheat and winter barley in a fully randomised and replicated crop trial. There will also be root imaging carried out to determine below ground carbon storage. Root architecture using root scanners will be determined by inserting tubes into the ground to take images on growth and used to measure root mass and density.

The focus of the PhD will be on the mechanisms of how carbon storage in soil promotes nutrient mineralisation to encourage uptake by crops to improve grain quality. Phosphorus taken up by crops will be stored in grains as phytate but binds strongly to Fe and Zn which are key micronutrients needed for human health causing a challenge to ensure grain quality meets nutritional needs. This project will unravel the scientific questions on how to strike a balance between making grain quality nutritious to meet human dietary needs and the impact on soil health due to the application of a more sustainable, green fertiliser. This project is very timely as it targets current policies such as the Climate Change Act, Net Zero, the Circular Economy, the Agriculture Bill and Defra 25 Year Environmental Plan.

This project will be led by Cranfield University with support from Aberystwyth University and brings together an excellent supervisory team with complementary skills including in soil and crop science to jointly tackle a significant scientific challenge. The involvement of an industrial sponsor, CCm Technologies, and a commercial farm, Luton Hoo Estate, creates a golden opportunity for industry practitioners to work with leading scientists in this field and provide an excellent training environment for the training of a PhD in addressing a significant challenge for agriculture. The student will be trained as a well-balanced research scientist with an excellent exposure to commercial scale operations.

In addition, there will also be opportunities to be trained in using specialist equipment and facilities to investigate fundamental interactions when fertiliser is applied to soils, to present the work in conferences and at scientific meetings both in the UK and abroad.

Training opportunities:

The student will have the opportunity for training of up to 3 months during the PhD at CCm Technologies with access to its pilot plant in Swindon to familiarise themselves with the fertiliser production processes including carbon capture technology and use of suitable feedstocks, process equipment and operational sites to allow real world commercial insight. There will also be an opportunity to engage with Luton Hoo Estate which operates a commercial farm where the field trial is currently located and to become familiar with farm scale operations of soil and crop husbandry. This is also a fantastic opportunity for the successful candidate to use specialist facilities of the Science Technology and Facilities Council such as access to the neutron computed tomography (NCT), Raman Spectroscopy and possibly muonic X-Rays to carry out more detailed physical and chemical characteristics of fertiliser pellets. The student will also be trained on plant phenotyping at the National Plant Phenomics Centre at Aberystwyth University.

Student profile:

Applicants should hold a minimum of a UK Honours Degree at 2:1 level or equivalent in subjects such as Soil Science, Environmental Science, Plant Science, Agronomy, Geography or Chemistry. Applicants with experience in carrying out field scale trials will be beneficial. It would also be desirable for candidates to have an MSc in the above subjects.

Funding particulars:

This project is co-funded by CCm Technologies as a CASE industry sponsor who will provide access to fertiliser and specialist training. The project is part of the FoodBioSystems BBSRC Doctoral Training Partnership (DTP), it will be funded subject to a competition to identify the strongest applicants.
The studentship is open to UK and international students (including EU countries) however due to funding rules, no more than 30% of the projects can be allocated to international students.
The funding will include a tax free stipend (minimum £15, 285 per year), support for tuition fees at the standard UK rate (currently £4,407 per year) and a contribution towards research costs. **Please note** that the host universities have not yet confirmed the level of fees charged to international students funded by the DTP. Fee levels may vary across the institutions. This information will be shared on the FoodBioSystems DTP website as soon as it becomes available.

To apply
Please go to FoodBioSystems DTP website for information on how to apply for this studentship. The closing date for applications will be 8 February 2021.