PhD Project Advertisement

Project title: Evaluating efficacy of organo-mineral fertilisers to improve soil health and grain quality
Project No: FBS2022-57-Sakrabani-ca

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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. Fertiliser production is dependent on fossil fuels requiring high energy demand which contributes towards release of greenhouse gases. One option is to utilise organic waste material and a reduced amount of mineral fertilisers, collectively known as organo-mineral fertilisers (OMF). OMFs can not only reduce the demand for mineral fertilisers but also contribute to soil health. Intensive agriculture results in degradation of soil health and requires sustainable options to boost it.

This project offers a fantastic opportunity to a suitable candidate to evaluate the efficacy of OMF in field scale plots at various locations in the UK in collaboration with Yara. Yara is one of the largest nitrogen fertiliser producers in the world and very keen to explore use of OMF as one of its portfolio of products. 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.

Training opportunities:

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, Yara and commercial farms 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.

Student will have the opportunity to be based for 3 months during the PhD at Yara in association with trial sites in Lincolnshire, Suffolk and Yorkshire. There will also be an opportunity to familiarise with carbon capture technology of CCm Technologies plant based in Swindon to better understand the fertiliser production technology. This will provide direct insight on the fertiliser production technology including carbon capture, associated processes to select suitable feedstock and its characterisation.

There will also be opportunities to be trained on using AAS, ICP-MS for heavy metal analysis, Elementar for carbon, segmental flow analyser for nitrate and spectrophotometer for phosphorus analysis. The student will also attend MSc modules in soil science, plant genetics and food quality, if required.

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 muonic X-Rays to carry out more detailed elemental analysis present in the organo-mineral fertilisers. 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.

References:

Antille DL, Godwin RJ, Sakrabani R, Seneweera S, Tyrrel SF & Johnston AE (2017). Field-scale evaluation of biosolids-derived organomineral fertilizers applied to winter wheat in England, Agronomy Journal, 109 (2) 654-674.

Pawlett M, Deeks LK & Sakrabani R (2015). Nutrient potential of biosolids and urea derived organo-mineral fertilisers in a field scale experiment using ryegrass (Lolium perenne L.), Field Crops Research, 175 56-63.

Deeks L.K., Chaney K., Murray C., Sakrabani R., Gedara S., Le MS, Tyrrel S., Pawlett M., Read R, Smith GH (2013). A new sludge-derived organo-mineral fertilizer gives similar crop yields as conventional fertilizers. Agronomy for Sustainable Development. 33:539–549.

Antille D., Sakrabani R., Godwin R.J. (2014a). Nitrogen release characteristics from biosolids-derived organomineral fertilisers. Communication in Soil Science and Plant Analysis. 45(12):1687-1698.

Antille D., Sakrabani R., Godwin R.J. (2014b). Nutrient release characteristics from biosolids-derived organomineral fertilisers. Part 2: Phosphorus. Communication in Soil Science and Plant Analysis. doi:10.1080/00103624.2014.912300.

Antille D., Sakrabani R., Godwin R.J. (2014c). Effects of biosolids-derived organomineral fertilizers, urea and biosolids granules on crop and soil established with Ryegrass (Lolium perenne L.) Communication in Soil Science and Plant Analysis. 45:12, 1605-1621.

Funding particulars:

This project is co-funded by Yara as a CASE industry sponsor who will provide access to field trial sites, specialist training on field agronomy and also cash contribution to cover travel expenses.

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