PhD Project Advertisement

Project title: Anaerobic fermentation of food waste to connect fork to farm and store carbon in soils

Lead supervisor: Tom Sizmur, University of Reading, Department of Geography and Environmental Science
Email: t.sizmur@reading.ac.uk

Co-supervisors:
Sreenivas Rao Ravella, Aberystwyth University rsr@aber.ac.uk
Michael Goodman, University of Reading, m.k.goodman@reading.ac.uk
Andrew Sincock, EM-Agriton Ltd, andrew@agriton.co.uk

Project description:

Lactic acid fermentation is an anaerobic process used by specific groups of microorganisms to break down carbohydrates into sugars and produce organic acids as a byproduct. Fermentation of food waste within households is commonplace in Asia where the process is referred to as 'Bokashi'. Bokashi produces a high-quality nutrient-rich organic fertiliser that has the potential to increase soil fertility and the amount of carbon stored in soils. However, Bokashi is not common in the UK. The majority of UK food waste is anaerobically digested for biogas production. The product of anaerobic digestion (anaerobic digestate) is a low-quality organic fertiliser that is not desirable to farmers, and so biogas facilities struggle to find farmers willing to accept anaerobic digestate as a soil amendment.

This project will explore and trial the use of lactic acid fermentation (Bokashi) as an alternative to anaerobic digestion of UK food waste. You will use the University of Reading Whiteknights campus as a 'living lab' and map the foodscapes across campus to understand the types of food waste produced in different locations (e.g. catering outlets, halls of residence, offices, and classrooms). You will use benchtop-scale bioreactors to quantify emissions during traditional aerobic composting, anaerobic digestion, and lactic acid fermentation and investigate how the composition of the food waste affects these processes. You will then setup a pilot facility on Whiteknights campus to trial Bokashi using food waste generated on campus and use the resulting organic fertilizer to setup a field experiment on farmland owned by the University. The field experiment will enable you to determine the fate of carbon from the food waste in the soil environment and quantify its contribution towards long term soil carbon storage.

During the project you will work with external organisations such as Agriton (a commercial enterprise supporting Bokashi in the UK) and Fre-Energy (a biogas company using anaerobic digestion). You will interact with key actors such as individuals creating, managing, and valorising food waste, including the University of Reading Sustainability team and the Farm managers. You will work closely with Reading Climate Action Network and make a valuable contribution towards delivering the Reading Climate Emergency Strategy that was developed by Reading Climate Change Partnership. These interactions will enable you to identify the socio-economic and legislative barriers and enablers of lactic acid fermentation of UK food waste and help ensure that the project has a positive legacy.

Training opportunities:

During this PhD you will develop skills to enable you to become an interdisciplinary environmental scientist. You will receive training in experimental design, microbiology, soil science, waste management, agriculture, and social science. You will gain valuable experience interacting with multiple stakeholders and undertake a placement with Agriton to help expose you to the operations of a small agricultural technology company developing solutions for the soil-crop-animal-waste cycle and decarbonising the food system.

Student profile:

We seek a student with a BSc honours degree at upper second class level (or equivalent) in Environmental Science, Biological Science, Agriculture, or Physical Geography with a passion for decarbonising the food system and good knowledge of soils, waste, and farming. Laboratory skills and fieldwork experience are essential. Experience undertaking participatory research or communicating science to non-scientists is desirable. A driving license is desirable. We particularly welcome applicants from diverse and under-represented backgrounds.

References: (optional)

Olle, M., 2021. Bokashi technology as a promising technology for crop production in Europe. The Journal of Horticultural Science and Biotechnology, 96(2), pp.145-152.

Anthony, M.A., Crowther, T.W., Maynard, D.S., van den Hoogen, J. and Averill, C., 2020. Distinct assembly processes and microbial communities constrain soil organic carbon formation. One Earth, 2(4), pp.349-360.

Funding particulars:

This project has CASE support from EM-Agriton Ltd that includes a £1,500 per annum enhancement to the standard BBSRC stipend that the student will receive

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