

PhD Project Advertisement

Project title: *Biochar Interventions to Improve Soil Health Under Oil Palm : Ensuring Agronomic and Environmental Sustainability of the Fastest Expanding Equatorial Crop*

Project No: FBS25-71-Williams-qr

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Project description: Oil-palm is the most productive oil crop in the world, capable of serving both human food and energy needs. Alarming though, land conversion to oil-palm is associated with biodiversity loss, regionally significant fire, toxic-haze and GHG emissions. Illegal practices like slash-n-burn are adopted at the end of oil-palm plantation life cycle as an easy means to clear land and increase the cultivability of peat by raising pH and nutrient availability. However, these benefits are short lived due to leaching of minerals. On the other hand, retaining oil-palm waste on site to decompose enhances the spread of Ganoderma fungi responsible for significant palm losses. Here we propose biochar production from oil-palm and re- application to oil-palm fields as a solution for these intersecting issues. Much of the current oil-palm in Malaysia is transitioning to the 2nd generation plantation cycle, providing an ideal opportunity to assess the potential of this approach.

The novel aspect of this project is the use of biochar (pyrolyzed biomass) produced from oil palm biowaste to help restore soil ecosystem functions on the land where oil palm is produced. Oil palm is a high biomass crop and provides a varied source of biomass that is currently wasted. This project aims to test the quality of biochar from different source material from oil palm waste (palm fronds, empty fruit bunch, kernel shell, kernel meal, mesocarp fibre, palm trunk, oil mill waste). This project further tests the effectiveness of different biochar from oil palm waste in restoring some of the degraded soil ecosystem services due to oil palm agriculture, and their ability to maintain soil health in ensuring sustainable oil palm production. Currently there is no scientifically tested information on quality of biochar produced from different oil palm waste and their effectiveness in restoring soil health and soil carbon sequestration in oil palm plantations. Additionally, this research also aims to assess land holder's perception of biochar amendment to improve soil health, which has not been researched to- date. This will help scaling up the project impact if biochar from oil palm waste was found to be effective in enhancing soil health.

Specific objectives include:

1. identify the uses of biowaste from oil-palm industry that is currently burned/wasted and to evaluate the suitability of different palm oil wastes as feedstocks to generate biochar that can aid in improvement of soil health and carbon sequestration.
2. quantify the impact of selected biochars application on soil health and GHG mitigation in oil-palm plantations of different soil types through field trials.
3. undertake hypothesis-led experiments in a controlled environment to uncover the mechanisms (microbial/physiochemical) responsible for interactions between biochar and soil.
4. test the willingness of wider farming community to take up biochar intervention to restore soil ecosystem services, and to ensure the impact of this project on smallholder oil-palm farming practices, with focus on capacity building, and scaling up for the wider region.

Training opportunities: The student will receive training for international fieldwork, with three of the supervisors having direct/extensive experience (>10 yrs) in field-sites in Malaysia. The supervisory team members also work closely with local oil palm industry/policy makers in Malaysia. The student will get mentoring for international stakeholder engagements and communications and be supported by our extensive stakeholder network in the region. The supervisory team together cover expertise in a wide range of techniques for soil biogeochemical analyses, in relation to soil-health, soil-plant interactions, soil-biology, nutrient cycling, GHG-emissions, sustainable agriculture and carbon sequestration. The student will be trained in advanced soil chemical analysis (including DGT, ICPMS), in monitoring utilising portable gas analysers (e.g LGR and FTIR- based GASMET) and PFLA analysis of soil microbial functional communities. This will then be supported with specialist training in data analysis approaches. Internships opportunities will exist with the Malaysian Palm Oil Board and in NI with AFBI.

Project supervision style: The student will be supported initially with weekly meetings with the primary supervisor for the first 6-months. Thereafter, fortnightly or monthly, depending on the preference of the student. The full supervisory team will convene once every month, but the student will also have the opportunity to meet with individual co-supervisors on an ad hoc basis. When on fieldwork, the expectation is for weekly meetings with field and home project team members. The supervisors will operate an open-door policy to address concerns and issues in the project and the student will join active research groups at QUB (Williams) and AFBI (Dhandapani) that also run regular group/lab meetings also on a bimonthly cycle. The student will be invited to join the Soil-Biogeochemistry Group online seminar series hosted by TS at the University of Reading and the Interpeat research group and associated research meetings in Liverpool John Moores University.

Student profile: We are looking for candidates with an interest in Soil Biogeochemistry, Agro- Ecology, tropical agroforestry, and assessment of land-use change impacts. Candidates should also have a willingness to travel abroad for fieldwork, willingness to learn and carry out field biogeochemical monitoring and related lab analyses/trials. Experience in the above-mentioned subject areas (or in relevant field or lab techniques), and international fieldwork would be useful.

Stipend (Salary):

FoodBioSystems DTP students receive an annual tax free stipend (salary) that is paid in instalments throughout the year. For 2024/25 this is £19,237 (£21,237 at Brunel University) and it will increase slightly each year at rate set by UKRI.

Equity Diversity and Inclusion:

The FoodBioSystems DTP is committed to equity, 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](#) and include:

- Offering reasonable adjustments at interview for shortlisted candidates who have disclosed a disability or specific learning difference.
- [Guaranteed interview](#) and [applicant mentoring](#) schemes for applicants, with UK home fees status, from eligible under-represented ethnic groups.

These are opt-in processes.

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](#).