

PhD Project Advertisement

Project title: Towards net-zero chocolate: carbon and nutrient budgets for compost use on cocoa farms

Project No: FBS2024-015-Sizmur-rc

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Project description:

The primary ingredient of chocolate, cocoa, has a high carbon footprint because it is grown in tropical regions, often on land that has recently been deforested. The easiest means to maintain cocoa yields is to apply mineral fertilisers, which themselves are produced in energy intensive processes, have a high carbon footprint, and are too expensive for most smallholder farmers. Without fertilisation the fertility of cocoa farms declines over time and farms are abandoned, leading to deforestation elsewhere. Further expansion of cultivated land by deforesting tropical rainforests is environmentally costly, socially unacceptable, and inherently unsustainable. It is therefore imperative that the fertility of existing cocoa farms is maintained or improved without the use of mineral fertilisers to prevent further deforestation and contribute towards the delivery of net-zero chocolate.

Despite declining fertility, there are several sources of nutrients available in an around cocoa farms that can be used to make organic fertilisers. For example, the husks of cocoa pods are rich in phosphorous and potassium and are often discarded on-farm in piles after the beans are extracted. There are also several species of leguminous trees that are grown on cocoa farms to provide shade for young cocoa trees. The branches and leaves of these trees are rich in nitrogen. Together these resources can be composted to make organic fertilisers.

In this PhD project you will take samples and make measurements from established field experiments on cocoa farms across Ghana where cocoa pod husk composts and biochars have been applied at different rates and combinations to construct carbon and nutrient budgets and assess their affect on soil health and crop yield and quality. You will also run greenhouse trials to test different composts made from different ratios of feedstock materials. These experiments may include innovative stable isotope labelling techniques to trace the fate of carbon and nitrogen in cocoa soils. You will run soil biogeochemical models to simulate and predict the effect of compost application on soil organic carbon content, nutrient cycling, and greenhouse gas emissions.

Your experiments will enable you to devise the optimum strategy for using the organic resources available on smallholder cocoa farms to reduce the carbon footprint of cocoa production and bring chocolate producers closer to being able to make net zero chocolate. You will have the opportunity to present your research at both national and international conferences

Training opportunities:

You will receive training, as needed, in soil science, tropical agricultural systems, cocoa agronomy, and stable isotope analysis. You will also undertake fieldwork in Ghana during placements hosted by Kwame Nkrumah University of Science and Technology where you will join field technicians sampling a network of field experiments located around the country.

Student profile:

This project is suitable for a student with a degree in Environmental Science, Soil Science, Agriculture, Physical Geography, or Biology

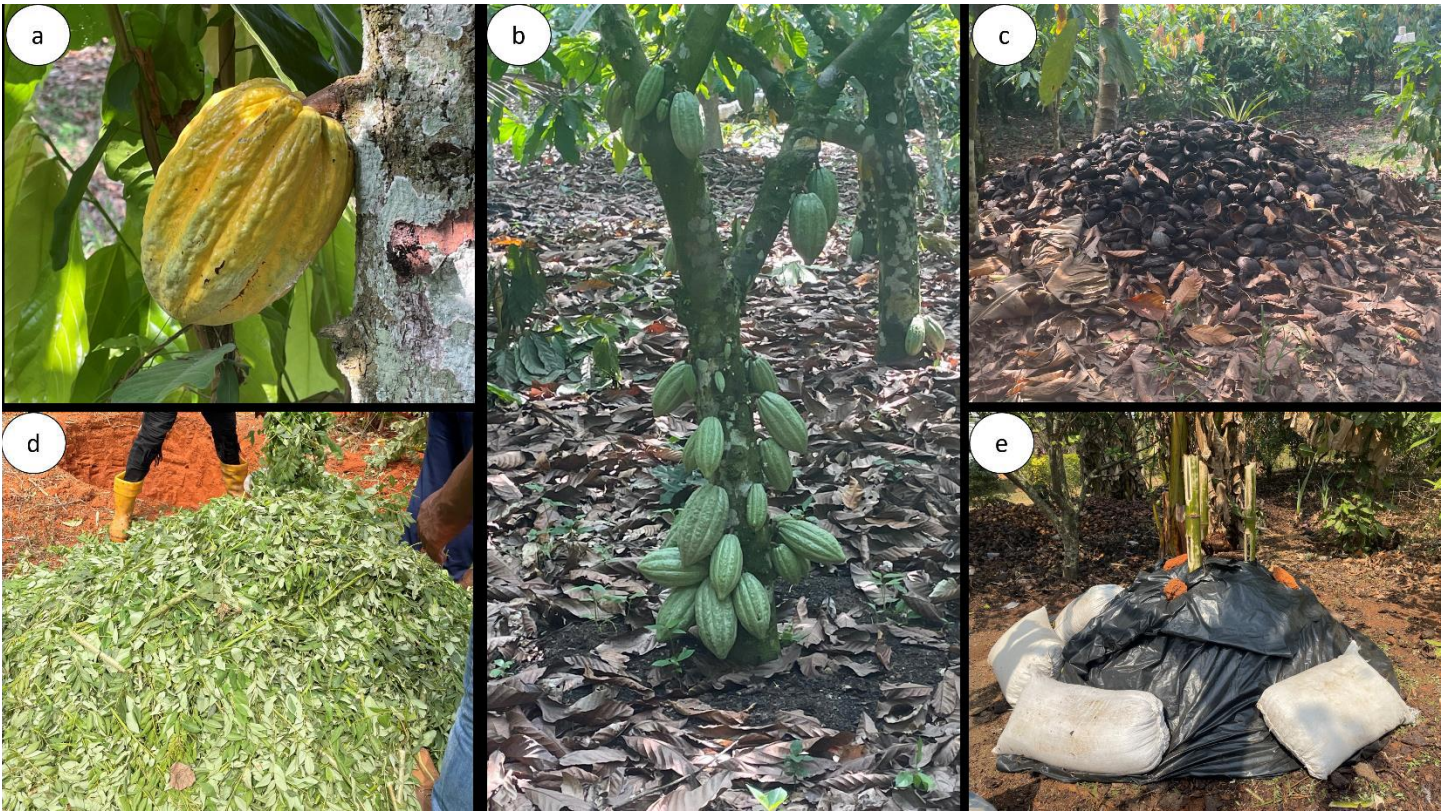


Figure 1: Images of a cocoa pod (a), a cocoa tree (b), cocoa pod husks (c), prunings of leguminous shade trees (d), and a compost heap (e). Photo credits: Tom Sizmur

Stipend (Salary):

FoodBioSystems DTP students receive an annual tax free stipend (salary) that is paid in instalments throughout the year. For 2023/24 this is £18,622 and it will increase slightly each year at rate set by UKRI.

Equality Diversity and Inclusion:

The FoodBioSystems DTP is committed to equality, 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](#).

In accordance with UKRI guidelines, 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.

References:

Amponsah-Doku, B., Daymond, A., Robinson, S., Atuah, L. and Sizmur, T., 2022. Improving soil health and closing the yield gap of cocoa production in Ghana—a review. *Scientific African*, 15, p.e01075.

<https://doi.org/10.1016/j.sciaf.2021.e01075>

Fungenzi T., Sakrabani R., Burgess P., Lambert S., and McMahon P., 2021. Medium-term effect of fertilizer, compost, and dolomite on cocoa soil and productivity in Sulawesi, Indonesia, *Experimental Agriculture*, 57 (3) 185-202. <https://doi.org/10.1017/S0014479721000132>

<https://research.reading.ac.uk/cocoa/soil-amendments-project/>

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