Functional traits characterisation of popular shade tree species in cocoa agroforestry systems in Ghana

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Abstract

Climate change is increasingly threatening agriculture and global food production and the strongest impacts are expected in tropical smallholder systems such as cocoa farms in Ghana.

Cocoa agroforestry systems are often seen as an opportunity to adapt to and mitigate the impacts of climate change while sustainably increasing production. Favourable microclimate under the shade trees buffers extreme weather conditions from the cocoa trees whilst sequestering atmospheric carbon.

However, it remains controversial whether shade trees have a positive or negative impact on cocoa yields, as previous studies have shown both higher and lower yields in agroforestry systems compared to monocultures.

Given the suggestion that the effect may also depend on the shade-tree species' specific traits, this thesis examines the above-ground morphology (DBH, tree height, canopy height, form, area and health) and below-canopy microclimatic conditions (solar radiation, temperature and relative humidity) of eight locally common shade-tree species in cocoa agroforestry systems. Effect of these traits on the development and productivity (DBH, tree height, canopy health, leaf CCI, flower intensity, cherelles, pods, black pods, pod sizes and weight) of surrounding cocoa trees in three different impact zones were further analysed. The central question is whether significant differences between the impacts of the different shade-tree species exist and, if so, which specific traits can be considered as the most important for productive and climate resilient cocoa agroforestry systems.

Measurements are conducted from April to June 2022 in ten smallholder cocoa agroforestry systems in the Ahafo region, Ghana. Results are still pending, although an initial review of preliminary data already indicates differences between some species.

The final results will allow a better understanding of species-related differences in cocoa agroforestry system resilience to climate change impacts as well as cocoa tree development and productivity, which may even serve to reconsider existing species recommendations.

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