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Optimising soil health in Africa: A holistic approach to fertiliser management with *ex situ* organic resources

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Abstract

Addressing soil health is being recognised as a key means to improve fertiliser efficiency, and nowhere is this more important than in Africa where fertiliser is a scarce resource, and highly expensive. Productivity and stable yields require investment in soil health integral to nutrient management. Organic inputs provide a means to recouple carbon and nutrient supply, which is essential to effective nutrient management for crop response.

Farm internal adaptations in organic matter management, including crop rotation, alley cropping, compost, animal manure and bioslurry, adjusted soil tillage, and specifically the inclusion of leguminous crops, play a crucial role to balance soil health and nutrient management.

In addition, *ex situ* organic fertilisers produced from farm external sources, like household waste, human faeces, market and agro-processing residues are valuable sources for composting and bioslurry production to further address carbon and nutrient deficiencies. Their proper use not only benefits farms but also reduces a considerable environmental burden due to their current mismanagement in many regions. Furthermore, biofertilisers (fungus- and bacteria-based) and soil amendments (like lime and biochar) can contribute to an increase of nutrient availability, functionality of soil characteristics and crop health. A strategic and considerate use of inorganic fertilisers can address specific nutrient deficiencies and provide readily available nitrogen, promoting yield and soil health.

This study explores a holistic approach to fertiliser management, examining the effects of various input and management strategies on soil productivity. Specifically, it highlights the contribution of externally sourced organic fertilisers (*ex-situ*) investigated across 12 African countries through expert interviews, a review of the literature, and a comparison of the effectiveness of diverse organic matter and nutrient sources through a modelled application of nutrient and carbon balances in three smallholder farming systems (stockless, mixed, and permanent tree-based systems) with annual rainfall ranging from 800 to 1800 mm.

This is a first step, with full awareness that carbon budgets are not sufficient to explain soil organic matter accrual alone. Relinking carbon inputs with nutrients is an important aspect of soil health maintenance that has been under invested in, and this study is a starting place.

Keywords: Africa, biostimulants, fertiliser efficiency, organic fertiliser, soil amendments, soil health, soil organic carbon