Effects of Tillage and Crop Residue Management on Soil Organic Carbon Stock Under Four Different Soil Types in Sudan-Savanna of West Africa

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Soil science: beyond food and fuel

Problem Statement

Erosion of topsoil from agricultural lands due to increasingly intense **rainfall** and improper **soil management practices** has become one of the most crucial threats to crop productivity in **Sudan-Savanna of West Africa**, causing removal of **soil organic carbon** and loss of soil inherent fertility.

Alternative management options consisting of a combination of tillage, crop residue incorporation and nitrogen management might be a potential technical solution

Research Aim

What is the relative contribution of alternate management practices to the soil organic carbon stock over five years?

1. To assess the single and interactive effects of tillage and crop residue management on soil organic carbon stock under four different soil types.
2. To generate soil data to improve and calibrate soil-crop models and conduct simulations of long-term soil organic matter dynamics in cultivated tropical soils

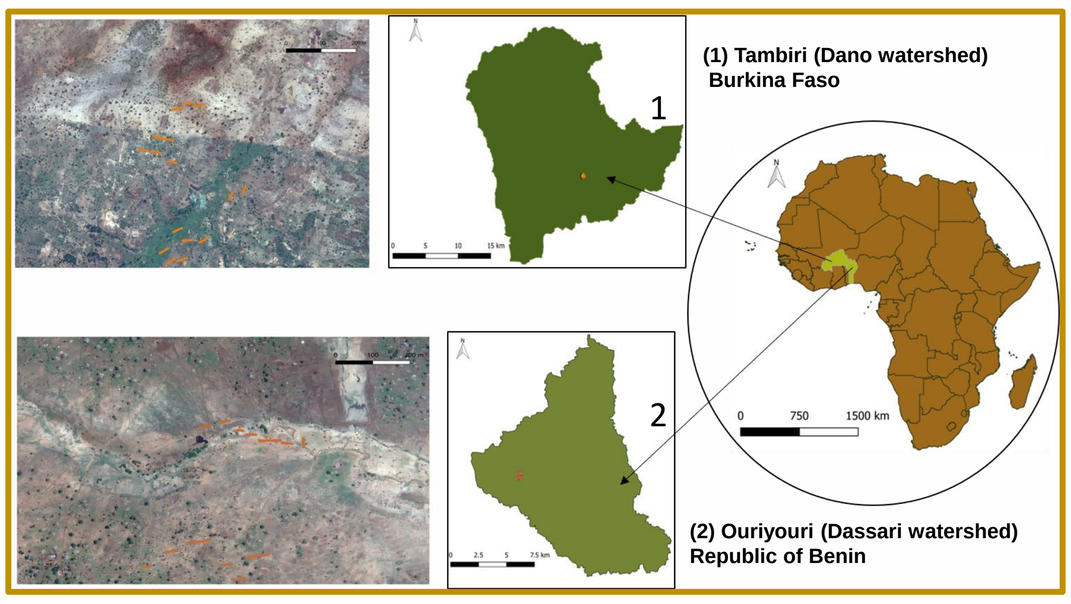

Figure 1: Study Area

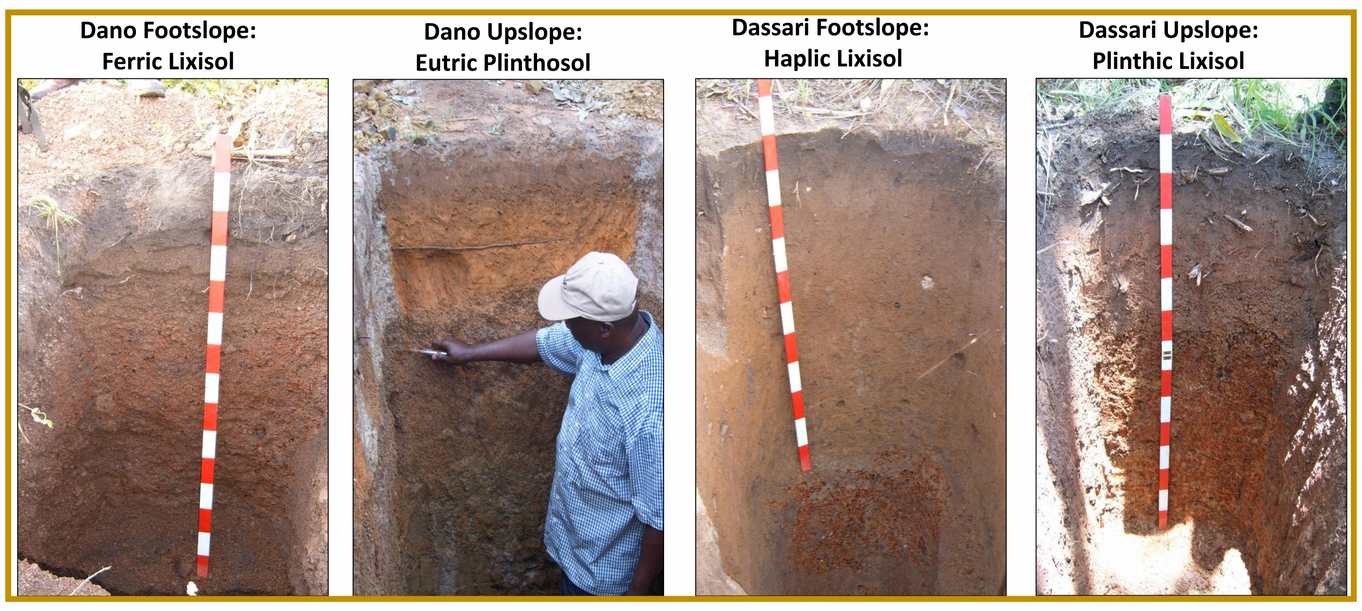

Figure 2: Four Soil Types

Take Home Message

- **The organic carbon stock in the topsoil under all four soil types is significantly higher under contour ridge tillage along with crop residue incorporation**
- **Such experimental data can be used to improve and calibrate soil organic models that can simulate the dynamics of soil organic carbon under different management practices in tropical soils**

Experimental Design

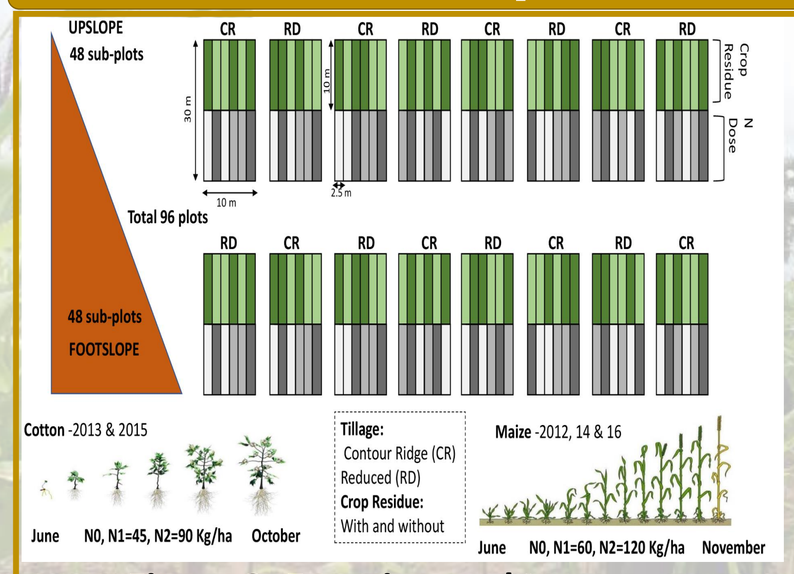

Figure 3: Experimental Layout

Strip-split plot design

- Main plot: 2 levels of tillage (contour ridge and reduced tillage)
- Sub-plot:2 levels of crop residue management (with and without) and 3 levels of nitrogen fertilizer rates randomized within the main plots
- Total 48 subplots under one soil type
- Crop: 2012, 2014 & 2016 maize, and 2013 & 2015 cotton

Results

Figure 4: Response of soil organic carbon stock (kg/ha) in the top soil layer (0-20 cm) to the interaction of two levels of tillage (contour and reduced) and two levels of crop residue management (with and without) for all four soil types

Sampling & Analysis

- 1st sampling: onset of the experiment in 2012
- 2nd sampling: August-September, 2016
- 0-20, 20-40, 40-70 & >70 cm sampling depth
- Carbon has been analyzed using CN elemental analyzer
- **Soil Organic Carbon Stock (kg/ha)** = ((%nutrient*((100-%Gravel)/(100*(soil layer thickness (cm)*0.01*Bulk Density (g/cm3)*1000))))/100)*10000

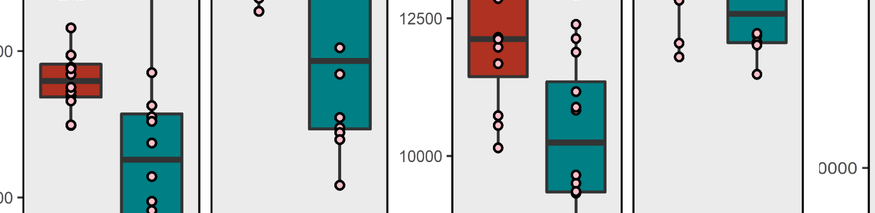

Figure 5: Soil Sampling & Processing

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Acknowledgement

This research has been funded by the German Federal Ministry of Education and Research (BMBF) within the WASCAL programme (Funding number FKZ 01LG1202A), the Eiselen Foundation Fiat Panis (Ulm), Stiftung Fiat Panis, Center for Development Research (ZEF)

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