Tropentag, September 16-18, 2026, hybrid conference

"Towards multi-functional agro-ecosystems
promoting climate resilient futures"

Biochar-based fertiliser can decouple smallholder farm economy from global market disturbances

Burkhard Wilske[1], Abebe Nigussie[2], Tilahun Abera[3], Konrad Siegfried[1], Milkiyas Ahmed[2], Reta Workumosisa[3], Bayu Dume[2], Gebeyanesh Worku[2], Amente Lema[3]

[1] *DBFZ German Biomass Research Center, Bioenergy Systems, Germany*

[2] *Jimma University – College of Agriculture and Veterinary Medicine, Natural Resources Management, Ethiopia*

[3] *IQQO – Batu Soil Research Centre, Batu-Ziway, Ethiopia,*

Abstract

About 41 % of Ethiopia's agricultural soils are affected by acidification and decreasing fertility. Smallholder farmers face the challenge that decomposition rates under tropical climate quickly consume soil organic carbon but crop residues need to supply various farm needs other than soil fertility management. On top, costs for imported synthetic fertiliser, e.g., Urea tripled from 2020 to 2025. The development project ETH-Soil embarked on sustainably improving soil conditions and thereby productivity through the application of biochar-based fertiliser (BBF). Concomitant soil monitoring in 2024 and 2025 compared plots in wheat fields treated with BBF (10 t/ha biochar) against plots treated business as usual (BAU: synthetic fertiliser recommended rates) at 24 farms located at different elevations and soil types in two regions, i.e., the Southwest and Southeast of Ethiopia. Regionally different BBF recipes were applied, i.e., co-composting of biochar with manure in the Southwest and vermicompost in the Southeast. In 2024, bare mean values of key soil quality indicators tended towards higher pH (up to +0.3 points), soil organic carbon content (SOC) (+0.15% 0.28 %) and available phosphorus (aP) (+0.78% 5.5 %) with BBF than with BAU across regions. However, none of the results attained a significance level ($p = 0.05$) except aP of Southeast sites (+5.5 %). Results in 2025 were similar, except a missing aP improvement even at Southeast sites. Overall, sampling soil parameters SOC, pH, and aP did not consistently indicate soil quality improvement across the regions. However, BBF application resulted mostly in similar or better dry grain yield (DGY) as compared to BAU. In 2024, DGY tended to be slightly higher though statistically not significant with BBF than with BAU at Southwest sites (+0.01 0.1 t/ha), whereas DGY increased significantly with BBF at Southeast sites (+1.3 t/ha). Conversely in 2025, DGY increases with BBF over BAU were not significant at Southeast sites (+0.4 t/ha) but significant at the Southwest sites (0.45 0.9 t/ha). While monitoring must continue to explain the soil data pattern along the soil-climate gradient, BBF helps smallholders to decouple their farm economy from global market disturbances. Reassurance in self-reliant grain crop production can encourage farmers to adopt additional agroecological practices including crop diversification and agroforestry.

Keywords: Biochar, cost-benefit ratio, pH, plant available phosphorous, soil fertility management, soil organic carbon

Contact Address: Burkhard Wilske, DBFZ German Biomass Research Center, Bioenergy Systems, Torgauer str. 116, 04347 Leipzig, Germany, e-mail: burkhard.wilske@dbfz.de