



Benefits and risks of traditional agricultural residue management and biochar applications in small-scale farming systems - A case study from India

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Soils in tropical regions are commonly depleted in soil organic matter due to high mineralization rates, but also due to limited input of fresh organic matter (OM). This creates strain in facing the agricultural challenges such as adaptation to climate change, soil degradation and for ensuring durable soil fertility and crop production.

Here, we address the challenge of OM application in tropical agro-ecosystems. We identified the benefits and risks of traditional residue management practices of small-scale farmers in the Berambadi (Karnataka, India) watershed and inquired the framework under which farmers would apply techniques such as biochar applications. We subsequently tested the results of the (combined) application of three organic soil amendments (compost, vermicompost and biochar) on selected functions (pH, TC content, C/N, WHC, microbial activity & diversity) of three representative soil types (Ferralsols, Anthroposol, Vertisol).

We highlight the benefit of creating tailor-made agricultural residue management applications from both socio-economic and agro-ecological perspectives. The socio-economic perspective of how farmers perceive (i.e. traditional perception of burning OM and its subsequent application) and use (i.e. traditional preparation of farmyard manure, compost or usage as fodder or heating material) agricultural residues as an agronomic resource has to be taken into account to evaluate the potential benefits and risks of biochar applications. Furthermore, farmers' expectations (guidance, simple and cheap, increase in nutrient and water content) and doubts (lack of knowledge, residue availability, harmfulness to soils) upon the introduction of such techniques has also been elaborated. The agro-ecological results reveal that the desired soil function and the soil type the OM is applied to, different OM applications can improve the fertility of their respective soils. Overall, a combination of biochar (either coconut shell or rice husk) with compost is most promising for all soil types. Surprisingly however, characteristic from soils with the lowest quality (i.e. Ferralsols) do not generally profit more from OM applications than soils with higher fertility (i.e. Vertisols), except for soil organic carbon (up to +50% for Ferralsols compared to max. +15% for other soils). The interest of farmers in technologies like biochar and the (possible) positive effects on plant-soil systems provide scope for successive in-depth field studies.