Tropentag, September 18-21, 2016, Vienna, Austria

"Solidarity in a competing world — fair use of resources"

Plant Residue-Derived Organic Carbon Input into Soil in African Indigenous Vegetable Production Systems

Enos Onyuka[1], Godfrey Nambafu[1], Holger Bessler[1], Anna Adam[1], Darius O. Andika[2], Joseph Patrick Gweyi-Onyango[3], Samuel Mwonga[4], Christof Engels[1]

[1] *Humboldt-Universität zu Berlin, Albrecht Daniel Thaer-Institute of Agricultural and Horticultural Sciences (ADTI), Germany*

[2] *Jaramogi Oginga Odinga University of Science and Technology, Dept. of Plant, Animal and Food Sciences, Kenya*

[3] *Kenyatta University, Dept. of Agricultural Science and Technology, Kenya*

[4] *Egerton University, Dept. of Crops, Horticulture and Soils, Kenya*

Abstract

Food production in sub Saharan Africa is constrained by low soil fertility, whereby soil organic matter (SOM) is key factor regulating many soil functions that determine the yielding ability of soils. SOM content is influenced by the mass and quality of organic carbon input into soil. In smallholder farming systems manure and composts are scarce, and only small fractions are allocated to soil amendment due to alternative use as feed and fuel. Therefore, organic matter input into soil is often restricted to plant residues remaining in the field. In this study, we quantified the effects of species and harvesting method on the mass and quality of plant-derived carbon input into soil with the aim to improve soil fertility management in African indigenous vegetable (AIV) production systems.

Five AIV species (amaranthus - *Amaranthus cruentus*, cowpea - *Vigna unguiculata*, African kale - *Brassica carinata*, African nightshade - *Solanum scabrum*, spider plant - *Cleome gynandra*) and common kale (*Brassica oleracea acephala*) were grown in a field experiment. Plants were harvested by two different methods, which are both commonly used in Kenya: Plants were either pulled out with some coarse roots adhering to the stems or cut about 5 cm above the soil surface. Leaf litter, above-ground plant residues and below-ground residues (coarse root, fine roots in 0–0.3 m and 0.3–0.6 m soil depth) were quantified and analysed for C content. The humification efficiency of plant residues was determined in incubation studies under controlled conditions.

Input of plant residue-derived organic carbon into the soil significantly differed among species with minimum of 0.3 kg C m^{-2} for cowpea and maximum of 0.8 kg C m^{-2} for amaranthus. In all species, input with leaf litter was negligible, while the contribution of fine roots to C input varied between about 40 % in spider plant and 80 % in cowpea. Pulling out instead of cutting plants reduced carbon input by 14 % in cowpea and nearly 60 % in African kale and spider plant.

It is concluded that in AIV production systems with low availability of organic fertilisers species selection and harvesting method are important determinants for soil C dynamics and fertility.

Keywords: Coarse roots, fine roots, harvest method, humification, leaf litter, stubble

Contact Address: Christof Engels, Humboldt-Universität zu Berlin, Albrecht Daniel Thaer-Institute of Agricultural and Horticultural Sciences (ADTI), Berlin, Germany, e-mail: christof.engels@agrar.hu-berlin.de