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with planetary health"

Compost and biochar improve crop productivity and carbon binding in different agro-ecological zones of Rwanda

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Abstract

As Rwanda faces mounting pressures from climate change and land scarcity, the pursuit of sustainable agricultural practices has become increasingly urgent.

This research aims to assess the carbon binding potential and crop productivity associated with different fertilisers across two contrasting agro-ecological zones in Rwanda. Long-term field trials are conducted in the northern volcanic region (N), known for its fertile soils, and in the southern forested region (S), where soils are less fertile.

In region N, six treatment plots with four repetitions of equal size were established: control, compost derived from urban solid mixed waste, vermicompost, synthetic NPK (17:17:17), and two combinations of NPK with vermicompost and NPK with compost, respectively. In region S, a similar protocol was applied, and plots included: control, on-site produced compost from agroforestry, biochar derived from three tree species (*Calliandra calothyrsus*, Polyscias fulva, and Cedrela serrata), and combinations of compost with each type of biochar. Soil samples were collected before and after each crop cultivation and analysed for both physical and chemical properties, with a particular focus on carbon content and the other nutrients. Currently we are on the sixth rotation at region N, using potatoes, beans and maize and on the second rotation at region (S) that were beans and maize.

The preliminary results showed differences between treatments on each site. In region (N), the combination of NPK and compost from urban waste increased yield overall by 13.4 % compared to control, which was the highest yield. This was followed by compost from urban waste, which increased yield by 7.4 %. Carbon content increased, for example, in vermicompost by 2.1 %. In region (S), the treatment compost mixed with biochar from Cedrela serrata plant species showed the highest increase of total maize biomass yield with of 64.7 % in comparison to control.

These findings highlight the potential for region and on soil-specific, integrated soil fertility management strategies that enhance both productivity and to contribute to climate change mitigation.

Keywords: Agro-ecological zones, biochar, carbon binding potential, climate change mitigation, compost, crop productivity, NPK, Rwanda, soil fertility management, sustainable agricultural practices, synthetic fertilisers, vermicompost

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