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Development of Macronutrients in an Ugandan Inland Valley under Rice Production

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Abstract

Soil degradation is one of the major problems in crop production. In combination with increasing population numbers this forces Ugandan smallholder farmers to produce their crops in the valley bottoms. Therefore, it is important to identify sustainable management options to maintain these areas in a healthy state.

Field experiments were conducted in an inland valley swamp in Central Uganda between 2014 and 2018 to study the effects of nitrogen and phosphorus addition (organic vs mineral) and water management on the availability of soil macronutrients. These were established in three positions crossing the valley bottom from the central channel (zone 3) to the fringe of the wetland (zone 1) with one zone in between (zone 2). Soil samples, taken from the topsoil (0–30 cm), were analysed for their carbon, nitrogen and Mehlich-3 extractable macronutrients (P, K, Mg, Ca). This Mehlich-3 solution allows the extraction of plant-available nutrients over a wide range of soil pH-values.

First results of the first four seasons show that before the implementation of the experiment the variability of C, N, K, and Ca was highest in zone 3, close to the channel. There was no significant difference between all three zones. After the first harvest the C and N content of the soil decreased (3–10 mg-C g^{-1}, <0.7 mg-N g^{-1}) in all three zones, but the variability of these elements within each zone became smaller. After the first season the C and N content is increasing, with different amounts due to different management options. Available P is very low in all three zones (< 50 mg-P kg^{-1}), but a slightly small impact of P-addition is recognisable in all three zones. There is no significant change in Ca and Mg in all three zones, whereas K keeps decreasing throughout the first four seasons in Zone 1, the fringe of the wetland.

Keywords: Carbon, Mehlich-3, nitrogen, Uganda, variability, wetland

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