



Sustainable smallholder intensification through improved water management requires adjusted fertilizer recommendation

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In Sub-Saharan Africa small scale irrigation is developing rapidly. Whilst emphasis is mainly placed on water resource availability and access for irrigation, less attention is paid to the interaction of water management on nutrient balances. The quality and quantity of irrigation water delivered to the field not only controls the nutrient flow dynamic system in the soil media but also affects production and uptake. The objective of this study is to evaluate the effect of different water management methods on partial nutrient balances in irrigated fields of the Ethiopian highlands. The study was conducted during the dry season of 2016 where farmers cultivated consecutively tomato and pepper. Farmers were grouped into three water management treatments: irrigation based on Time Domain reflect meter (TDR), on the standard crop water requirements (CWR) and the traditional farmers practice (FARM). The average water consumption for tomato in the CWR, TDR and FARM groups were 590 mm, 476 mm and 575 mm, respectively. The comparison of the water use at different stages showed that traditional farmer practice used less water at the initial stage and more water at the maturity stage which influenced the crop yield and the nutrient dynamics of NPK. For pepper, the linkage to the supplemental irrigation was slightly different due to the onset of the rainy season. The average tomato yield obtained in the farmer practice plots was 20.8 Mg ha⁻¹ which was significantly lower than those obtained in the TDR (31.67 Mg ha⁻¹) and the CWR (33.2 Mg ha⁻¹) plots. The average partial nitrogen (N) depletion balance obtained for tomato in the TDR, CWR and FARM treatment were -91 kg ha⁻¹, -151 kg ha⁻¹ and 19 kg ha⁻¹ respectively. For phosphorus (P) the calculated depletion balance was -0.6 kg ha⁻¹, -0.5 kg ha⁻¹, and -0.2 kg ha⁻¹, respectively whereas for potassium (K) the balances were largely negative (i.e. -284 kg ha⁻¹, -270 kg ha⁻¹ and -97 kg ha⁻¹, respectively). Similar observations were found for pepper. The N and K balances were less negative when farmers used organic fertilizers aside from inorganic fertilizers compared to those farmers who only applied Urea and Di-Ammonium Phosphate (DAP). Furthermore, the largest negative nutrient balances were obtained for the water management leading to the highest crop and water productivity (i.e. CWR). Hence, introducing sustainable water management practices in irrigation requires associated fertilizer recommendations to compensate for the increased yields obtained, avoiding land degradation in the long term.