2021-04-02

Characterization of soil phosphate status, sorption and saturation in paddy wetlands in usangu basin-Tanzania.

Mng'ong'o, Marco

Characterization of Soil Phosphate Status, Sorption and Saturation in Paddy wetlands in Usangu basin-Tanzania

Marco Mng'ong'o, Linus K. Munishi, Blake William, Patrick A. Ndakidemi, Sean Comber, Thomas H. Hutchinson

To download full text click that link
DOI: https://doi.org/10.1016/j.chemosphere.2021.130466

Abstract

Phosphorus (P) is a vital plant macronutrient required for plant growth which usually available in limited amount. P availability for plant uptake in highly weathered soil is controlled by soil erosion and high fixation. The availability of P applied from fertilizers depend on the soil pH, soil sorption capacity (PSC) and P saturation status (PSD), which determines P storage, losses, fixation, and additional P to be added with minimal loss to the environment. PSC and PSD are agro-environmental indicators used to estimate P availability and P loss to the environment. However, PSC and PSD of agricultural soils had been never studied in Tanzanian soils. This study was conducted to assess and estimate P availability, PSC and PSD and the risks of P losses in tropical soils from Usangu basin popular for paddy farming. In total, 198 soil samples from 10 paddy irrigation schemes were collected (November–December 2019) and analyzed for inherent P (PM3), metal oxides of Aluminium (Al M3), iron (Fe M3), and calcium (Ca M3) as main PSC and PSD determinant. The determined concentrations were in range of; P M3 014.9–974.69 mg/kg, Al M3 234.56–3789.36 mg/kg, Fe M3 456.78–2980.23 mg/kg, and Ca M3 234.67–973.34 mg/kg. Estimated PSCM3 ranged 5.62–34.85 mmol/kg with a mean value of 14.14 mmol/kg corresponding to high status, ensuring high P holding capacity for plant uptake. However, some soils had very low PSCM3 creating a risk of P loss to environment. Among soils, the estimated PSD M3 ranged from 0.01 to 17.57% and was below (<24%), indicating low P loss risks to surface and groundwater, however, some soils were observed to have PSDM3 above 15% which correspond to a critical degree of phosphate saturation of 25% in a watershed using oxalate extraction method. Therefore some sites were associated with high P loss to the environment, immediate and precautionary actions for sustainable P management to increase productivity, environmental safety and sustainability are needed to be in place.

Keywords
Agro-environmental; Eutrophication; Mehlich 3; Phosphate loss; Sorption capacity; Phosphate saturation degree