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Soil nutrient distribution and soil carbon stocks in pigeon peas growing areas in Lindi, Tanzania

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Abstract

Pigeon peas are a key legume crop contributing to dietary needs and economic livelihood of smallholder farmers in Tanzania. Soil organic carbon stocks facilitate the sustainability of the crop production system. The aim of this study was to assess soil nutrient content and soil organic carbon (SOC) stocks in selected pigeon pea growing areas in Lindi, Tanzania. Bulk soil samples were taken at 0–30 cm depth from 22 pigeon pea farms in two districts – Nachingwea and Ruangwa. Soil samples were analysed for soil-physicochemical properties (pH, Clay and Silt) and nutrient content (Nitrogen (N), Phosphorus (P) and Potassium (K)). Soil Organic carbon stocks were calculated following Zeng et al. (2021). Bulk density was estimated using a pedotransfer function. Inverse distance weighing was used to generate the maps of soil Nutrients (NPK) and SOC stocks. All sampled PP farms were intercropped with maize and had no fertiliser amendments. Most of the sampled soils in the study areas were of sandy clay loam texture. The mean Nitrogen, Phosphorus and Potassium content was 0.1 %, 31.4 mg/kg, 225 mg/kg respectively. Mean Organic Carbon was 1.4 % while mean SOC stocks were 504.6 gm⁻². Mean clay, silt and sand content were 29.6 %, 2.8 % and 67.6 %. Nutrient contents and SOC stocks were generally higher for Nachingwea than Ruangwa district. Results indicate that mean nitrogen content was beyond the optimal range, while phosphorus and potassium contents were high. The N-fixing capability of pigeon peas enhances the supply of nitrogen in the production system. Intercropping pigeon peas with major food crops is essential for this farming system to maintain the nutrient balance required to sustain production of crops for dietary supply without fertilisers.

Keywords: Pigeon peas, soil nutrients, soil organic carbon stocks