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Prospects and limitations of farmers’ knowledge and portable sensor equipment in soil salinity assessment and monitoring: A case study from Mozambique

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Abstract

Salinisation of agricultural soil resources is an ever-increasing problem for global sustainable food production. Smallholder farmers and extension services in affected regions of the Global South often lack the necessary infrastructure and financial resources to conduct comprehensive and timely salinity assessments. In these contexts, local knowledge systems on soil and water quality parameters prevail. In recent years, robust portable devices such as pH and electrical conductivity (EC) probes have become increasingly accessible and provide an interesting complementary tool. In order to evaluate the accuracy and validity of these alternative approaches, we conducted participatory mapping activities together with farmers of Maputo’s vegetable production areas, in southern Mozambique. Farmers’ salinity assessments were compared with probe-based readings in soil and water (pH, EC, activity), as well as with local standard laboratory soil analysis. Local farmers’ salinity zonation compared well with soil and water measurements in a mapping exercise implemented in 2018, as examined by ANOVA and Fisher’s LSD test. However, the same approach showed no alignment when conducted in a neighbouring location in 2022. This was explained by the occurrence of different constraining soil characteristics, misinterpreted by farmers as salinity. Amongst the probe-based salinity readings, activity correlated strongest with EC as determined in the laboratory (Spearman $r = 0.784$). Respective linear regression equations were established, considering different soil texture classes. We conclude that local farmers’ evaluation may serve as a tentative proxy indicator for salinity assessment and should guide sampling approaches with the objective to reduce time and costs. However, it should be always complemented by either probe- or laboratory-based evaluations in order to more accurately characterise the salinity problem and rule out the confounding influence of possible other constraining soil parameters. For the accurate use of soil probes it is imperative to establish standardised locally adapted procedures for data collection, as well as conversion factors to standard parameters such as EC, inter alia considering the effects of soil texture.

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