

Assessment of Soil Quality Indicators in Rice Soil of Tamil Nadu

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Abstract : Soil quality in an agroecosystem is influenced by the cropping system, water and soil fertility management. A valid soil quality index would help to assess the soil and crop management practices for desired productivity and soil health. The soil quality indices also provide an early indication of soil degradation and needy remedial and rehabilitation measures. Imbalanced fertilization and inadequate organic carbon dynamics deteriorate soil quality in an intensive cropping system. The rice soil ecosystem is different from other arable systems since rice is grown under submergence, which requires a different set of key soil attributes for enhancing soil quality and productivity. Assessment of the soil quality index involves indicator selection, indicator scoring and comprehensive score into one index. The most appropriate indicator to evaluate soil quality can be selected by establishing the minimum data set, which can be screened by linear and multiple regression factor analysis and score function. This investigation was carried out in intensive rice cultivating regions (having >1.0 lakh hectares) of Tamil Nadu viz., Thanjavur, Thiruvarur, Nagapattinam, Villupuram, Thiruvannamalai, Cuddalore and Ramanathapuram districts. In each district, intensive rice growing block was identified. In each block, two sampling grids (10 x 10 sq.km) were used with a sampling depth of 10 - 15 cm. Using GIS coordinates, and soil sampling was carried out at various locations in the study area. The number of soil sampling points were 41, 28, 28, 32, 37, 29 and 29 in Thanjavur, Thiruvarur, Nagapattinam, Cuddalore, Villupuram, Thiruvannamalai and Ramanathapuram districts, respectively. Principal Component Analysis is a data reduction tool to select some of the potential indicators. Principal Component is a linear combination of different variables that represents the maximum variance of the dataset. Principal Component that has eigenvalues equal or higher than 1.0 was taken as the minimum data set. Principal Component Analysis was used to select the representative soil quality indicators in rice soils based on factor loading values and contribution percent values. Variables having significant differences within the production system were used for the preparation of the minimum data set. Each Principal Component explained a certain amount of variation (%) in the total dataset. This percentage provided the weight for variables. The final Principal Component Analysis based soil quality equation is $SQI = \sum_{i=1} (W_i \times S_i)$; where S- score for the subscripted variable; W-weighing factor derived from PCA. Higher index scores meant better soil quality. Soil respiration, Soil available Nitrogen and Potentially Mineralizable Nitrogen were assessed as soil quality indicators in rice soil of the Cauvery Delta zone covering Thanjavur, Thiruvavur and Nagapattinam districts. Soil available phosphorus could be used as a soil quality indicator of rice soils in the Cuddalore district. In rain-fed rice ecosystems of coastal sandy soil, DTPA - Zn could be used as an effective soil quality indicator. Among the soil parameters selected from Principal Component Analysis, Microbial Biomass Nitrogen could be used quality indicator for rice soils of the Villupuram district. Cauvery Delta zone has better SQI as compared with other intensive rice growing zone of Tamil Nadu.

Keywords : soil quality index, soil attributes, soil mapping, and rice soil

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