

Assessment of Soil Quality Indicators in Rice Soils Under Rainfed Ecosystem

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Abstract : An investigation was carried out to assess the soil biological quality parameters in rice soils under rainfed and to compare soil quality indexing methods viz., Principal component analysis, Minimum data set and Indicator scoring method and to develop soil quality indices for formulating soil and crop management strategies. Soil samples were collected and analyzed for soil biological properties by adopting standard procedure. Biological indicators were determined for soil quality assessment, viz., microbial biomass carbon and nitrogen (MBC and MBN), potentially mineralizable nitrogen (PMN) and soil respiration and dehydrogenase activity. Among the methods of rice cultivation, Organic nutrition, Integrated Nutrient Management (INM) and System of Rice Intensification (SRI), rice cultivation registered higher values of MBC, MBN and PMN. Mechanical and conventional rice cultivation registered lower values of biological quality indicators. Organic nutrient management and INM enhanced the soil respiration rate. SRI and aerobic rice cultivation methods increased the rate of soil respiration, while conventional and mechanical rice farming lowered the soil respiration rate. Dehydrogenase activity (DHA) was registered to be higher in soils under organic nutrition and Integrated Nutrient Management INM. System of Rice Intensification SRI and aerobic rice cultivation enhanced the DHA; while conventional and mechanical rice cultivation methods reduced DHA. The microbial biomass carbon (MBC) of the rice soils varied from 65 to 244 mg kg⁻¹. Among the nutrient management practices, INM registered the highest available microbial biomass carbon of 285 mg kg⁻¹. Potentially mineralizable N content of the rice soils varied from 20.3 to 56.8 mg kg⁻¹. Aerobic rice farming registered the highest potentially mineralizable N of 78.9 mg kg⁻¹. The soil respiration rate of the rice soils varied from 60 to 125 µgCO₂ g⁻¹. Nutrient management practices of INM practice registered the highest soil respiration rate of 129 µgCO₂ g⁻¹. The dehydrogenase activity of the rice soils varied from 38.3 to 135.3 µgTPFg⁻¹ day⁻¹. SRI method of rice cultivation registered the highest dehydrogenase activity of 160.2 µgTPFg⁻¹ day⁻¹. Soil variables from each PC were considered for minimum soil data set (MDS). Principal component analysis (PCA) was used to select the representative soil quality indicators. In intensive rice cultivating regions, soil quality indicators were selected based on factor loading value and contribution percentage value using principal component analysis (PCA). Variables having significant difference within production systems were used for the preparation of minimum data set (MDS).

Keywords : soil quality, rice, biological properties, PCA analysis

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