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Optimization of Soil Organic Carbon through Particle Size Fractions and Cation Exchange Capacity in Humid Sub-Tropical Climate of Eastern India for Land Use Planning

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Abstract–*Critical value of soil organic carbon, a range of threshold to optimum is determined from the relative yield/soil quality index with soil organic carbon (SOC) content of soils and affected by pedogenic processes, land use and input management. But optimization of SOC is related to dominant clay minerals in soils. Here, we attempted to determine the optimum soil organic carbon through CEC /particle (clay, silt) ratios and SOC pool for land use planning. The study area comprised of Maynaguri block, Japaiguri district, West Bengal, India (Agro-Ecological Sub-Region 15.3), where details soil survey had been conducted for soil resource mapping. Horizon wise soils sample were collected from fifteen modal soils profiles upto a depth of 150 cm in seven established land management units (LMU) through soil survey database representing Indo-Gangetic Alluvial plains soils at the Maynaguri block of Jalpaiguri district, West Bengal having three land uses (field crops, forest and tea plantation). The SOC chemical pools of very labile (P1), labile (P2), less labile (P3) and non-labile (P4) in different LMUs varies from 24-34,14-20,19-24 and 26-38 % of total soil organic carbon, respectively in the above root zone depth (ARZD) while it varies from 24-31, 12-22, 20-22 and 26-34% of total soil organic carbon, respectively in the below root zone depth (BRZD) following the order of P4>P1>P3>P2. The labile pool was highest (14.69 g kg^{-1}) in LMU1 having forest land use and lowest (1.61 g kg^{-1}) in LMU3 in single cropping in the ARZD and the same trend followed at BRZD. The recalcitrant pool is also highest (14.13 g kg^{-1}) in LMU1 and lowest (2.05 g kg^{-1}) in LMU3 but the same trend did not follow in BRZD. The recalcitrant pool is also highest (14.13 g kg^{-1}) in LMU1 and lowest (2.05 g kg^{-1}) in LMU3 but the same trend did not follow in BRZD. Relationship among the soil particles with different C polls showed significant positive correlation with clay, fine silt, fine silt +clay and their ratios but not significant with silt fraction indicating very initial soil aggregation process. It has been observed that the CEC/clay+fine silt ratios (Illite dominant in clay fraction; Mica and Feldspars in fine silt fraction) showed exponential relationship with labile (L) and recalcitrant (R) pools. The recalcitrant pool in BRZD, SOC pools maxima and its derived priority class will guide selection of root zone depth basis crop suitability, cropping intensity and input management practices for long-term soil carbon restorative land use plan.*

Keywords: SOC pools, CEC, soil particles, crop choice and LUP