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Soil Organic Carbon to Clay Ratio as an Indicator of Structural Soil Quality: A Case Study of South Bihar, India

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Abstract: Soil is a valuable and non-renewable resource for agricultural production, and it is essential to establish indicators to monitor its condition. Soil organic carbon (SOC) is a key indicator of soil quality and health since it regulates important physical, chemical, and biological soil properties. Hence, a simple measure of appropriate levels of soil organic matter is needed for soil evaluation, management and monitoring, based on readily measurable soil properties. In this study, an index of soil organic matter based on the SOC to clay ratio, defined by thresholds of SOC/clay ratio for specified levels of soil structural quality, was tested. We assess the index using data from the land resource inventory of WDC2.0/III/Gaya watershed under agricultural land, forest land and open scrub. The results showed that SOC was ranged between 2.40 to 10.40 g kg⁻¹ (surface) and 0.70 to 6.10 g kg⁻¹ (sub-surface) for agriculture; 1.80 to 12.90 g kg⁻¹ (surface) and 1.0 to 5.10 g kg⁻¹ (sub-surface) for forest and for the open scrub, it ranged from 1.30 to 10.20 g kg⁻¹ (surface) and 0.70 to 5.90 g kg⁻¹ (surface). Mean clay content increased in the order of agriculture > forest > open scrub in the surface layer and increased in sub-surface layer across the LULC. Thresholds of SOC/clay ratio of 1/8, 1/10 and 1/13 indicated the boundaries between “very good”, “good”, “moderate” and “degraded” levels of structural condition. On this scale, 92.0, 77.8 and 71.4% of agricultural land, open scrub and forest sites, respectively, were degraded. The index gives a method to assess and monitor soil organic matter at national, regional or sub-regional scales based on two routinely measured soil properties.

Keywords: SOC/clay ratio; Soil function; Structural soil quality; Mapping; Spatial variability