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SOIL CARBON POOLS AS AFFECTED BY THE HISTORY OF AGRICULTURAL LAND USE OF CALCIC RED LATOSOLS IN JAFFNA

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The agriculture sector is growing in the Jaffna district in Sri Lanka. Mismanagement of agricultural lands could lead to soil degradation. Soil organic carbon (SOC) is a key determinant of soil fertility. Information on the quantity and quality of carbon pools will be useful in formulating long term plans to manage soil fertility. A study was conducted to compare SOC pools in different land-use histories in Jaffna and to assess the activity of organic-matter decomposing microorganisms in the respective soils.

Land-uses on calcic red yellow latosol with no-cultivation history (A), and history of cropping with organic amendments only (B and C), inorganic amendments only (D) and both amendments (E) were selected. Soil was sampled from 0-15 cm depth, air-dried and brought to University of Peradeniya and passed through a 2 mm sieve. Soil was analyzed for SOC using loss on ignition (LOI) and Walkley and Black methods, particulate organic-matter (POM), active-carbon (AC), inorganic-carbon, and potential mineralizable nitrogen (PMN). Soil respiration was determined after bringing soil moisture content to 25% (w/w). To assess the activity of SOC decomposing microorganisms, the response to organic inputs with different complexities was determined. For this, subsamples from each land-use history were incubated with rice-straw, poultry manure (PM) and glucose (2%, w/w), and soil respiration was measured for 2 weeks. Data were statistically analyzed using SAS 9.1.3 software.

In cultivated sites (B – E), pH was neutral, EC ranged from 419 to 620 µS/cm and cation exchange capacity (CEC) ranged from 20.3 to 33.3 cmol+/kg. At site A, pH, EC and CEC were 7.75, 168.4 µS/cm and 12.8 cmol+/kg, respectively. CEC was positively correlated with SOC (r^2= 0.8, $p<0.05$). SOC pools varied across land-use histories. Application of organic manure caused significantly higher SOC and AC contents. Uncultivated site A had a higher basal soil respiration (1.21 µg CO_2/g/wk) than cultivated sites (ranged from 0.55 to 0.88 µg CO_2/g/wk). PMN was different across land-use histories (2 – 8 µg N/g/wk) and hence the quality of labile SOC. Amending uncultivated soil with PM decreased respiration by 50% but respiration increased by more than 10% with the same treatment in other land-uses with a history of organic manure usage. Increase in respiration rate in response to amending soil with glucose, rice-straw and PM was positively correlated with AC (r= 0.6, 0.6 and 0.7) and POM (r= 0.5, 0.5, and 0.6). History of land-use affects the quantity and quality of soil carbon pools and organic carbon decomposing microbial communities.