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Research article

Impact of chronosequence of poplar based agroforestry system on storage of soil organic carbon in active and recalcitrant pools

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Abstract

The study comprised of five land uses *viz*., sites having continuous poplar (*Populus deltoides*)-based agroforestry system (AFS) for 10, 20 and 30 years, fodder [pearlmillet (*Pennisetum glaucum*)/ sorghum (*Sorghum bicolor)*]-fodder [oats (*Avena sativa*)/ berseem (*Trifolium alexandrinum*)] (F-F) rotation and fallow land (control) to determine depthwise (0-15, 15-30, 30-60 and 60-90 cm) changes in total C (TC), soil inorganic C (SIC), soil organic C (SOC), total organic C (TOC) and its fractions in different land uses. The TOC pools consisting of very labile C (VLC), labile C (LC), less labile C (LLC) and recalcitrant C (RC) were determined. Fallow land had highest (1.53 Mg m^{-3}) whereas 30 years AFS had lowest bulk density (1.42 Mg m^{-3}) of the surface soil depth. The TC, SOC and TOC stocks followed the order: AFS > F-F > FL in various soil depths. The active carbon (AC) pools (VLC + LC) were higher in 10-year plantation cycle (62.3% of TOC) than 30-year cycle (32.9% of TOC), whereas the passive carbon (PC) pools (LLC + RC) were higher in 30-year plantation cycle (67.1%) than in 10 years (37.7%) in surface depth. The contribution of LLC to PC was higher in 30-year plantation cycle (65%) than in 10-year plantation cycle (48%). Therefore, long-term adoption of poplar based agroforestry system plays a significant role in sequestration of resistant carbon pools in the soils.

Keywords: Active carbon, Carbon sequestration, Organic carbon fractions, Passive carbon, Poplar plantations