Abstract

Soil is the largest sink of carbon (C) in terrestrial ecosystem. The soil C status is a determinant of soil health, quality, sustainability as well as the climate change. Dynamics of C in soils of coastal agro-ecosystem, foundation of food security for almost one-fifth of humankind, is influenced by occasional visits of salt-laden sea water. The frequency and intensity of such visit is apprehended to be increased because of current prediction of global warming leading to sea-level rise resulting in an increase in the salinity of the coastal soils. Following the reported higher soil organic C (SOC) status of coastal saline soils in comparison to its inland counterparts, coastal agro-ecosystem is considered as a good niche for C sequestration as well as a better sink of C in future. This study is focused on the dynamics of SOC and the detail of the mechanistic pathway for higher content of SOC in coastal agro-ecosystem. Results revealed, soil total C, inorganic C and total organic C increased with increase in soil salinity. Further, there was increase in relatively stable fraction and concomitant decrease in labile fraction of SOC (according to their oxidizability) with salinity. This implied that salinity in coastal cultivated soils imparted recalcitrance character to SOC or simply C sequestration. On the other hand, as established from earlier researches, results of this study also revealed that, salinity consequence curbed soil microbial dynamics in terms of soil microbial biomass and activities. This subdued microbial activities and less soil C mineralization might be a probable cause of higher SOC stocks in coastal soils with higher salinity. Beside this, as found in this study, salinity in coastal cultivated soils caused a better soil aggregation and thus physical occlusion of more organic C into soil aggregates protecting it from microbial oxidation increasing the residence time of C in soil. Moreover, salinity resulted decrease in labile pools of SOC and migration of the organic C towards more recalcitrance by attachment of its de-protonated –COO groups onto soil or hydroxylated mineral surfaces and metal-chelating contributing towards its (SOC) longer persistence and thus its enrichment in coastal agricultural soils. All these resulted a higher SOC stock and C sequestration in coastal saline than the inland non-saline agro-ecosystem. This less-accessible aggregate occluded

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organic C and even decline in available free/ non-occluded labile SOC or soil food source, per unit soil total organic C with increase of salinity in soils also explicated the curbed soil microbial dynamics in soils of coastal agro-ecosystem along with the well known hyper-osmotic stress in saline soils.

Keywords: Coastal agro-ecosystem, Soil salinity, SOC enrichment, Mechanism, Physical occlusion, Recalcitrance, Soil microbial dynamics.

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