RIO18 21st World Congress of Soil Science
21 WORLD CONGRESS OF SOIL SCIENCE
Sunday 12 – Friday 17 August 2018
Rio de Janeiro, Brazil
Rio de Janeiro August | 12 - 17

Soil carbon stocks under integrated crop-livestock-forest system in the Brazilian Atlantic Forest region

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Integrated crop-livestock-forest systems (ICLFS) are one of the leading strategies of the Brazilian government program “Low-Carbon Agriculture” to reduce or compensate the carbon emissions, with simultaneous improvement in harvest efficiency. ICLFS provide a strategy for sustainable agricultural production which integrates annual crops, trees, and livestock activities on the same area, and in the same season. The system is based on crop rotations and no-tillage practice that contributes to the quantity and quality of residues input and increasing soil organic matter content. Farmers are adopting ICLFS, but there is still a lack of quantitative data on C stock primarily for the integrated systems. This research aims to address the soil carbon stocks under different management systems in Atlantic Forest biome. Soil carbon stocks were estimated to a depth of 100 cm in a 30-ha ICLFS in São Carlos-SP, Brazil (21°57'S, 47°50'W, 860m alt). The soil classified as a sandy-clay-texture dystrophic Red-Yellow Latosol and climate is Cwa. The experimental area included: i) intensive (INT) grazing of palisade grass; ii) crop-livestock (CLS), one-third of the area is renovated with corn intercropped with palisade grass; iii) crop-livestock-forest (CLFS), CLS planted with *Eucalyptus urograndis* (333 trees per ha); iv) livestock-forest system (LFS), with palisade grass and *Eucalyptus*; v) extensive pasture (EXT) of signal grass, and the control of vi) natural Atlantic forest. After five years soil C stocks (in Mg ha^{-1}) were: LFS, 179.9; INT, 173.1; CLFIS, 160.2; LFIS, 136.4; and EXT, 121.0 Mg ha^{-1}. LFS, INT, and CLFIS stocks were significantly ($p<0.001$) higher, and EXT significantly lower than C stocks under natural Atlantic Forest (129.7 Mg ha^{-1}). Results indicated that under the local edaphic and climatic conditions of the study both agroforestry systems (CLFIS and LFS) and intensive managed pasture (INT) lead to high SOC accumulation even in the short term such as five years study. Land use change, based on adequate farm and soil management strategies, such balanced nutrient management, improved grazing, no-till farming and crop rotation increased soil carbon accumulation.

Keywords: Soil organic matter, ICLFS, carbon sequestration, land use change, Red-Yellow Latosol

Financial Support: Embrapa