SOIL CARBON IN INTEGRATED AGRICULTURAL PRODUCTION SYSTEMS IN THE CERRADO-AMAZON TRANSITION AREA

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The objective of this scientific research was to identify the origin and quantify C accumulation in the soil after 3.5 years of implantation of a crop-livestock-forest integration system (ICLF) in the transition region of the Cerrado and Amazon biomes. Recently, several studies have been conducted on the emission of Greenhouse Gases (GHG) in agriculture. Thus, systems such as the ICLF have been evaluated because they are considered promising both for greater efficiency in production and in the mitigation of GHG emissions and simultaneous accumulation of carbon both in the soil and in plant biomass. Two areas under ICLF (ICLF1 and ICLF3) were selected, systems with one row and three rows of Eucalyptus urograndis per row, respectively, an area under pasture and a forest in the municipality of Nova Canaã do Norte, Mato Grosso (Figure 1). The soil was dystrophic Red-Yellow Latosol, clayey. The area, cultivated since 1998, was converted to the ICLF system in 2009. Soil samples were taken at eight depths up to 1 meter. In the areas under ICLF, sampling was carried out in the area under the trees influence, in the pasture and in the transition zone; considering points in the tree lines and points away from them having them as a reference of distance. In the reference areas (pasture and forest), samples were collected in a cross section, at points approximately 50 m away from each other. The analysis of C stocks in the soil was performed for the 0.0-0.3 and 0.0-1.0 m layers.

An important observation in this study was the presence of trees in the system that, in just 3.5 years, favored accumulations of more than 20 t/ ha of total organic soil carbon (COS) in the soil layer of up to 1 m, especially in areas with 3-row eucalyptus tree rows (Table 1). It is very common to see a significant accumulation only after 5 years under a certain type of management.

Compared to the area under pasture with 110.66 t/ha of COS in the 1 m deep layer, although the area under ICLF1 did not show any significant difference, the area under ICLF3 showed a positive balance of COS with 128.34 t/ha. The additional 17.68 Mg C ha^{-1} in ICLF3 meant an annual accumulation rate of 5.05 Mg C ha^{-1} between the pasture and the ICLF system. A possible cause of the weak impact of ICLF1on the carbon accumulation in the soil could be due to the low total N content in the area.

Considering a 1 m deep soil layer, the surface layer (0.3 m) contained 49% COS. In the topsoil, no significant differences were observed between ICLF and Pasture. We found a strong indication that the trees played an important role in the accumulation or preservation of the subsoil.

RESULTS

Our results suggested that, in the edaphoclimatic conditions of the study site, agricultural systems that include forest components may represent viable solutions for the accumulation of COS, even in the short term, if soil fertility restrictions are not present.

NEXT STEPS AND RECOMMENDATIONS

Due to the results obtained, ICLF should be promoted as a practice that contributes to the mitigation of climate change and promotes the adaptation of the production system to a scenario of environmental changes. Monitoring the evolution of these systems in regards to their C soil accumulation is recommended during longer periods, which will allow for assessing the evolution and stability of the benefits of the soil due to implementing this system in the field.

DATA PUBLISHED IN:

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OLIVEIRA. J. M. O.; MADARI. B. E.; CARVALHO. M. T. M.; ASSIS. P. C. R.; SILVEIRA. A. L. R.; LIMA. M. L.; WRUCK. F. J.; MEDEIROS. J. C.; MACHADO. P. L. O. A. Integrated farming systems for improving soil carbon balance in the southern Amazon of Brazil. Regional Environmental Change. v. 18. n. 1. p. 105-116. 2017.

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Table 1: : Carbon stock, based on the equivalent density of the soil, for the 0.0-0.3 and 0.0-1.0 m layers, in a dystrophic Red-Yellow Latosol, cultivated in a crop-livestock integration system -forest and continuous pasture in Nova Canaã do Norte, Mato Grosso, Brazil.

Area	0.0-0.3		0.0-1.0	
Pasture	55.76		110.63	
ICLF1[1]	57.49	NS	123.58	**
ICLF3[2]	61.53	**	128.34	*

*[1]Integrated crop-livestock-forest system with a line of eucalyptus per row (ICLF1); [2] Integrated crop-livestock-forest system with three lines of eucalyptus per row. Values are weighted averages. ICLFS averages were compared to Pasture averages using the T test. * P = 0.05, ** p = 0.01, *** p = 0.0001, NS = non-significant difference.*

Figure 1: Integrated crop-livestock-forest system with one eucalyptus line per row (a) with three eucalyptus lines per row (b), in a Dystrophic Red-Yellow Latosol, in Nova Canaã do Norte, Mato Grosso, Brazil

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