Soil C stocks and isotopic signature in integrated crop-livestock-forest systems of the Cerrado-Amazon transition zone

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Introduction

Integrated crop-livestock-forest systems (iCLF) are gaining importance as they are considered promising systems for the mitigation of greenhouse gas emissions and carbon sinks. We investigated if iCLF was able to improve soil C stocks when implemented on an area of pasture showing signs of overgrazing.

Material and Methods

Our study was carried out in the north of Mato Grosso State, in Brazil, a transitional region between the Amazon and Cerrado ecosystems (10º38'13" S, 55º42'32" W). Two areas under iCLF were selected (iCLF1 and iCLF3, systems with one and three rows of *Eucalyptus urograndis* by hedgerow, respectively) and an overgrazed pasture. The soil was a clayey Oxisol (*"Latossolo vermelho-amarelo distrófico", SiBCS*). The climate was Aw, according to Köppen's classification. The areas have been cultivated since 1998, and was converted into iCLF in 2009. Soil samples were collected from 0.00-0.05; 0.05-0.10; 0.10-0.20, 0.20-0.30; 0.30-0.40; 0.40-0.60; 0.60-0.80 and 0.80-1.00 m soil layers to quantify the bulk density, texture, total C content and isotope ratio ($\delta^{13}C$) of the soil. In areas under iCLF samples were taken from the influence zone of the trees to the middle of the pasture zone. Carbon stocks were analyzed for the 0.0 to 0.3 and 0.0 to 1.0 m soil layers.

Results and Conclusions

The isotopic composition of the soil was affected by the implementation of iCLF, and the forestry component was a major important factor in the accumulation of C in the soil. The C accumulation in the soil at all sampling positions was greater in the iCLF3 and in the iCLF1 (in the area under the influence of trees) than in the pasture (Table 1). We concluded that iCLF affected soil C and N stocks in the short term, however, long lasting iCLF deployment would be necessary to elucidate the impact of iCLF in the long-term.

Table 1. Weighted means of carbon stocks (Kg ha^{-1}), based on equivalent soil mass, in a clayey Oxisol under integrated crop-livestock-forestry systems (iCLF) and overgrazed pasture in Nova Canaã do Norte, MT, Brazil

Layer	Pasture	iCLF1[1]		iCLF3[2]	
0.0-0.3	55.76	57.49	NS	61.53	**
0.0-1.0	110.63	123.58	**	128.34	*

[1]iCLF with one line of eucalyptus trees by hedgerow; [2]iCLF with three lines of eucalyptus trees by hedgerow. Comparison between the iCLF and overgrazed pasture means were done using the T-test (nominal significance levels: * p = 0.05, ** p = 0.01, *** p = 0.0001, NS = not significant).

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