Soil carbon and nitrogen stocks under natural forested savannah and cultivated pasture in the Pantanal, Mato Grosso do Sul, Brazil

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Introduction

Changes in land use can affect the biogeochemical processes, with consequences to the soil organic matter (SOM) stocks. Depending on the characteristics of the area and management system adopted, these changes may jeopardize the role of soil as one carbon (C) sink on the Earth. A sound understanding of C sequestration potential in soil could be crucial for the development of practical management approaches, to reduce CO2 concentrations in the atmosphere as well as to maintain the sustainability of production systems. In the Pantanal, the establishment of cultivated pastures in no- flooded savannah areas is one of the major land-use changes in the region. They receive no fertilization, and the maintenance of satisfactory levels of production depends on the nutrients naturally released into the soil by the decomposition and mineralization processes related to the SOM dynamics. The goal of this study was to estimate the soil C and N stocks under *Urochloa* spp. pasture with a natural forested savannah as a reference.

Material and Methods

The experiment was carried at the Embrapa Pantanal experimental farm. The studied areas comprised an Urochloa pasture spp., introduced about 21 years ago in an area under non-flooded forested savan-

nah, and as a reference for comparison purposes a natural non-flooded forested savannah adjacent to pasture, which floristic composition and structural and edaphic characteristics are similar to the deforested area. The pasture has never received any fertilizer. It has been using for lactating females and newly weaned calves. When necessary, the pasture has submitted to cleaning by mowing. Soil samples were collected at depths 0-10, 10-20, 20-30, 30-40, 40-60, 60-80 and 80-100 cm in three trenches, to determine soil bulk density, and in four different transects amounting 315 samples per area (45 per depth). The C and N content were assessed by dry combustion in a CHNS analyzer equipment. The stocks from the pasture area were fixed for the same soil mass according to Carvalho et al. (2009). Since the results were not normally distributed, the Kruskal-Wallis/Wilcoxon nonparametric test for means comparisons at 5% of probability was used.

Results and Conclusions

According to Figure 1a, one observes that the higher soil C storage occurred in the sub-surface layers ($p < 0.05$) in both of the areas. Under the natural forested savannah, a larger soil storage C was found at the layer 0-30 cm (13.719 and 10.934 Mg C ha^{-1}, respectively, for natural forested savannah and *Urochloa* spp. pasture). Regarding the layer of 40-100 cm deep, the soil C stocks were higher in the area under pasture (23.021 and 18.691 Mg C ha^{-1}, respectively, for *Urochloa* spp. pasture and natural forested savannah). When one considers the 0-100 cm layer, however, it appears that there were no differences between areas (33.995 and 32.409 Mg C ha^{-1}). These results suggest that 21 years after pasture implantation there was no reduction the in soil C stock when compared to the primary area once the loss of C in its surface layers was offset by the higher storage in the deeper soil layers. As for the soil C, the soil N storage is also greater in the sub-surface layers (Figure 1b). However, a statistical difference ($p < 0.05$) was observed only in the 0-30 cm layer, with stocks ranging from 1.028 to 1.364 Mg N ha^{-1}, respectively, for the

soil under *Urochloa* spp. pasture and natural forested savannah). In the 40-100 cm layer, the soil N stocks were 2.054 and 2.245 Mg N ha^{-1}, respectively, for natural forested savannah and *Urochloa* spp. pasture, and in the layer 0-100 cm they ranged from 3.273 to 3.419 Mg ha^{-1}, respectively for *Urochloa* spp. pasture natural and natural forested savannah. Despite not having provoked a reduction in C and N soil stocks, the establishment of pastures in forested savannah areas show certain restraints. The removal of the original vegetation represents losses of about 49 Mg C ha^{-1} associated to the aboveground biomass (FERNANDES et al., 2008). This amount is greater than that stored in the soil up to 1 meter deep. When estimating the C balance for the area, such removal shall be taken into account, which will certainly contribute to obtaining unfavorable balance to the greenhouse gas emissions from the production system. Furthermore, one has to consider the costs of the clearing operation, which make this unattractive agricultural practice. Currently, the trend in the Pantanal has been the introduction of exotic pastures in field areas with low nutritional quality forage.

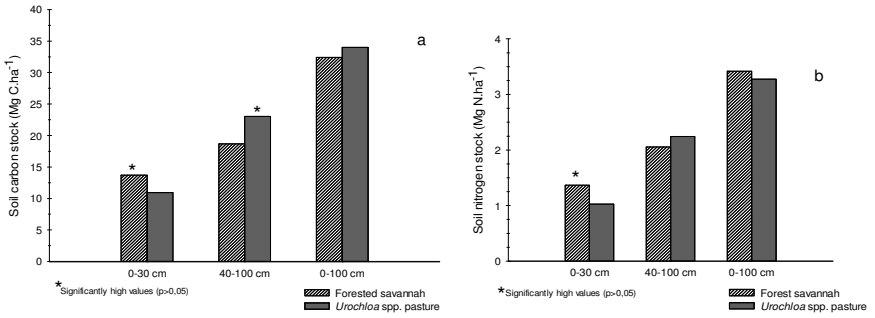

Figure 1. Carbon (a) and nitrogen (b) stocks in soils under natural forested savannah and Urochloa spp. pastures in Pantanal, MS

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