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Evaluation of the stability of soil organic matter in different types of livestock management

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Introduction

Agricultural and livestock perform an important role in the economy, especially in a country like Brazil, where the natural conditions favor advantages for the development of agribusiness, while generating jobs for the population, income and consumer market for industrial goods. Of the 850 million hectares (Mha) existing in the country, 200 Mha are destined for livestock (Sparovek et al., 2007).

There is concern about the practice of livestock, since this type of management can liberate to the atmosphere greenhouse gases (GHGs), on the other hand, various agricultural practices are able to offset GHG emissions to the atmosphere by sequestering carbon in the atmosphere to the soil. Carbon sequestration can be achieved by the introduction of grass species, well-managed pastures and no soil disturbance, favor carbon accumulation process in the soil (Roscoe et al., 2006).

One way to evaluate the carbon sequestration by the soil is the quantification of the stock and the characterization of soil organic matter (SOM). The SOM is the largest carbon reservoir of the terrestrial surface, reservoir that is dynamic and may vary with management practices. The study of humic substances (HS), which is the SOM highly decomposed, can provide information about the stability of the carbon present in this soil (Segnini, 2007).

One way to assess such impacts is analyzing soil organic matter (SOM). It's possible measure the changes suffered by the SOM using their fluorescence properties (Kalbitz et al., 1999).

Thus, the aim of this study was to evaluate the amount of carbon present in humic acid (HA) and check the humification indices thereof in different types of livestock management.

Material and Methods

To attain the proposed objectives humic acids of five areas of different pastures were extracted. Table 1 details the characteristics of the five areas evaluated. The experimental area is located in the city of São Carlos, SP, Brazil

Table 1. Description of the samples about of kind management, texture and stocking.

Experimental area	management	texture	stocking rate
Area 1	irrigated	medium sandy	high
Area 2	dry	loamy	high
Area 3	in recovery	loamy	medium
Area 4	degraded	medium sandy	short
Area 5	native forest	medium	without

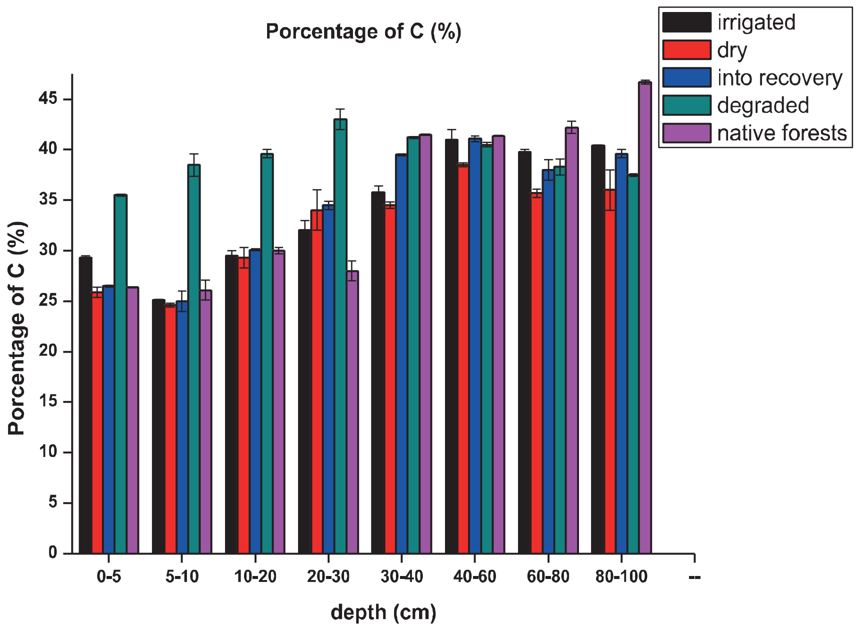
The sampling was conducted in 8 depths (0-5, 5-10, 10-20, 20-30, 30-40, 40-60, 60-80 and 80-100 cm) for each area, totaling 40 samples soil. The extraction and purification of humic acids of soil followed the recommendations described by Swift (1996) and the International Humic Substances Society (IHSS).

The fraction of humic substances used for the analysis was the humic acid. Was used an elemental analyzer (CHNS) Perkin-Elmer (2400 Serious II CHNS/O Elemental Analyzer) model, to determine the humification index was used luminescence spectrometer Perkin Elmer LS--50B model and the indexes were calculated according to the method proposed by Milori et al., 2002.

Results and Conclusions

The average values of carbon for each area evaluated are shown in figure 1.

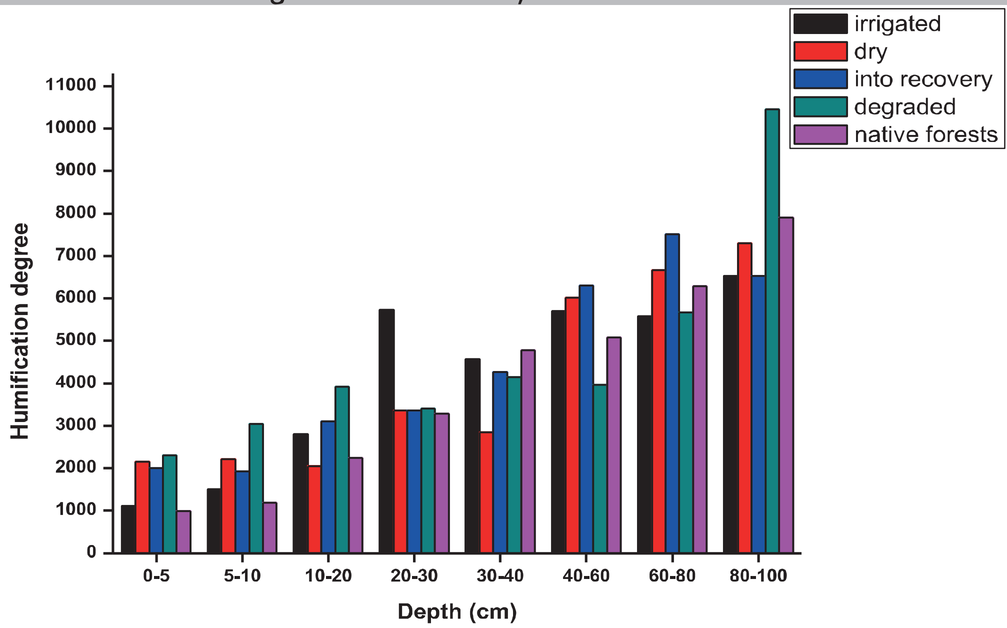
Figure 1. Carbon content in humic acids in percentage (%).



It is observed that the carbon values increase with depth for all evaluated areas, except for the degraded area that keeps the carbon content of around 35 to 40% for all depths. This behavior in degraded area suggests the presence of a SOM which is already more humified in the whole soil profile. For the other areas, it can be said that still have a fresher SOM in surface. Were evaluated the carbon content of the whole soil in the same samples from this study, and lower carbon content was found for the degraded area, thus indicating that pasture degradation leads to loss of carbon to the atmosphere (Segnini et al. , 2014).

The humification indexes are in Figure 2. The values of humification indexes increase with increasing depth for all evaluated areas.

Figure 2. Humification indexes obtained by Milori et al., 2002. The values of humification indexes are given in arbitrary units.



Analyzing separately the areas observed that the degraded area has the largest humification index values at depths of 0 to 20 cm, and 80 to 100 cm. Already the native forest has the smallest humification values in almost all depths. The irrigated area has higher values of the humification index in the intermediary of the soil profile horizons, between 20 to 40 cm. The dry areas and recovery have similar behavior, both increase the values of the humification index in the deeper horizons.

The degraded area has the highest values of humification indexes, along with the higher carbon values, thus suggesting the presence of a SOM most recalcitrant, which in turn will not easily interact with the soil, leaving the soil more depleted and less fertile. Already the native forest showed lowest values of humification indexes in this area there is a more labile organic material, that is, the SOM is subject to more interactions with the soil compartments, resulting in a more fertile soil.

Although this study is very preliminary to effective analysis of pasture management, the results showed a coherence between the fluorescence results with carbon content. To make a more accurate assessment about carbon cycling and effective recommendation on pasture management, you need to relate the results with other soil parameters such as physical parameters, and thus can establish a management that allows a carbon stability in the soil.

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