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PROPOSAL FOR BRAZILIAN TAXONOMY OF HISTOSOLS BASED ON HUMIC SUBSTANCE CONTENT

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I. INTRODUCTION

Most of Brazilian soil surveys maps are presented in a scale smaller than 1:400000. Only recently, with the development of techniques applying satellite images with high definition, soil surveys are executed at semidetailed levels or more detailed, with larger map scale. For these surveys, criteria must be developed and diagnostic characteristics determined for soil classification at the family and series levels, specially for Histosols, equivalent to Organossolos in Brazilian System of Soil Classification (Embrapa, 1999).

Because the nature of Organossolos, the distribution of humic substances (HS) is an attribute even more important in this class than other soil Orders. Also, there is a significant correlation between different HS fractions and many soil attributes (Valladares, 2003). Thus, it is proposed the classification of Organossolos or histic horizons, at the family or series levels, based on the humic substance contents, especially fulvic acids (FAF) and humic acids (FAH).

II. MATERIAL AND METHODS

The samples used in the study included 19 Organossolos and 53 samples of soils with high organic matter content, from representative Brazilian regions (Figure 1). The HS was extraction was made with three replications, according to differential solubility technique, using the concepts of humic fractions established by International Society of Humic Substances, adapted by Benites et al. (2003). The quantitative carbon, in extracts of fulvic (FAF) and humic (FAH) acid fractions, was determined according to Yeomans and Bremner (1988).

The following frequency distribution classes were applied to define the classes:

- FAF in the soil $\leq$ 20g kg^{-1} of C - **hipofulvic** (n=28), and > 20g kg^{-1} of C - **fulvic** (n=25); and
- FAH in the soil $\leq$ 90g kg^{-1} of C - **hipohumic** (n=25), and > 90g kg^{-1} of C - **humic** (n=28).

The classes identified above were validated with statistical analysis, comparing average and median among the properties of soils for which the classes proposed were applied (Table 1).

III. RESULTS AND DISCUSSION

The HS have high contents in the studied soils. The content of FAF, FAH, and humin fractions also explain the differences between Organossolos and other soil Orders, related to soil cation exchange capacity, pH buffering, acidity, and other attributes. The FAF presented values of average and standard deviation (20,8 $\pm$ 11,2g kg^{-1}), representing in average 10% of total carbon, and also the lesser variability, with coefficient of variation equal 54% with minimum value equal 5,9g kg^{-1}) and the maximum 57,3g kg^{-1}. The FAH presented average value and standard deviation of 99,2 $\pm$ 57,9g kg^{-1}, with 58% of coefficient variation and represents in average 40% of total carbon. The minimum value was 12,5g kg^{-1} and the maximum 208,4g kg^{-1}.

Table 1 shows a significant difference according to FAF classification for the soil properties: total N content, sum of base, bulk density (Ds), minimum residue (RM), % of rubbed fibers, and degree of decomposition using von Post index. The total N content N, % of rubbed fibers, and sums of base levels were highest in the fulvic soil class. The Ds, RM, and the values of von Post index

were lowest in the fulvic soil class. Such results lead to infer that fulvic soils tend to present higher natural fertility, smaller degree of decomposition of soil organic matter, and higher subsidence potential than Organossolos classified as hipofulvic.

Figure 1 – Approximate origin of soil profiles.

The differences between hipohumic and humic classes (Table 1) were shown in the total N content, CEC (cation capacity exchange), sum of base, $H^+ + Al^{3+}$, pH in water, C/N ratio, Ds, and RM. The content of total N, sum of base values, CEC, $H^+ + Al^{3+}$, and C/N ratios were higher in the samples classified as humic than in hipohumic. The pH values were smallest in the humic, reflecting the presence in this class of soils with sulfuric materials, as well as the higher levels of acidity ($H^+ + Al^{3+}$) than in the hipohumic. The Ds and RM were smallest in the humic class, indicating the higher subsidence potential of these soils when compared to the hipohumic.

IV. CONCLUSION

The content of fulvic and humic acid fractions proved to be efficient to grouping the studied Organossolos (Histosols), differentiating well their chemical and physical properties. The results validate the proposal of using FAF and FAH for classification of soils with high organic matter, at the family or series taxonomic levels.

Table 1 – Comparison between averages and median of soil properties, based on the classification according to fulvic acid (FAF) and humic acid (FAH) fractions content.

Properties	Statistical test (measure)	Hipofulvic (n=28) (≤ 20g C kg^{-1} FAF)	Fulvic (n=25) (> 20g C kg^{-1} FAF)
Total N (g kg^{-1})	t (average)	6.5 b	14.2 a
Von Post Index	Mann-Whitney (median)	9 a	6 b
Rubbed fibers (%)	Mann-Whitney (median)	7 b	24 a
Sum of base ($cmol_c kg^{-1}$)	Mann-Whitney (median)	3.95 b	5.80 a
Bulk density - Ds (g cm^{-3})	Mann-Whitney (median)	0.54 a	0.19 b
RM (cm cm^{-1})	Mann-Whitney (median)	0.251 a	0.040 b
Properties	**Statistical test (measure)**	**Hipohumic (n=25) (≤ 90g C kg^{-1} FAH)**	**Humic (n=28) (>90g C kg^{-1} FAH)**
Total N (g kg^{-1})	t (average)	7.4 b	12.6 a
Von Post Index	Mann-Whitney (median)	8 a	7 a
Sum of base ($cmol_c kg^{-1}$)	Mann-Whitney (median)	2.6 b	7.4 a
CEC ($cmol_c kg^{-1}$)	Mann-Whitney (median)	29.0 b	56.9 a
H + Al ($cmol_c kg^{-1}$)	Mann-Whitney (median)	24.4 b	46.2 a
pH H_2O	t (average)	4.7 a	4.0 b
C/N	Mann-Whitney (median)	18.0 b	28.5 a
Bulk density - Ds (g cm^{-3})	Mann-Whitney (median)	0.56 a	0.23 b
RM (cm cm^{-1})	Mann-Whitney (median)	0.265 a	0.037 b

Different letters in the same row differ significantly at p = 0.05.

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