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EVALUATION OF THE APPLICABILITY OF PEAT FROM MOGI-GUAÇU AS A SOIL IMPROVER IN AN AGRICULTURAL CONTEXT

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Abstract: Since peat is a sedimentary soil extremely rich in organic matter, micro and macro nutrients, with a high cation exchange capacity (CEC) and water retention capacity, it's can be seen as a more environmentally sustainable alternative to the synthetic fertilisers widely used. The physical-chemical characterisation of a soil extracted from the state of São Paulo and its comparison with other better-known peats can provide a preliminary indication of its potential agricultural applicability.

Keywords: peat, Mogi-Guaçu River, agriculture, soil fertility, water retention, organic matter, nutrients.

AVALIAÇÃO DA APLICABILIDADE DE TURFA DE MOGI-GUAÇU COMO MELHORADOR DO SOLO EM CONTEXTO AGRÍCOLA

Resumo: Sendo a turfa um solo sedimentar extremamente rico em matéria orgânica, micro e macro nutrientes, com alta capacidade de troca catiônica (CTC) e capacidade de retenção de água, essa dispõe-se como uma alternativa mais ambientalmente sustentável aos fertilizantes sintéticos amplamente utilizados. A caracterização físico-química de solo extraído do estado de São Paulo e sua comparação com outras turfas melhor conhecidas pode indicar de maneira preliminar o potencial de sua aplicabilidade agrícola.

Palavras-chave: turfa, Rio Mogi-Guaçu, agricultura, fertilidade, retenção de água, matéria orgânica, nutrientes.

1. Introduction

Along the lines of today's agriculture, synthetic compounds are widely used to improve the soil quality in rural areas, although both their application and manufacture can often result in direct and indirect environmental problems (Kiehl, 1985). In this context, it is extremely important to look for more sustainable alternatives, that's where peat can be utilized, as a consequence of its physical and chemical characteristics (Couillard, 1994; Cao, 2019).

This typology of soil is characterized by its formation process, which consists primarily of the submergence and burial of high quantities of organic materials from plant origin - which can be shrubby, woody or even algae - in aerobic (superficial) and anaerobic or anoxic (deep) environments, occurring in higher quantities in regions with a temperate climate (IPT, 1979). This typical process results in deposits called peat bogs, which present extremely favorable conditions for the development of microbial communities responsible for breaking down this material, resulting in complex compounds such as humin, humic and fulvic acids, as well as other nutrients (Fuchsman, 1980). As a result, peat tends to have a high organic load, a high presence of nutrients and a favorable CEC for the fixation

and bioavailability of these elements, which together with its distinct water retention capacity and the greenhouse gas sink potential makes the agricultural use of this material highly interesting (Kiehl, 1985).

Several national and international studies have focused on understanding the agricultural applicability of this type of soil, including Biasi et al (1995), Franchi, Sígolo e Lima (2003), Bezerra e Sousa (2023), Schmitz, Souza e Kampf (2002), Cao (2019), Uddin et al (2023), Hytonen (1998), Hemes et al (2019), Sitzmann et al (2025) e Rezanezhad et al (2016), where different uses of national - respectively the first four - and international peats were evaluated and found to be efficient.

Furthermore, given that the properties of peat differ according to its formation, it is important that this analysis be carried out for any deposit in which it is desired to observe the existence of this feature. Therefore, this study aims to characterize a peat soil extracted from the margins of the Mogi-Guaçu River - SP, Brazil - in order to compare its properties with other similar soils that have the potential to be used as a conditioning agent, so as to obtain a preliminary diagnosis of its applicability.

2. Materials and Methods

Initially, the peat evaluated was sampled in the rural area of the city of Luis Antônio (SP), on the shore of the Mogi-Guaçu River, more precisely at coordinates 21°35'53.2‘ S and 47°57'03.3’ W. The sample was then properly prepared at the Geotechnics Department of the São Carlos School of Engineering - USP, so that the subsequent analyses could be carried out properly. In this context, Table 1 shows the most relevant tests carried out for this study, along with the methodologies used for each one.

Table 1. Methodologies used for main tests

Laboratory Test	Methodology Adopted	Location of Analysis
Moisture Content	MAPA (2013)	Department of Geotechnical Engineering (EESC-USP)
pH	EMBRAPA (2011)	Department of Geotechnical Engineering (EESC-USP)
CEC	MAPA (2013)	Department of Soil Science (ESALQ-USP)
Organic Matter and Ash Content	Kiehl, 1985	Department of Geotechnical Engineering (EESC-USP)
Elemental Composition (CHNS)	CHNS/O PerkinElmer	São Carlos Institute of Chemistry (IQSC-USP)
Organic Carbon	MAPA (2013)	Department of Soil Science (ESALQ-USP)
Total Nitrogen, Phosphorus, Potassium, Calcium and Magnesium	MAPA (2017)	Department of Soil Science (ESALQ-USP)

3. Results and Discussion

To this effect, the methodologies described above were used to obtain concrete results for the main properties considered in the proposed analysis. In this context, Table 2 shows the final values for the peat evaluated, together with the results for other peatlands with confirmed agricultural potential, allowing the desired comparison to be made.

Table 2. Properties of the peat evaluated and other peatlands with agricultural use

Properties		Claro, Rodrigues e Vieira, 2025	Franchi, Sígolo e Lima, 2003	Sitzmann et al, 2025	Schmitz, Souza e Kampf, 2002	Paleckiene, Navikaite e Slinksiene, 2021
Sampling Site		Luis Antônio - SP, Brazil	São José dos Campos - SP, Brazil	Italy	Criciúma - SC, Bazil	Ezerelio, Lithuania
Moisture Content (%)		66.71	58.90	37.60	35.00	—
pH		4.6	—	—	3.8	4.4
CEC ($cmol_c\ kg^{-1}$)		63.69	76.00	—	48.70	—
Organic Matter (%)		36.30	93.40	—	—	—
Ash Content (%)		63.7	6.60	—	—	—
Elemental Composition	C (%)	12.61	51.9	—	—	23.11
	H (%)	1.95	—	—	—	—
	S (%)	0.00	0.15	1.13	—	—
Organic Carbon (%)		15.49	41.77	16.69	27.60	—
Total Nitrogen (%)		1.00	1.47	1.00	—	2.11
Total Phosphorus (%)		0.33	0.15	0.24	—	0.11
Total Potassium (%)		0.03	0.03	1.03	—	0.06
Total Calcium (%)		0.04	0.37	4.07	—	—
Total Magnesium (%)		0.02	0.03	1.40	—	16.08

— *not determined*

Therefore, it can be seen that the peat studied has the characteristics expected for this type of soil. However, its cation exchange capacity, which facilitates the fixation of nutrients and consequently their bioavailability to plant organisms, and the concentration of phosphorus, an important macronutrient that when compared to other peats is found more exponentially in the soil in question, stand out positively. The peat also has quantities of organic carbon and nitrogen within the expected range, with intermediate values.

As for the amount of organic matter, total carbon and other micronutrients such as calcium and especially magnesium, as well as the ash content, there is a slight discrepancy compared to other matrices.

Finally, it is noticeable that one of the constants of peat soils is its more acidic pH, which means that its application must be in accordance with the needs of the cultivation and the properties of the soil, and may or may not require liming. It is also noteworthy that, compared to other national peats, the soil evaluated has a high moisture content, which may indicate a greater water retention capacity, as Lima (2023) points out, which is extremely positive in agriculture as it intensifies irrigation efficiency by facilitating the accumulation of water in surface layers, where there is a greater concentration of plant roots.

4. Conclusions

It can therefore be concluded that the peat sampled in Luis Antônio - SP, near the Mogi-

Guaçu River, has potential for use as a soil improver in agricultural applications and in the recovery of degraded areas.

To this end, as presented above, the material has some qualities, especially the presence of phosphorus and CEC, but it also has negative points in terms of the lack of some nutrients and an amount of organic matter lower than expected .

Finally, it should be noted that some tests still need to be carried out to complement the proposed study, especially on the soil's water retention capacity, its real applicability and its potential for adsorbing ions of interest. In addition to the extraction of the humic compounds present in the material, so that its isolated applicability can also be tested, along the same lines as for peat, allowing a direct comparison between both of them.

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