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AN OVERVIEW ON THE MAIN PROPERTIES OF A GLEYIC PHAEOZEM LOCATED IN MITOC, BOTOŞANI COUNTY, ROMANIA

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Abstract

The present scientific paper focuses on morphological description and characterization of one of the most representative soil types in Romania, in terms of natural fertility – the phaeozem. In order to emphasize its main physical and chemical features, a soil profile was digged on a plane arable surface located in Mitoc locality, Botosani county – a region situated in Romania's north-eastern part. The field characterization of soil, as well as the laboratory analysis, were made in order to evaluate its current agricultural potential, especially because the land occupied by phaeozems that corresponds to the investigated area has been used as pasture in the past, but it's intended to be intensively cultivated in present. The indicators that were analysed refer to both physical and chemical soil features, such as: particle size distribution (soil texture), carbonates content, soil reaction, organic matter content, C/N ratio, macronutrients content (total nitrogen, mobile phosphorus, mobile potassium), as well as a few of the micronutrients (such as zinc, copper, iron and manganese). All the soil samples collected from the field were analysed at National Research and Development Institute for Soil Science, Agro-Chemistry and Environment (ICPA Bucharest), in early 2012. The interpretation of data was made in accordance to the Methodology of Soil Studies Elaboration. The results indicated that the phaeozem investigated in Mitoc is a loamy soil, with moderate soil reaction, medium humus content, medium nitrogen, but very low phosphorus content on the entire soil profile; also, due to the particularity of the relief in the area, it is highly influenced by the ground water level, an aspect which led to frame it as a gleyic phaeozem subtype.

Key words**:** *phaeozem, Mitoc - Botosani, physical and chemical indicators, agricultural potential.*

INTRODUCTION

Phaeozems are among the world's most fertile soils, occupying approximately 1.5% of the continental land area on Earth, highly spread in American prairies in the north, as well as in south-eastern part of Europe, American pampas in south and Asian steppes [7]. In Romania, phaeozems are located mostly along the chernozems area, significant surfaces could be especially found in sub-Carpathian regions and Moldavian Tableland [6]. Due to their natural fertility, all surfaces occupied by phaeozems present major agricultural interest. In this context, the present work-paper focuses on the investigation of a phaeozem soil, located in Romania's north-eastern part, (respectively in Botosani county), in order to bring up to date the pedological data and to prepare the 300 ha land surface occupied by this specific soil for intensive using as arable land and a large range of crops. The investigated perimeter is part of Moldavian Plain, Dărăbani geomorphologic district [1]. The whole area, situated in close proximity to Prut river (less than 5 km distance), has an average altitude of 100-125 m. A particularity of the researched area is represented by the presence of small springs, an aspect which significantly influences soil type morphological features. At the date of field investigation, in 2011, the land occupied by phaeozems was used as pasture.

MATERIAL AND METHOD

In order to point out the main indicators that are related to agricultural potential of the phaeozem corresponding to the investigated perimeter, a profile was prepared and morphologically described in the early summer of year 2011, when the field was still unused for annual crops cultivation. The delimitation of the soil layers,

the field observations, as well as the collection of soil samples for laboratory were made in accordance to the current pedologic methodology [8]. Based on the influence exerted by environmental elements and the determination of soil characteristics, the soil was identified as a Gleyic Phaeozem – FZgc (PHgl according to WRB-SR, 1998), with a profound, considerable thickness of topsoil horizon, Am (fig. 1). An important characteristic in definition of this specific soil type was represented by the absence of carbonates on the entire soil profile [4, 6] - as the samples treated with HCl solution and the soil analysis demonstrated later on. After the identification and short description in the field, soil samples have been taken for detailed laboratory analysis at ICPA Bucharest, Department of Agro-Chemistry and Plant Nutrition. The following indicators were determined: *particle size distribution* – using the standard procedure, based on sedimentation, pipette sampling and chemical treatment; *soil reaction* – by potentiometric method, in water suspension (1: 2.5); *humus content* (%) by Walkley-Black method, modified by Gogoaşă; *total nitrogen* – by Kjeldahl method; *mobile phosphorus and potassium content* by Egner-Riehm-Domingo method; in addition to this, a few of some *soil micronutrients* (such as Zn, Cu, Fe, Mn) were considered. The interpretation of laboratory data was made according to the limits prefigured by the previous cited methodology [8].

RESULTS AND DISCUSSIONS

Aspects regarding the morphology of the profile. As it could be observed in figure 1, the soil profile highlights the most important characteristics of phaeozems, respectively: *profound and dark Am horizon* (2.5B1/2 value according to Munsell color chart); *transition horizon with chroma < 3.5*; *the absence of carbonates*, as well as the *sporadic presence of biogenic formations.* However, in ABv and Bv horizons, slight mineral films were observed, continuing with increased accumulation of manganese and iron formations, along the profile depth.

Location: west of Mitoc village
Parental material: loess deposits [9]
Relief: generally flat
Average height: 100-150 m
Land using: pasture
Ground water depth: 1-1.5 m
Texture determined in the field: loamy

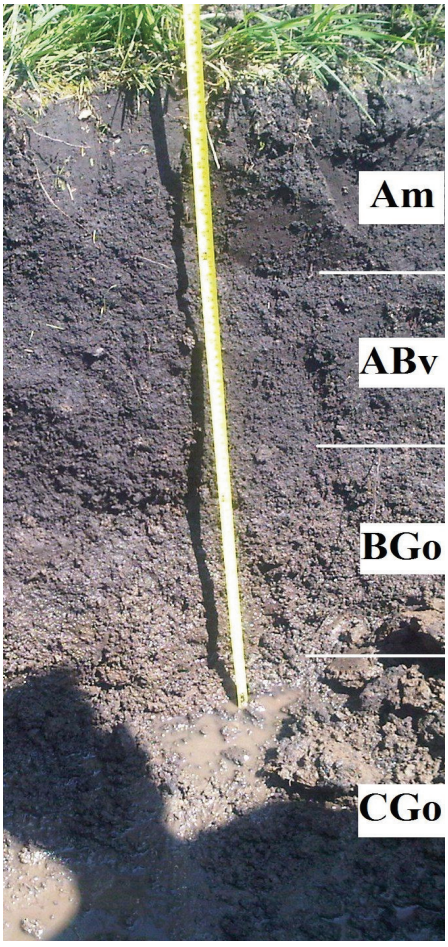

Fig. 1. Gleyic phaeozem profile - Mitoc, BotoŞani

Within profile, the soil material is slightly moist, a feature which increases and becomes dominant in Bv layer. The profile is also characterized by the presence of gleyization process (which appears evident before 95 cm depth) and determined the delimitation of the Go horizon; as a result of that, before C horizon, the soil material presents the specific orange and reddish-brown gleyization spots, due to the presence of iron. The gleyization

intensity is moderate. Stagnant ground water appears in C horizon (before 120 cm depth), an aspect which, along with the other mentioned characteristics, led to the definition of soil at the subtype level: Gleyic Phaeozem - PHgl (WRB-SR, 1998) (Photo 1).

Photo 1. Stagnant ground water on soil profile, which determines the appearance of gleyization process

Photo 2. The general configuration of the relief in the researched perimeter (capture of a cultivated plot)

According to the results provided by the analysis tests of collected samples (table 1), the phaeozem from Mitoc has a loamy (medium) texture; also, the laboratory data confirmed the absence of carbonates all across the profile, an important element in definition of this specific soil type [4]. In order to emphasize the agricultural potential of Mitoc gleyic phaeozem, the most representative chemical indicators have been determined and rated, such as: soil reaction (pH), humus content (H%), total nitrogen (Ntot), phosphorus and potassium (mg/kg^{-1}); also, the C/N ratio which, together with the humus content, reflects the potential fertility of one soil: the higher fertility potential when C/N ratio is lower [3]. Thus, the Mitoc gleyic phaeozem presents a neutral reaction in the topsoil and the second horizon, which becomes slighty alkaline, once the depth increases (Table 2). The humus content, correlated with soil loamy texture is rated as edium (4.8-4.32%) for the two surface horizons and, of course, decreases significantly with depth. The C/N values going from 13.4 - 12.8 are rated as medium. Regarding the major macronutrients content (N, P, K), determined values are as follows: 0.059-0.243% in case of *nitrogen*, the first indispensable nutrient for plants, reflecting a moderate supply in the first 50 cm of soil; 13.7-1.5 mg/kg^{-1}, in case of the second major macronutrient - a value which shows a very low to extremely low *phosphorus* content for Mitoc gleyic phaeozem; regarding the *potassium*, analytical data provide no surprise, respectively a good and a very good supply, in accordance with general chemical characteristics of this specific soil (Table 2). Because of the importance of some micronutrients for plants nutrition (as long as their value does not exceed the allowable limit), figure 2 presents the determined values for the considered inorganic compounds (zinc, copper, iron and manganese), in relation with each horizon of the profile. The values are rated according to the limits provided by the speciality literature [2]. The following considerations can be enunciated: zinc is rated as medium in the first 50 cm and low in the 55-120 cm interval; copper content is rated as high in all four horizons considered (> 1.5 mg/kg reference limit); iron content is over the normal limit (> 0.3 mg/kg), an aspect which can be correlated with the influence exerted by the high level of ground water and appearance of gleyization process; as for the manganese content, it is rated as moderate, overall (5-20 mg/kg).

Table 1. Physical characteristics and carbonates content of Mitoc gleyic phaeozem (2012)

Soil horizon	Depth (cm)	Granulometric fractions (% of soil mineral part)				Carbonates (%)	Soil texture
		Coarse sand (2-0,2 mm)	Fine sand (0.2-0.02 mm)	Loam (0.02-0.002 mm)	Clay (< 0.002 mm)		
Am	0 – 30	0.5	42.1	28.6	28.8	0.0	LL
ABv	30 – 55	0.4	41.2	27.9	30.5	0.0	LL
Bv	55 – 90	0.4	30.1	36	33.5	0.0	TP
C	90 -120	0.5	39.9	27.3	32.3	0.0	LL

Tabel 2. Representative chemical indicators of the analyzed phaeozem in Mitoc (2012)

Soil horizon	Depth (cm)	Soil reaction (pH)	Humus content (H%)	Total nitrogen (Nt)	C/N ratio	P_{AL} (mg/kg^{-1})	K_{AL} (mg/kg^{-1})
Am	0 - 30	7.11	4.80	0.243	13.4	13.7	201
ABv	30 - 55	7.12	4.32	0.239	12.2	3.7	190
Bv	55 - 90	7.58	1.92	0.101	12.8	1.5	208
C	90-120	7.85	0.48	0.059	5.49	1.1	187

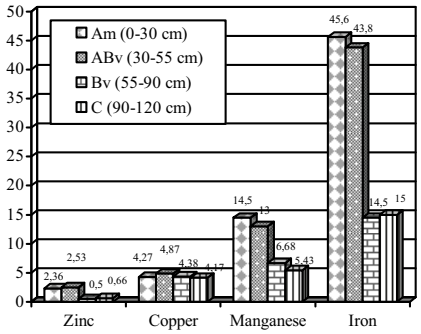

Fig. 2. Micronutrients content (mg/kg) for the investigated soil (2012)

CONCLUSIONS

The data regarding the investigated gleyic phaeozem located in Mitoc, Botosani county confirm its natural high potential for arable crops (medium texture, thick Am horizon, moderate humus content). Regarding the high level of ground water, as it was encountered in the field at the date of investigation, it can be evaluated as unfavourable only in the rainy years, when it can cause water excess and affect the soil normal airy and hydro regime. However, in latest dry years and in an area with no irrigation, it should not be considered as a restrictive factor, but on the contrary. A special attention should be given to nutrients supply: thus, although the micronutrients and potassium content are satisfactory, the phosphorus content rated as very low, as well as the medium nitrogen content, may impose the necessity of fertilization.

Still, the application of fertilizers, once the soil supply is already known, must be correlated with each plant requirements, anticipated yield and previous crop, in accordance to the proper agronomic technology. In addition to that, it is to say that the 300 ha land located in Mitoc and occupied by gleyic phaeozem can offer very good conditions for a large assortment of agricultural crops.

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