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SOME PEDO-ECOLOGICAL CHARACTERISTICS OF THE ACTIVE LAYER OF VERTIC LUVOSOL FROM ALBOTA - ARGES

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Abstract

The paper point out, by the aim of the field observations and the laboratory data, some pedo-ecological characteristics of the active layer of the Vertic Luvosol from Albota – Arges. The results showed that pedological properties were affected by tillage, the horizon being structureless and moderate compacted. As a result, the micromorphological characteristics were also influenced: the structure being with packing and rarely with planar voids (or fissures) induced by a moderate compaction. The mineralogical composition of the clay (<2μm) showed the dominance of the chlorite and illite (the kaolinite being very low). The smectite appears as distinct phase under the active layer (giving to the Luvosol the Vertic character). The ecological characteristics of the active layer are emphasized by the soil reaction that is strong acid and the exchanges properties (cation exchange capacity and base saturation degree), which have small to medium values. The organic matter and the clay (the two main components of the soil colloidal complex), suffer quantitative and qualitative changes under the influence of the pedological processes. The organic matter content is small. The values of the nitrogen are medium and of the mobile phosphorus are high. The mobile potassium values are medium-low. The micronutrients supply of the soil is over the susceptibility limit. In these conditions, the land capability for crops production of the studied area belongs to the II-nd class, with low limitations for crop production, being the most favorable for wheat, maize, potato and sugar beat (52 points for each crop), and the less favorable for sunflower (37 points).

INTRODUCTION

The ecological characteristics of the soil are strongly influenced by the properties of the edaphic environment.

The aim of this paper is to present the data concerning some properties (micromorphological, mineralogical, physical and chemical) of the active layer of the Vertic Luvosol from Albota – Arges and the consequences of these properties from the ecological point of view.

MATERIAL AND METHODS

The investigated site is located in the experimental field of the Research Development Agricultural Station Albota, in the Piteşti Plain (part of the West Romanian Plain), on a terrace of Arges River [1]. The soil is Vertic Luvisol formed in loess-like deposits. The absolute altitude is 334 m. The average of the annual temperature is 9.8^{o}C and of precipitations is 700 mm, while the potential evapotranspiration is 662mm and the aridity index is 34. The water table is at > 10 m depth. The vegetation was, in the past, the *Quercus* forests, replaced at present by the arable lands and pasture. The soil was sampled from the active layer (the upper 50cm): for the micromorphological (undisturbed samples), as well as for the mineralogical, physical and chemical analyses. The analytical determinations were carried out by using ICPA methodology [2, 3].

RESULTS AND DISCUSSION

A structural crust was formed in the topsoil (1-1.5 cm), as a result of the aggregate collapse, under the raindrop impact.

From the morphological point of view, the surface horizon (Ao+El)p (0-23 cm) has a loam texture and a very dark grayish brown – dark brown (10YR 3/2.5) color when wet. The structure was affected by tillage, the horizon being structureless and moderate compacted. Along the horizon there were observed very fine and frequent plant roots, as well as the fine pores. Small nodules (Fe±Mn) appear randomly distributed into the surface horizon. The morphology of the El horizon (23-32 cm) is relatively similar with the top horizon, but more friable when dries. The EB (31-50 cm) horizon has a different morphology: loam texture and dark grayish brown - brown (10YR 4/2.5) color when wet. The structure is medium subangular blocky, well developed. The fine pores were frequents and the fine roots rare. Small and frequent nodules (Fe±Mn) were also present into the horizon.

At microscopic level the characteristics of the upper part of the active layer (the [Ao+El]p and El horizon respectively) are also the same, showing a structure (figure 1) with packing and planar voids as a result of a moderate compaction and a small-medium subangular blocky and vughy structure (generated mainly by the soil fauna activity). Sporadically were observed deformed lumbric canals (as a result of compaction). The soil plasma is poor in humic substances. The amorphous features as very small (0.5-2mm) Fe± Mn nodules were observed into the horizon matrix. The micromorphology of the EB horizon showed a complex structure: spongy (with more or less interconnected voids) and vughy structure (with many irregular voids generated by mezofauna activity) and small areas with packing voids (due to the compaction processes). The other characteristics are, generally, the same as the other two horizons.

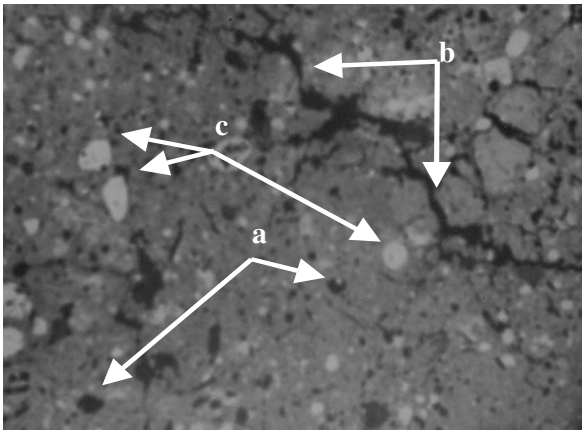

Fig. 1. The El horizon: compacted area with packed voids (a); planar voids (b); Fe± Mn nodules (c).

The granulometric analysis (figure 2) showed that clay content is 26.1% in the upper part of the active layer and increased to 30.9% in its bottom part. The loam has higher values than the clay (33.7% – 35.4%), while the coarse sand have the lowest values (11.5%-11.4%), comparing with the others granulometric fractions. The fine sand content is medium (26.2%-22.3%) and decreases with the depth.

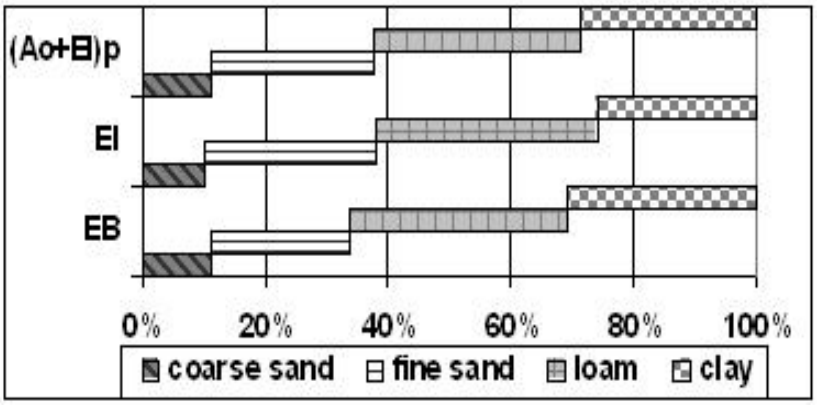

Fig. 2. The granulometry of the active layer of Vertic Luvosol

The mineralogical composition (figure 3) of the clay (< 2μm) showed the dominance of the chlorite and illite (46-51% and 41-46% respectively), while the kaolinite content is very low (8%). The smectite minerals, as distinct phase,

became the dominant component of the clay under the active layer (giving to the soil the Vertic character).

The total porosity is high (52%) in the surface horizon and medium in the El and EB (42% and 43% respectively). The bulk density is also high (1,27 gcm^{-3}) in the upper horizon medium-high in El (1.56 gcm^{-3}) and EB (1.52 gcm^{-3}). The resistance of the soil to penetration in low (14 kgf/cm2) in the first 22 cm and it is medium (25-34 $kgfcm^{-2}$) under this depth. The field capacity is medium to high (23.5-25.6%) and the available water capacity is very high (13.3-17.2%). The wilting point is low to medium (8.2-10.2%gg^{-1}). The permeability of the (Ao+El)p horizon is high (16.3mmh^{-1}) and medium (3.3-3.8mmh^{-1}) in the others two horizons.

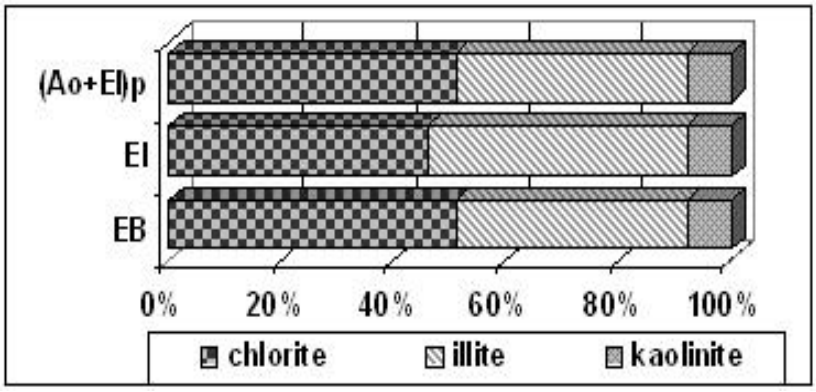

Fig. 3. The mineralogical composition of the clay (< 2µm)

The organic matter content decreases with the depth: from the 2.94% in the (Ao+El)p horizon to 2.70% in El and 1,56% into the EB horizon. The pH is strong acid (5.02-5.03) into the upper horizons and medium acid (5.18) in the EB horizon. In spite of an acid pH, the exchangeable Al content is low (0.92-1.39 me/100gsoil) in the all studied horizons. The cation exchange capacity is also low (18.86-19.46 me/100g), while the base saturation degree is high (57.3-73.9%). The values of the total N content (0.120-0.135%) and mobile K (69-75ppm) are low, while of the mobile P are high (49 ppm) in the (Ao+El)p horizon and low (11 ppm) in El, respectively.

The ecological characteristics of the soil active layer are emphasized by the reaction that is strong acid and the exchange properties (cation exchange capacity and base saturation degree), which have small to medium values. The organic matter and the clay, the two main components of the soil colloidal complex, suffer quantitative and qualitative changes under the influence of the pedological processes. According to the base saturation degree the soil is oligomesobasic. The organic matter content is low. The nitrogen content is medium, while the mobile

phosphorus is high and the potassium is medium-low. The micronutrients supply of the soil is over the susceptibility limit.

In what concerning the land capability, the studied area belongs to the II-nd class, having a good capability for crop production and low limitations. The limiting factors for the arable land is the clayey texture (from the 40 cm depth), which induced: stagnogleysation, vertic process and hardpan formation. After the agro-pedomelioration (including irrigation) the land is most favorable for the wheat, maize, potato and sugar beat (52 points for each crop), while the less favorable is for sunflower (37 points).

CONCLUSIONS

1. The obtained results showed that the pedological characteristics (micromorphological, mineralogical, physical and chemical) of the active layer of the soil were influenced by the properties of the edaphic environment and by soil tillage.
2. The ecological characteristics of the active layer developed on the background of an oligomesobasic soil (according to small-medium base saturation degree), due to a strong acid reaction, a small-medium exchange cation capacity, a low organic matter content and a moderate good micronutrient supply.
3. The studied area belongs to the II-nd class of land capability for crop production, having low limitations for crop production and being most favorable for wheat, maize, potato and sugar beat, and less favorable for sunflower.

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