Analele Universităţii din Craiova, seria Agricultură – Montanologie – Cadastru (Annals of the University of Craiova - Agriculture, Montanology, Cadastre Series) Vol. XLII 2012/2

PRESENTATION OF THE HYDRIC AND CHEMICAL INDICES OF THE MAIN TYPES OF SOIL IN RECAS VITICULTURE CENTRE, TIMIS COUNTY

KOCIS ELISABETA[1], ADALBERT OKROS[1], CASIANA MIHUȚ[1], LUCIAN NIȚĂ[1], ANIȘOARA DUMA COPCEA[1], MARIUS BOLDEA[1]

[1]USAMV Timisoara, Calea Aradului,Nr. 119, Timisoara, e-mail: adalbertokros@yahoo.com

Key words: soil, hydric and chemical indices, pH, analyses, land, viticulture centre

ABSTRACT

In order to reach the aim of this paper, we established the following objectives that we researched in the field and in the laboratory:

- *identification of the soils and of soil units and land units*
- *morphological, physical and chemical characterization of the main types of soil,*

We made use of several research methods that are specific for pedology: soil mapping, morphological description, expeditive field determinations, laboratory analyses, processing the data referring to soils, etc. Thus, we identified nine genetic types of soil in the perimeter under research, after direct observations made recently in the field and processed in the laboratory.

INTRODUCTION

Soil, a means of production and object of human work, is defined in the reference literature through a wide range of physical characteristics and socio-economic features, different from any other means of production because of some unique elements it possesses (Niţă L. D., 2004):

- land is a creation, and it represents a product of human intervention only to a small extent;
- in the process of production, land is not “consumed“ if it is used in a rational way, but on the contrary, its quality can be improved;
- it is limited in space and cannot be multiplied.

The production capacity of lands is extremely varied, which determines great differences in the productivity of agricultural producers (Țărău D., 2006).

As a matter of fact, the choice of the "right" place or making sure that a certain place is suitable for certain uses and crops was the first concern of agriculturists (after the stage of itinerant agriculture), and this skill was acquired intuitively and was transmitted from generation to generation. (Blaga Gh., Rusu I., Udrescu S., Vasile D., 1996).

MATERIAL AND METHOD

The aim of the present paper is to obtain a database of agrochemical and pedological information regarding the soil in Recas viticulture centre, regarding its morphological, physical and mechanical, hydro-physical and chemical characteristics, for the purpose of assessing their quality from the point of view of their productivity. We also wanted to gather data regarding the nature and intensity of the limiting factors and possible degradation phenomena, which would lay the technical and scientific foundations for choosing the most appropriate technological measures, specific for each portion of land which is distinct in terms of ecology. The profiles were placed in representative areas of the space under research, so that we could describe the most representative types and subtypes of soil. For every profile, the samples were taken from pedogenetic horizons, both in natural (not modified) setting, and in modified setting. In order to describe certain physical and hydrophysical characteristics, we sampled soil in natural setting in metallic cylinders of known volume, with the soil humidity at the time, in cardboard boxes (made specially for this); then we could perform the micro-morphological characterisation.In order to make the physical, chemical and partially biological characterisation, we took samples in the modified setting. The samples were placed in bags, on every genetic horizon. We also took agrochemical samples (from the toiled layer) in order to determine certain specific chemical indices. The study of the ecopedological conditions and the morphological description of the soil were performed in conformity with "Sistemul Român de taxonomie a solurilor" ("The Romanian Soil Classification System") (1980), completed and/or modified by "Metodologia elaborării studiilor pedologice" ("The Methodology of Performing Pedological Studies" - vol. I, II, III), issued by The Research Institute for Soil Science and Agrochemistry from Bucharest in 1987. The analyses and other determinations were performed in laboratories pertaining to the Office for Soil Science and Agrochemistry from Timişoara, and to Banat University of Agricultural Sciences and Veterinary Medicine from Timişoara. They were performed in compliance with national norms and standards, approved by A.S.R.O. (The Romanian Standards Association). Thus, the following analyses were performed (Table 1):

Table 1

Types of analysis

Type of analysis	Method
granulometric analysis (%)	Kacinscki method
apparent density (D.A.g/cm^3)	method of metallic cylinders
density (D.g/cm^3)	pycnometer method
higroscopicity (CH%)	Mittscherlich method
pH (in H_2O)	potentiometric titration
carbonates ($CaCo_3$ %)	Scheibler method
humus (%)	Walkley-Blanck method
available (mobile) phosphorus ppm	Egnér Riehm-Domingo method
available (mobile) potassium ppm	Egnér Riehm-Domingo method
exchange bases (S.B. me /100 g soil)	Kappen-Chiriţă method
exchangeable hydrogen (S.H.,me/100 g sol)	percolation in N/K acetate
cap. of cationic exchange (T.,me/100 g sol)	Bower method
exchangeable Na and K (me/100 g sol)	Schőllenberger-Cernescu method
exchangeable Ca and Mg (me/100 g sol)	Schőllenberger-Cernescu method
base cations (Ca^{++},Mg^{++},Na^{+},K^{+})	Schőllenberger-Dreibellis-Cernescu method
Anions (CO_3^{--},$HCO_3^{-}$$SO_4^{--}$,$Cl^{-}$)	electric conductibility method

RESULTS AND DISCUSSIONS

This part presents the analysis and graphical interpretation of the analytical data obtained after sampling the soil in Recas viticulture centre and their physical and chemical analysis, in accordance with the methods described under "Material and method". The types of soil we found in the area under research are the following:

- Stagnic preluvisol, slightly stagnogleized
- Vertic reddish preluvisol, slightly gleized in-depth
- Vertic reddish preluvisol with in-depth stagnogleization
- Stagnic vertic preluvisol
- Stagnic vertic preluvisol, slightly stagnogleized
- Stagnic vertic preluvisol with slight stagnogleization

Stagnic vertic preluvisol strongly stagnogleized

Thus, we obtained the following data regarding vertic reddish preluvisol with in-depth stagnogleization (Table 2): the values of the withering coefficient increase together with depth, from 12.58% Ap horizon to 14.61% in Bty horizon, being high. The values of the field capacity increase from 23.44% Ap horizon, to 23.80% in Bty horizon, being medium.

Total water capacity presents values ranging from 42.68% in Ap horizon and 23.52% in Bty horizon. (fig. 1.). pH values become higher as the depth is bigger, from 5.96 in Ah horizon, to 7.81 in Ck horizon. These values indicate that the soil presents reactions from slightly acid to slightly alkaline (fig. 2). The sum of exchangeable bases has values between 16.03 me/100g soil in Ap horizon and 24.62 me/100 g soil in Cy horizon, thus being medium. The sum of hydrogen presents decreasing values, from 6.70 me/100 g soil in Ap horizon to 3.37 me/g soil in Cy horizon, being very small in Cy horizon and big in Ap horizon. The values of the total capacity for cationic exchange increase from 22.73 me/100 g soil in Ap horizon to 27.99 me/100 g soil in Cy horizon, thus we consider the characteristic as being medium. The base saturation degree has values that increase from 70.52 % in Ap horizon to 87.95 % in Cy horizon. From this point if view, we can state that the soil is mesobasic at the surface and eubasic in-depth (fig.3). The vertic reddish preluvisol, slightly gleized in-depth has the following values, as seen in Table 2. The values of the withering coefficient grow from 8.59% to 15.52 % , from medium in Ad horizon to large in Bt_yw_2 horizon. The values of the field capacity are from 22.73% to 23.97%, so we consider field capacity is being medium. Total capacity has values which decrease from 47.43% in Ad horizon to 26.49% in Bt_yw_2 horizon, thus being very high at the surface and medium in-depth. Useful water capacity presents values between 14.14% and 8.45%, it being large in Ad horizon and small in Bt_yw_2 horizon (fig. 4). pH values increase from 6.12 in Ad horizon to 7.88 in Ck horizon. These values enable us to state that soil reaction is slightly acid in Ad horizon and slightly alkaline in Ck horizon. (fig. 5). Humus percentage decreases from 3.9 in Ad horizon to 1.44 in Bt_yw_2 horizon, being medium at he surface and small in-depth. Alkali sum presents values between 19.1 me/100g soil in AB horizon and 23.81 me/100 g soil in Bt_yw_3 horizon, it being medium. Hydrogen sum presents values that get smaller, from 5.83 me/100g soil in Ad horizon, it being medium here, to 3.42 me/100g soil in Bt_yw_3 horizon, it being small here. The values of the total capacity of cationic exchange increase from 24.36 me / 100g soil in AB horizon, it being medium here, to 27.69 me/100g soil in Bt_yw_2 horizon. Alkali saturation degree presents values that increase from 77.53% in Ad horizon to 87.44% in Bt_yw_3 horizon, thus the soil is eubasic (fig. 6). Table 3 presents hydrophysical and chemical characteristics of stagnic preluvisol, slightly stagnogleized. The withering coefficient has values that range from 11.5% in Ahw_2 horizon to 14.61 in Abw_3 horizon, being medium and high. Field capacity has values between 23.25% in Ahw_2 horizon and 23.8 in ABw_3 horizon, being medium. Total capacity presents values that decrease as we go deeper into the soil, from 31.43% in Ap horizon to 23.12% in Btw_3 horizon, being high at the surface and low in-depth (fig. 7). Ph has values between 5.96 in Ap horizon and 7.62 in CK horizon, soil reaction being moderately acid at the surface and slightly alkaline in-depth (fig. 8). Humus content gets smaller as the depth is bigger, from 3.57% in Ap horizon to 1.48 % in Aow_3 horizon, being moderate at the surface and small in-depth. Alkali sum values increase with the depth, from 18.08 me/100g soil in Ap horizon to 25.74 me/100g soil in BCw2 horizon, being medium. Exchangeable hydrogen has values that range from 5.58 me/100g soil in Ahw_2 horizon and 2.76 me/100g soil in BCw_2 horizon, being medium at the surface and very small in-depth. Total capacity of cationic exchange has values that increase together with the depth from 23.55 me/199 g soil in Ap horizon to 28.93 me/100g soil in Btw_2 horizon, being medium. The values of alkali saturation degree increase as we go deeper into the soil, from 76.62% in Ahw_2 horizon to 90.31 in BCw_2 horizon, the soil being eubasic (fig. 9).

Table 2.

Hydro-physical and chemical properties of vertic-reddish preluvisol with in-depth stagnogleization

Horizon	Ap	Ah	AB (X)	Bty	BCy	Cy	Ck
Depth (cm)	0-12	-27	+45	-75	-100	-140	-165
settlement degree (GT %)	-0.75	25.62	30.20	30.51			
Hygroscopicity index (CH %)	8.39	8.37	9.41	9.74			
Wither index (CO %)	12.58	12.55	14.12	14.61			
Field capacity (CC %)	23.44	23.43	23.72	23.80			
Total capacity (CT %)	42.68	24.71	23.52	23.52			
Useful water capacity (CU %)	10.86	10.88	9.60	9.19			
Maximum yield capacity (CCDmax %)	19.24	1.28	-0.20	-0.20			
pH in (H_2O)	6.11	5.96	6.18	6.27	6.63	6.70	7.81
Carbonates ($CaCO_3$%)							7.00
Humus (%)	3.48	2.51	1.38	0.60			
Nitrogen index (IN)	2.45	1.89	1.13	0.49			
Humus supply (t/ha)	150.31						
mobile P (ppm)	31.6	25.2					
recalculated mobile P (ppm)	31.56	25.2					
mobile K (ppm)	140	103					
Exchange base (SB) me/100 g sol	16.03	17.26	22.58	21.15	23.81	24.62	
Exchangeable hydrogen (SH me)	6.70	5.67	4.96	4.50	4.04	3.37	
Total capacity of cationic exchange T me/100 g soil	22.73	22.93	27.54	25.65	27.85	27.99	
Alkali saturation degree (V%)	70.52	75.27	81.98	82.45	85.49	87.95	

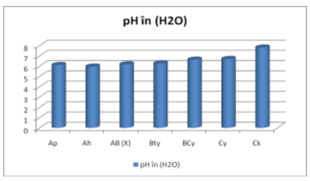

Fig. 2. Graphic representation of the pH

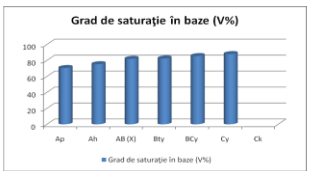

Fig. 3. Graphic representation of the V%

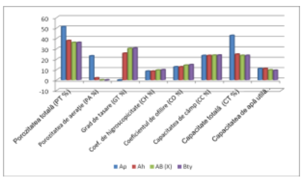

Fig. 1. Graphic representation of the hydro-physical indices

Table 2.

Hydro-physical and chemical properties of slightly stagnogleized stagnic-vertic preluvisol

Horizon	Ad	AB	Btw2	Btyw3	BCw2	Ck
Depth (cm)	0-8	-40	-755	-105	-135	-155
Hygroscopicity coefficient (CH %)	5.73	9.44	10.35			
Wither coefficient (CO %)	8.59	14.16	15.52			
Field capacity (CC %)	22.73	23.72	23.97			
Total capacity (CT %)	47.43	27.32	26.49			
Useful water capacity (CU %)	14.14	9.56	8.45			
maximum yield capacity (CCDmax %)	24.70	3.60	2.52			
pH in (H_2O)	6.12	6.03	6.27	6.36	7.00	7.88
$CaCO_3$ (%)						23.33
Humus (%)	3.90	2.82	1.44			
Nitrogen index (IN)	3.02	2.21	1.18			
humus supply (t/ha)	184.78					
mobile P (ppm)	150	108				
recalculated mobile P (ppm)	14.97	10.8				
mobile K (ppm)	180	143				
Exchange base (SB) me/100 g soil	20.12	19.10	22.78	23.81		
Exchangeable hydrogen (SH me)	5.83	5.26	4.91	3.42		
Alkali saturation degree (V%)	77.53	78.40	82.26	87.44		

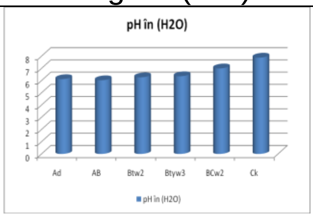

Fig. 5. Graphic representation of the pH

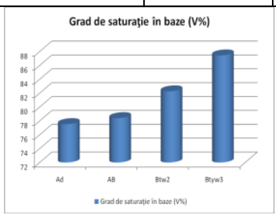

Fig. 6. Graphic representation of the V%

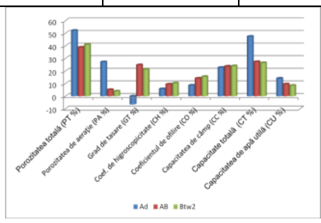

Fig. 4. Graphic representation of the hydro-physical indices

Table 3.

Hydro-physical and chemical properties of slightly stagnogleized stagnic preluvisol

Horizon	Ap	Ahw2	A0 w2	AB w3	Btw3	Bt(y)w	BCw2	Ck
Depth (cm)	0-22	-35	-53	-68	-88	-123	-150	-200
Higroscopicity coefficient (CH %)	7.99	7.67	9.16	9.74	9,46			
Wither coefficient (CO %)	11.99	11.50	13.74	14.61	14,19			
Field capacity (CC %)	23.33	23.25	23.65	23.80	23,73			
Total capacity (CT %)	31.43	27.45	25.12	25.41	23,12			
Useful water capacity (CU %)	11.34	11.75	9.91	9.19	9,54			
Maximum yield capacity (CCDmax %)	8.10	4.20	1.47	1.61	-0,61			

pH in (H_2O)	5.96	6.11	6.33	6.51	6,58	6.56	6.75	7.62
Humus (%)	3.57	2.50	1.48					
Nitrogen index (IN)	3.07	1.91	1.22					
C:N	2.36	1.46	1.00					
Humus supply (t/ha)	193.7							
mobile P (ppm)	26.8	36.4						
mobile K (ppm)	143	110						
Exchange base (SB) me/100 g sol	18.08	18.29	21.49	24.04	24,46	25.53	25.74	

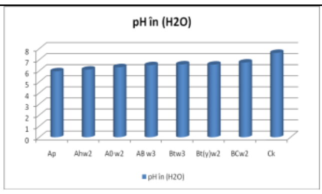

Fig. 8. Graphic representation of the pH

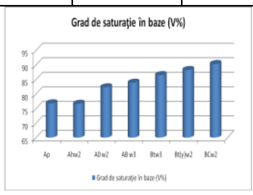

Fig. 9. Graphic representation of the base saturation degree

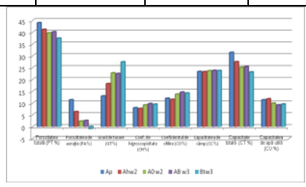

Fig. 7. Graphic representation of the hydro-physical indices

CONCLUSIONS

Recaş viticulture centre is situated in the south-west of Romania, in a moderate temperate-continental climate, with shorter and milder winders; it is frequently under the influence of cyclones and hot-air masses coming from the Mediterranean sea and the Adriatic sea. Of the morphological, chemical, physical and hydro-physical characteristics that have a direct influence on the composition and growth environment of plants, and which have a determining role in other soil characteristics, the following play a greater part: gleyzation, salination, alkalization, $CaCO_3$ content, soil reaction, humus supply, texture, porosity, useful edaphic volume and permeability. These features are more stable in time and easier to determine, even with the equipments that the specialized institutions currently have. Resulting from soil water regime, predominantly phreatic, gleization is useful for separating the soil varieties and some subtypes, while at the same time causing different favorabilities for certain cultivated plants.Hygroscopicity index vacillates between 6.61 – 9.49 %, and the wither index presents high values, between 9.2% and 14.23%.Field capacity for water in Ao horizon is medium, with values between 22.7% and 23.74% and with a clear tendency to increase in Bt horizon. Useful water capacity presents the same dynamics per soil profile, with values from 13.5% to 11.95% in Ao horizon and lower in Btz, reaching 9.59%. Humus content in cultivated preluvisols is medium, with values ranging from 3.3% to 2.46% and with a supply of 171 t/ha for 0-40 cm deep. Under forests, the humus supply is bigger. Soil reaction in Ao horizon is slightly cid, with pH values of 6.3 – 6.7. Total capacity of cationic exchange (T) is higher than 21 m.e/100 g soil, and the alkali saturation degree (V%) varies from 62% to 88%.

BIBLIOGRAPHY

Blaga Gh., Rusu I., Udrescu S., Vasile D., 1996, Pedologie, Editura Didactică şi Pedagogică. R. A., Bucureşti,

Niţă L. D., 2004, Pedologie, Ed. Eurobit Timişoara,

Țărău D., 2006, Cartarea și bonitarea solurilor și evaluarea terenurilor, Ed. Eurobit Timișoara,

*** Metodologia elaborării studiilor pedologice, vol. I,II,III, Bucureşti, 1987,