AGROCHEMICAL CHARACTERIZATION OF THE SOIL RESOURCES IN ȘEPREUȘ LOCALITY, ARAD COUNTY, ROMANIA

Ariana-Maria PIZMAȘ, F. MARIAN, A. BORCEAN, A. OKROS
***University of Agricultural Sciences and Veterinary Medicine"King Michel I of Romania" of Banat from Timisoara* 119, Aradului Avenue, Timișoara 30064, Romania**
Corresponding author: adalbertokros@yahoo.com

Abstract. *Agriculture is a traditional branch in the Romanian economy that has as the means of production agricultural land (all land located within the borders of a country, including those under water), which provides food for the population, raw materials for industries and products for export.(Berbecea 2014) It has been practiced in our country since prehistoric times, for a longtime predominating pastoralism, practiced in several forms including transhumant (the permutation of the herds depending on the season from high to low areas). (Duma – Copcea 2014) Through this research we want to highlight the agrochemical characteristics of the soil resources in Şepreuş, Arad County, Romania. In order to highlight these characteristics, six plots with different surfaces were chosen: Ceichi (1ha), Jidovi (20ha), Armata (7ha), Cabana (5ha), Ciobanu (7ha), Goldis (14ha), from which soil samples were taken, on which a series of analyzes were performed. Among the characteristics sought to find out we can find the pH value, the supply of humus, phosphorus, potassium, and the calcium carbonate content, and the texture of the soil, were monitored, on all the six plots, mentioned above. For each plot, the recommended fertilizer requirement (NPK) was calculated, depending on the crop to be established but also taking into consideration the previous crop. The main crops present on these plots are corn, autumn wheat and autumn barley. (Marin 2013)*

Keywords: *soil, agrochemistry, soil supply, fertilization*

INTRODUCTION

Agriculture is a traditional branch of the Romanian economy, which has as means of production the agricultural land fund, which provides the food for the population, raw materials to industrial branches and export products. (GROSZLER 2017)

The natural and social conditions influencing agricultural production are:

The natural conditions represented by relief plays the role of a thermal threshold causing a differentiation of agricultural practices on large relief units: mountain areas dominated by livestock (BORCEAN 2009); hill and plateau areas dominated by viticulture, fruit culture, and animal husbandry; plain areas dominated by cereals, industrial plants, and vegetable plants; the climate is generally favourable, sometimes there are phenomena that partially compromise crops (frost, drought, etc.); the soils are highly fertile in the plain (molisols), medium in hills and plateaus (argiluvisols and cambisols), sometimes being affected by geomorphological processes requiring ameliorative works. (MIHUȚ 2018)

Demographic conditions: the increasing number of people requires higher and more diversified productions; (MARIN 2017) at the same time, in areas with high population densities, it is necessary to practice cultures that require a larger workforce, while in low density areas, mechanization of agriculture is necessary. (FLORESCU 2014) Industrial conditions: industrial branches are conditioned by the distribution of agricultural crops (sugar, oil, canned food, etc.); in order to reduce production costs and production streamlines, food manufactures should be located in agricultural areas. (DICU 2016)

The perimeter of the Commune of Șepreuș is located in the northern part of Arad County, Romania, in the plain area, and is bordered to the north by the territory of the communes

of Apateu and Mișca, to the west by the territory of the Commune of Sintea Mare, to the south with the territory of the Commune of Sicula and to the east by the territory of the Commune of Cermei. The territory of the Commune of Șepreuș is crossed from east to west by a paved road that connects Cermei and Chișineu Criș. (OKROS 2016) The other links with neighbouring areas are made by non-modernized roads. (URLICA 2019)

The territory of the Commune of Șepreuș is, geomorphologically, part of the West Plain, the low plain subunit of Cașurilor. This low plain of the Criș rivers is a divagation plain, plane in form, in which many tablelands appear. (MIRCOV 2016) The overall evolution of the territory is closely linked to the interference between the evolution of the Pannonia depression and movements on the neighbouring crystalline block (Apuseni Mountains). (Nita 2007)

With the movements, deep ruptures appeared determining the start of partition blocks and sketching future bay-like depressions. The invasion of these depressions is caused by Pannonia basin waters, followed by intense clogging processes. (NIȚĂ 2018) From a hydrographic point of view, the territory of the Commune of Șepreuș is part of the Crișul Negru River basin and includes under the Teuz, Sartiș, and Binișel basins, part of the Levelas Valley sub-basin area. The most important valley in the Commune of Șepreuș is the Teuz Valley, situated in the south of the territory at the border with the administrative territory of the Commune of Sicula. (OANCEA 2012)

MATERIAL AND METHODS

Determination of physical properties.

Soil texture- through the Cernikova method (the principle underlying the pipetting method is the sedimentation of particles into a liquid at different rates, depending on their size, according to Stokes' law).

The determination of the granulometric fractions in weight percentages was done using the following formulas:

Coarse sand (2 - 0.2 mm in diameter) % = $\frac{m_1 \ x100}{m_0 xF}$

Fine sand (0.2-0.02 mm in diameter) % = $\frac{100xm_2}{m'}$

Dust (0.02 - 0.002 mm in diameter) % = $\frac{(m_2 - m_3)xVx100}{(Vxm_0)xF}$

Clay (diameter less than 0.002 mm) % = $\frac{m_3 xVx100}{Vxm_0 - dxF}$

Soil density (cm3) - using a pycnometer, using distilled water;

Soil density is calculated using the following formula:

$D = \frac{M_2 - M}{M_1 + M_2 - M - M_3}$ x d

Apparent density (cm3) -the formula by which we calculated the bulk density is as follows:

$$DA = \frac{M_1 - M_2}{V}$$

Total Porosity Pt (%) -was calculated using the following formula: $PT = \left(1 - \frac{DA}{D}\right) x100$

AEROSIS POROSITY PA (%). In order to determine it by calculation we used the values of some hydrophysical and physical indices: PA = PT - CC x DA

Setting and soil compaction (gt)

$$GT = \frac{PMN - PT}{PMN} x100$$

PMN = 45 + 0,163 x A

Determination Of Chemical Properties

Soil humus content (%) - by titrimetric methods, respectively Tiurin method;

The principle of the method is to oxidize the carbon in the humus with a solution of chromium anhydride or potassium dichromate in the presence of sulfuric acid.

The humus content of a soil sample was calculated using the following formula:

$$\text{Humus\%} = \frac{(\text{V1 V2}) \text{ x f x } 0{,}0005181 \text{ x } 100}{\text{m}} \text{ x K}$$

pH of the soil solution - according to the potentiometric method, in aqueous extract 1: 2.5;

Total nitrogen dosage - was done by Kjeldahl method (soil mineralization is done by boiling with concentrated sulfuric acid in the presence of catalyst);

Mobile phosphorus - determined by Egner-Rhiem-Domingo on a UV-VIS spectrophotometer;

Assimilable potassium - extracted into ammonium lactate acetate and determined with atomic absorption spectrophotometer;

Total cationic exchange capacity (t) - determined by the Bower method;

Degree Of Saturation In Bases (V%) - was calculated by the formula:

$$V = \frac{S_B}{S_B + S_H} X100(\%)$$

RESULTS AND DISCUSSIONS

Agrochemical characterization of soil resources in the Commune of Şepreuş, Arad County, Romania

Table 1

The chemical properties of the soils in every plot on different depths

NAME OF THE PLOT	SUP Ha	Sample code	pH (H2O)	Plasticity	Ca (%)	CaCo3 (%)	Humus (%)	NO_3-N+NO_2-N (mg/kg)	P_2O_5 (mg/kg)	K_2O (mg/kg)
Jidovi 0-20 cm	20.00	191376	6.47	42	0.25	-	1.99	2.1	33	125
Jidovi 20-40 cm	20.00	191377	6.74	45	0.30	0.7	1.43	0.8	259	102
Armata 0-20 cm	7.00	191378	7.27	47	0.35	0.9	2.40	9.4	20	129
Armata 20-40 cm	7.00	191379	8.23	50	0.33	0.8	1.43	3.3	**	92
Cabana 0-20 cm	5.00	191380	6.39	43	0.27	-	2.61	6,4	139	125
Cabana 20-40 cm	5.00	191381	6.60	37	0.25	0.6	1.32	0.9	16	70
Ciobanu 0-20 cm	7.00	191382	6.31	36	0.15	-	1.79	5.5	22	78
Ciobanu 20-40	7.00	191383	6.35	37	0.15	-	1.52	3.7	18	69
Goldis 0-20 cm	14.00	191384	6.58	58	0.39	1.0	3.35	8.4	69	98
Goldis 20-40 cm	14.00	191385	7.19	59	0.41	1.0	2.14	4.7	32	81
Ceichi 0-20 cm	1.00	191475	6.23	37	0.20	-	1.77	6.0	15	101
Ceichi 0-20 cm	1,00	191474	7.04	41	0.29	0.7	1.21	3.5	22	91

The investigated territory is characterized by a moderate mainland temperate climate with shorter and gentler winters due to a certain circulation of air masses of various types, caused either by the dynamic centre of action (azoic and subtropical anticyclones), or by seasonal thermal action (Siberian anti-cyclone, Asian or Mediterranean depression).

The studied area is, therefore, at the interference of air masses that have an oceanic character of western origin that often comes with a higher degree of continentalisation and the continental one, of the eastern origin, frequently under the influence of some southern high air masses that cross the Mediterranean Sea.

Plot name: GOLDIS – Plot (ha): 14

Following soil analyses, we can see that soil reaction is poorly acidic, with an average pH of 6.89. Soil texture is clayey and calcium carbon content is medium. At the same time, a medium supply with humus, low with phosphorus and ammonia nitrogen and a very low potassium supply.

Table 2

Seeded crop and the fertilizer requirement

Max NPK s.a (kg/ha):				164	121	224
Year of production	**2019/2020**		**Product. t/ha**	N	P_2O_5	K_2O
				s.a kg/ha		
Main crop	Maize		10	164	121	224
The subject		Year of planting				
Cultivation method		Distance				
Total correction						
Previous culture:	Autumn wheat		4.5			
1. Organic fertilizer:						
2. Organic fertilizer:						
3. Organic fertilizer:						
Irrigation						
Chemical reaction (pH):						
Green manure						
The effect of the report K/Mg						
Plant analysis						
Recommended fertilizer required:				164	121	224

Plot name: CIOBANU – Plot (ha) 7

Compared to the first ground plot, we notice that, in the second plot, the soil reaction is low acidic, the texture belongs to the same textural class, being clayed, and calcium carbonate content remains in the same state of supply, i.e., average. Humus content does not suffer important changes, being soil supplied. The content in phosphorus and ammonia nitrogen shows low soil supply in these nutrients, and potassium supply remains very low in this plot.

Table 3

Seeded crop and the fertilizer requirement

Max NPK s.a (kg/ha):				166	126	207
Year of production	**2019/2020**		**Product. t/ha**	N	P_2O_5	K_2O
				s.a kg/ha		
Main crop	Maize		10	166	126	207
The subject		Year of planting				
Cultivation method		Distance				
Total correction						
Previous culture:	Autumn wheat		3			
1. Organic fertilizer						
2. Organic fertilizer						
3. Organic fertilizer						
Irrigation						
Chemical reaction (pH):						
Green manure						
The effect of the report K/Mg						
Plant analysis						
Recommended fertilizer required:				166	126	207

Plot name: CABANA – Plot (ha) 5

Compared to the second ground plot, we notice that in the third plot, the soil reaction is low acidic, the texture belongs to the same textural class, being clayed, and calcium carbon content remains in the same state of supply, i.e., averaging. Humus content does not suffer important changes, being soil supplied. The content in phosphorus and ammonia nitrogen shows low soil supply in these nutrients, and potassium supply remains very low in this plot.

Table 4

Seeded crop and the fertilizer requirement

Max NPK s.a (kg/ha):				163	98	192
Year of production	**2019/2020**		**Product. t/ha**	N	P_2O_5	K_2O
				s.a kg/ha		
Main crop	Maize		10	163	98	192
The subject		Year of planting				
Cultivation method		Distance				
Total correction						
Previous culture:	Autumn wheat		4			
1. Organic fertilizer						
2. Organic fertilizer						
3. Organic fertilizer						
Irrigation						
Chemical reaction (pH):						
Green manure						
The effect of the report K/Mg						
Plant analysis						
Recommended fertilizer required:				163	98	192

Plot name: ARMATA – Plot (ha) 5

Compared to the third plot of soil, we notice that in the fourth plot, the soil reaction is maintained low, the texture belongs to the same textural class, being clayed, and calcium carbon content remains in the same state of supply, i.e., average. Humus content does not suffer important changes, being soil supplied. The content in phosphorus and ammonia nitrogen shows poor soil supply in these nutrients, and potassium supply remains very low in this plot.

Table 5

Seeded crop and the fertilizer requirement

Max NPK s.a (kg/ha):			175	118	191
Year of production	**2019/2020**	**Product. t/ha**	N	P_2O_5	K_2O
			s.a kg/ha		
Main crop	Maize	10	175	118	191
The subject		Year of planting			
Metoda de cultivare		Distance			
Total correction					
Cultura premergătoare:	Autumn wheat		4		
1. Organic fertilizer					
2. Organic fertilizer					
3. Organic fertilizer					
Irrigation					
Chemical reaction (pH):					
Green manure					

The effect of the report K/Mg						
Plant analysis						
Recommended fertilizer required:			175	118	191	

Plot name: JIDOVI – Plot (ha) 20

Compared to the fourth ground plot, we notice that in the fifth plot, the soil reaction is kept acid, the texture belongs to the same textural class, being clayed, and calcium carbonate content remains in the same state of supply, i.e., average. Humus content does not suffer important changes, being soil supplied. The content in phosphorus and ammonia nitrogen shows low soil supply in these nutrients, and potassium supply remains very low in this plot.

Table 6

Seeded crop and the fertilizer requirement

Max NPK s.a (kg/ha):				146	24	94
Year of production	**2019/2020**		**Product. t/ha**	N	P_2O_5	K_2O
				s.a kg/ha		
Main crop	Autumn wheat		7	146	24	94
The subject		Year of planting				
Cultivation method		Distance				
Total correction						
Previous culture:	Maize		5			
1. Organic fertilizer						
2. Organic fertilizer						
3. Organic fertilizer						
Irrigation						
Chemical reaction (pH):						
Green manure						
The effect of the report K/Mg						
Plant analysis						
Recommended fertilizer required:				146	24	94

Plot name: CEICHI – Plot (ha) 1

Compared to the fifth plot, we notice that, in the sixth plot, the soil reaction is kept low, the texture belongs to the same textural class, being clayey, and calcium carbon content remains in the same state of supply, i.e., average. Humus content does not suffer important changes, being soil supplied. The content in phosphorus and ammonia nitrogen shows low soil supply in these nutrients, and potassium supply remains very low in this plot.

Table 7

Seeded crop and the fertilizer requirement

Max NPK s.a (kg/ha):				175	118	192
Year of production	**2019/2020**		**Product. t/ha**	N	P_2O_5	K_2O
				s.a kg/ha		
Main crop	Maize		10	175	118	192
The subject		Year of planting				
Cultivation method		Distance				
Total correction						

Previous culture:	Autumn barley		2.5			
1. Organic fertilizer						
2. Organic fertilizer						
3. Organic fertilizer						
Irrigation						
Chemical reaction (pH):						
Green manure						
The effect of the report K/Mg						
Plant analysis						
Recommended fertilizer required:				175	118	192

CONCLUSIONS

Following soil analyses, we can see that soil reaction is low acidic, with an average pH of 6.89. Soil texture is clayey and calcium carbon content is medium. At the same time, a medium supply with humus, low with phosphorus and ammonia nitrogen and a very low potassium supply.

In the second plot, the soil reaction is low acidic, the texture belongs to the same textural class, being clayey, and calcium carbonate content remains in the same state of supply, i.e., average.

In the third plot, the soil reaction is low acidic, the texture belongs to the same textural class, being clayed.

In the fourth plot, the soil reaction is low acidic, the texture belongs to the same textural class, being clayey, and calcium carbonate content remains in the same state of supply, i.e., average.

In the fifth plot, soil reaction is low acidic, the content in phosphorus and ammonia nitrogen shows a low soil supply

In the sixth plot, the soil reaction is low acidic, the content in phosphorus and ammonia nitrogen shows a low soil supply in these nutrients, and potassium supply remains very low in this plot.

BIBLIOGRAPHY

BERBECEA ADINA, ISIDORA RADULOV, L NIŢA, C VOGYVOLGYI, ALINA LAŢO, A ŐKROS, F CRISTA, KI LAŢO, 2014 - The quality of Maros River water in Romania Hungary cross border area. Research Journal of Agricultural Science 2014/6/1 CABI

BORCEAN A., MANEA D., SIMONA NIŢĂ, 2009 - The behavior of a sunflower assortment at the attack of the main pathogens under conditions from didactic station of U.S.A.M.V.B. Timişoara, Research Journal of Agricultural Science, vol. 41, pp 217, Romania

DICU D, BERTICI R, GAICA I., 2016 - Evaluation of eco-pedological conditions for orchards conversion of lands from Moravita, Timis county Research Journal of Agricultural Science, Facultatea de Agricultură, Vol. 48 (4), Ed. Agroprint Timişoara,ISSN 2066-1843

DRAGOESCU URLICA, A. A.; COROAMA-DORNEANU, L. KAMBERI, L., 2019 - Sustainable Learning and Material Development in ESP - English for the Life Sciences. International Journal for Quality Research 13(3):753-760. DOI: 10.24874/IJQR13.03-16

DUMA COPCEA ANIŞOARA, MIHUŢ CASIANA, NIŢĂ L., 2014, The bonitation of agricultural lands in Foeni locality, Timiş county, International Symposium, Trends in the European Agriculture Development", - 29-30 May, edition VII a, Timişoara

FLORESCU T., A OKROS, LAȚO ALINA, 2014 - THE AGRICULTURAL SYSTEM FROM THE CHIȘINEU CRIȘ LOCALITY AREA, ARAD COUNTY, Research Journal of Agricultural Science 2014 CABI

GROSZLER ASTRID-SIMONE, ADALBERT ÖKROS, ALINA-ANDREEA DRAGOESCU, 2017 - A guide to basic Romanian agricultural terms and their english equivalents.Research Journal of Agricultural Science 2017/1/1 CABI

MARIN DIANA, 2017 - Research Regarding the Nutritional Value of the Food Products, Animal Science & Biotechnologies / Lucrari Stiintifice: Zootehnie si Biotehnologii. 2017, Vol. 50 Issue 1, p278-281. 4p;

MARIN DIANA, CORNELIA PETROMAN, IOAN PETROMAN, IOANA BALAN, RAMONA CIOLAC, ANA MARIA DINCU, CARMEN DUMITRESCU, ANA LOZICI, 2013 - The role of non-agricultural activities in rural area development Lucrări Științifice Management Agricol Vol 15, No 4;

MIHUT C, A. DUMA-COPCEA, L. NIȚĂ 2014 - The soil improvement Giarmata community, Timis county for use sustainable Horticulture in quality and culture of life, Lednice, Czech Republic. September 23-26

MIHUȚ CASIANA, DUMA-COPCEA ANIȘOARA, 2018 – The influence of soil works on physical-mechnical properties of the soils from the main banat vineyards, International Conference on life sciences ISBN 978-88-85813-24-3 pg. 645-654, Timisoara 2018

MIRCOV DRAGOSLAV V., VUXANOVICI S., COSMA ANTOANELA, OKROS A., PINTILIE SOFIA, NICHITA ANCA IULIANA, MOISESCU CARMEN IRINA, 2016 - Climate records registered in western Romania European Biotechnology Conference, vol. 231, ISSN 0168-1656, factor 3,34

NIȚĂ L, ȚĂRĂU D, ROGOBETE GH, DAVID GH, DICU D, NIȚĂ S., 2018 - Using pedologic information in defining the quality and sustainable use of land in western Romania, 2018/1/1; Jurnal Research Journal of Agricultural Science; Volumul 50; Numărul 1

NIȚĂ SIMONA, BORCEAN A., 2007 - Study regarding some varieties of Zea mays everta Stuart which grow under the pedo-climatic conditions in Almaj Depresion, „60 de ani de învăţământ superior în Oltenia", Annales of University of Craiova, Vol XXXVII / A 2007, pag. 664-666, Romania.

OANCEA I, 2012- Tehnologii agricole performante, Editura Ceres București

OKROS A., POP GEORGETA, NIȚĂ SIMONA, RADULOV ISIDORA, MICU LAVINIA MĂDĂLINA, MIRCOV V., DICU D. D., 2016 - Agricultural systems in the western part of Romania Journal of Biotechnology, Volume 231, Supplement, 10 August 2016, 05-09.05.2016 Riga Letonia 3,14, Page S58