DETERMINATION OF THE PHYSICAL PROPERTIES OF SOILS FROM A VINEYARD PLANTATION FROM LUGOJ

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Abstract. *The paper presents a series of physical properties of soils (texture, soil density, apparent density, total and aeration porosity) from a vineyard-tree plantation located in the outskirts of the town of Lugoj. The municipality of Lugoj being the second city in terms of size and importance in Timiș county. The purpose of this work was oriented towards the determination and knowledge of the physical properties of two types of soils studied, namely, the Preluvosol and the Luvosol, soils that are occupied by fruit trees and vines. The proposed objectives aim at the following aspects: identification and delimitation of soil and land units; collecting soil samples, performing laboratory analyses; performing calculations and presenting the values obtained on the main physical properties of soils, aiming at their determination both for fruit trees and for vines. The density of the soil (g/cm^3) recorded values between 2.42 g/cm^3 and 2.49 g/cm^3, depending on the depth, type of soil, month of irrigation and crop. The apparent density of the soil had values between 1.14 g/cm^3 and 1.35 g/cm^3. Total soil porosity (%) was between 41% for fruit trees and 47% for vines. The aeration porosity (%) had values between 10.90% and 13.70%. The obtained results highlight very well the data we wanted to present.*

Keywords*: soil, physical properties, tree plantation - vineyard*

INTRODUCTION

The physical properties of the soil indirectly have a strong influence on the growth and fruiting of plants, as the water and air regime, as well as the microbial life and the transformation of the nutrients in the soil, depend on them (N. CONSTANTINESCU and A. NEGRILĂ, citation DRĂGĂNESCU E., 2002; TROCME S, GRAS R., 1977; IANOȘ GH., PUȘCĂ I., GOIAN M., 1997; DOBREI ALINA GEORGETA, DOBREI A., IORDĂNESCU OLIMPIA, NISTOR ELEONORA, BALLA G., MĂLĂESCU MIHAELA, DRĂGUNESCU ANCA, 2015; MIHUȚ CASIANA, RADULOV ISIDORA, 2012).

Texture is a property of the soil, practically unmodifiable, so that agricultural and amelioration technologies must adapt to the textural specifics of each soil, try to compensate for the negative properties derived from the percentage of grain size fractions, possibly improve other physical properties in compensation, more easily modifiable. It has a particularly important role in determining most of the other physical properties, as well as some chemical properties (MIHUȚ, C., 2018; BORLAN Z., HERA C., 1994; CANARACHE A., 1997; MIRCOV V. D. , OKROS A, Casiana MIHUȚ,S. Jercimovici,M. Dudas, Sorin CIULCA, 2021; ROGOBETE GH., 1994).

Numerous authors, including (TROCME and GRAS., 1977; DOBREI A., NAN ROXANA, NISTOR ELEONORA, DOBREI ALINA, 2021; MĂLĂESCU MIHAELA, VAN LEEUWEN C., LAURE DE RESSÉGUIER, SÉVERINE MARY, CORALIE E., MOUSSET-LIBEAU E., MARGUERIT ELISA, JEAN-PHILIPPE R., QUIQUERZ AMÉLIE, 2018; TOTI MIHAI AND COLAB., 2017) appreciate that the physical properties of soils are more important from this point of view than the chemical ones, whose correction through fertilization and amendment is easier to accomplished. However, both in the foreign specialized literature and in the research and production activity in our country, the physical properties of the soils and the problems related to their improvement have been given little attention. (CANARACHE A.,1997; FLOREA N.,MUNTEANU I., 2012) made a general analysis of soil physical conditions, presented the physical properties of several characteristic soil profiles and their implications for the orientation of soil improvement research and practice

(ANTOCE ARINA OANA, CĂLUGĂRU LAURA LIDIA, 2017; NIȚĂ, L., GROZAV, A., ROGOBETE, GH., 2019; OKROS, A., 2015; RUSU RAUL ARIAN, 2007).

MATERIAL AND METHODS

The two types of soils, Preluvosol and Luvosol, respectively, on which the research was carried out, are located in the perimeter of the city of Lugoj in Timiș county.

The plantation was established in the fall of 2012. Soil samples were taken in two different periods of the year, namely early spring, in March, and autumn, in October.

We followed the determination of the main physical properties of soils, on soil samples collected in natural settlement, at two depths, respectively: 0-20 and 20-40 cm.

The research was carried out over the course of two years, 2020 and 2021, the following analyzes were carried out, and the following methods were used: soil density (cm3) - with the help of the pycnometer, using distilled water; the apparent density (cm3), with the help of cylinders, in natural settlement and the total and aeration porosity, by calculation (ȚĂRĂU D. ȘI COLAB., 2007).

RESULTS AND DISCUSSIONS

The surveyed area is 616.35 ha, of which 440.25 ha are occupied by vines and 176.1 ha by orchards.

The soils on which the tree-vine plantations are found are: Preluvosol and Luvosol. Following the determinations made in the two years of research, the following emerged:

1. Soil density (D)

Soil samples were collected in two different periods, autumn (October) and spring (March).

The harvesting depth being: 0-20 cm and 20-40 cm in 2020 and 2021. The data on the value of soil density are presented in tables 1. and 2.

Table 1

Density of Preluvosol (g/cm3)

Culture	**Month**	**Depth, in cm**	**Years**	
			2020	**2021**
Fruit trees	March	0-20	2.42	2.43
		20-40	2.43	2.44
	October	0-20	2.45	2.46
		20-40	2.46	2.47
Vine	March	0-20	2.44	2.43
		20-40	2.45	2.45
	October	0-20	2.45	2.46
		20-40	2.47	2.47

In table 1, it can be seen that, in the case of preluvosol, the soil density had values between 2.42 g/cm3, at 0-20 cm for fruit trees in March 2020 and 2.47 g/cm3, at 20-40 cm, in October 2021.

Table 2

Density of Luvosol (g/cm3)

Culture	Month	Depth, in cm	Years	
			2020	2021
Fruit trees	March	0-20	2.45	2.46
		20-40	2.46	2.47
	October	0-20	2.46	2.47
		20-40	2.48	2.48
Vine	March	0-20	2.44	2.45
		20-40	2.45	2.46
	October	0-20	2.45	2.46
		20-40	2.47	2.49

On Luvosol, the densities ranged between 2.44 g/cm3, in 2018 for fruit trees, at a depth of 0-20 cm, in March 2018 and 2.49 g/cm3, for vines, at a depth of 20- 40 cm, in October 2019.

2. Apparent soil density (DA)

Tables 3. and 4. show the apparent density values for the two soils taken in the research. From which it can be seen that, on Preluvosol, DA had values between 1.14 g/cm3, at ad. 0-20 cm for the vine, in March 2019 and 1.20 g/cm3, for ad. 20-40 cm, in October 2020 and 2021.

Table 3

Bulk density of Preluvosol (g/cm3)

Culture	**Month**	**Depth, in cm**	**Years**	
			2020	**2021**
Fruit trees	March	0-20	1.16	1.17
		20-40	1.19	1.19
	October	0-20	1.17	1.18
		20-40	1.20	1.20
Vine	March	0-20	1.15	1.14
		20-40	1.17	1.17
	October	0-20	1.18	1.17
		20-40	1.20	1.20

At Luvosol, the DA values of the soil were 1.26 g/cm3, for fruit trees, at a depth of 0-20 cm, in March 2020 and 1.35 g/cm3, at a depth of 20-40 cm, in October 2021.

Table 4

Aparent density of Luvosol (g/cm3)

Culture	**Month**	**Depth, in cm**	**Years**	
			2020	**2021**
Fruit trees	March	0-20	1.27	1.28
		20-40	1.28	1.29
	October	0-20	1.30	1.31
		20-40	1.33	1.35
Vine	March	0-20	1.26	1.27
		20-40	1.28	1.29
	October	0-20	1.27	1.28
		20-40	1.29	1.30

3. Total soil porosity (%)

Total porosity is a physical property, that is, an index of the relative volume of pores in the soil. The values of this index are usually between certain limits (30 – 60%).

There is a correlation between apparent density and porosity that can be used to classify soils into porosity classes. Total porosity values are shown in table 5. and 6.

Table 5

Total porosity (%) in Preluvosol

Culture	Month	Depth, in cm	Years	
			2018	2019
Fruit trees	March	0-20	45	45
		20-40	44	44
	October	0-20	43	43
		20-40	42	41
Vine	March	0-20	49	47
		20-40	47	46
	October	0-20	46	45
		20-40	45	44

On Luvosol, total porosity had the lowest values, respectively 41%, in fruit trees, at ad. 20-40 cm, in October 2020, and the highest values in the vine, per ad. 0-20 cm, in March 2021, respectively 47%.

Table 6

Determination porosity (%), at Luvosoil

Culture	Month	Depth, in cm	Years	
			2020	2021
Fruit trees	March	0-20	44	43
		20-40	43	42
	October	0-20	43	42
		20-40	41	40
Vine	March	0-20	46	47
		20-40	45	45
	October	0-20	45	46
		20-40	44	45

4. Aeration porosity (%)

Aeration porosity is of great importance in fruit plantations, when their values are low, the roots of the trees do not grow and develop well, which leads to a lower growth of the trees and therefore to a decrease in fruit production.

Organic fertilizers are the ones that lead to the most significant increases in soil aeration porosity values (tables 7. and 8.).

Table 7

Determination of aeration porosity (%), at Preluvosol

Culture	Month	Depth, in cm	Years	
			2020	2021
Fruit trees	March	0-20	13.90	13.30
		20-40	12.60	12.00
	October	0-20	12.70	11.40
		20-40	12.10	10.90
Vine	March	0-20	14.30	14.40
		20-40	13.70	13.90
	October	0-20	13.90	14.10
		20-40	13.40	13.30

At Preluvosol, the aeration porosity had values between 10.90%, for fruit trees at 20-40 cm depth, in October 2021 and 14.40%, for vines, at 0-20 cm, in March 2021.

Table 8

Aeration porosity (%) at Luvosol

Culture	Month	Depth, in cm	Years	
			2020	2021
Fruit trees	March	0-20	12.40	12.20
		20-40	11.30	11.00
	October	0-20	10.20	10.10
		20-40	9.40	9.60
Vine	March	0-20	13.60	13.70
		20-40	12.90	13.10
	October	0-20	12.80	12.90
		20-40	12.10	12.00

At Luvosol, PA had values of 9.40%, for fruit trees, at 20-40 cm depth, in October 2020 and 13.70% for vines, at ad. 0-20 cm, in March 2021.

CONCLUSIONS

Within Timiş county, Lugoj is located in the central-eastern part, being the second municipality in the county in terms of size, economic development and population.

Most of the land on which the town is located has a flat relief, with a few elevations that do not exceed 2-3 m altitude from the surface of the terrace.

The plantation of trees and vines was established in October 2012.

Knowing the physical properties of the two types of soils identified (preluvos and luvosol), will not help in the future to try to take the necessary measures to increase the production capacity of these soils and therefore obtain higher and good productions . quality. From the data presented, the following general conclusions can be drawn:

Soil density (D g/cm3) on Preluvosol, recorded values between 2.42 g/cm3, at a depth of 0-20 cm for fruit trees in March 2020 and 2.47 g/cm3, at a depth of 20-40 cm , in October 2020 and 2021. On Luvosol, the soil density values were between 2.44 g/cm3, in 2020 for fruit trees, at a depth of 0-20 cm, in March 2020 and 2.49 g/ cm3, on the vine, at a depth of 20-40 cm, in October 2021.

The apparent density of the soil on Preluvosol had values between 1.14 g/cm3, at the depth of 0-20 cm for the vines, in March 2021 and 1.20 g/cm3, at the depth of 20-40 cm, in during the month of October. On Luvosol, the values were between 1.26 g/cm3, for fruit trees, at a depth of 0-20 cm, during March 2020 and 1.35 g/cm3, for fruit trees, at a depth of 20-40 cm, in October 2021.

Total soil porosity (%) on Preluvosol had values between 41%, for fruit trees, at a depth of 20-40 cm, in October 2021 and 49%, for vines, at a depth of 0-20 cm, during of March 2020. On Luvosol it had values of 41%, for fruit trees, at a depth of 20-40 cm, in October 2020 and 47% for vines, at a depth of 0-20 cm, in March 2021.

The aeration porosity (%) on Preluvosol, had values between 10.90%, for fruit trees at a depth of 20-40 cm, in October 2021 and 14.40%, for vines, at a depth of 0-20 cm, in March 2021. On Luvosol, the aeration porosity had values between 9.40%, for fruit trees, at a depth of 20-40 cm, in October 2020 and 13.70% for vines, at a depth of 0- 20 cm, in March 2021.

After we determined and presented these physical properties of the soils, we identified the options we have for a more sustainable use of the lands occupied with tree-vine plantations and the identification of solutions that can ensure the best use; following the evolution of soils following the application of pedoameliorative measures; providing optimal solutions for the

various problems regarding the protection, improvement and efficient use of the soil and characterization of the lands intended for the establishment of tree-vine plantations according to the requirements of the management of an agricultural holding

BIBLIOGRAPHY

ANTOCE ARINA OANA, CĂLUGĂRU LAURA LIDIA, 2017 - Evolution of grapevine surfaces in Romania after accession to European Union – period 2007–2016, BIO Web Conf., 40th World Congress of Vine and Wine, Art. 03018 Volume 9, 2017, https://doi.org/10.1051/bioconf/20170903018

BORLAN Z., HERA C., 1994 - Fertilitatea și fertilizarea solurilor. Ed. Ceres, București, 1994;

CANARACHE A., 1997 – Însuşirile fizice ale solurilor agricole din Banat, Lucrări ştiinţifice SNRSS Timişoara, 1997;

DOBREI ALINA GEORGETA, DOBREI A., IORDĂNESCU OLIMPIA, NISTOR ELEONORA, BALLA G., MĂLĂESCU MIHAELA, DRĂGUNESCU ANCA, 2015 - Research concerning the correlation of soil with wines quality in some varieties of wine grapes in Miniș-Măderat vineyards, Journal of Horticulture, Forestry and Biotechnology, Vol. 19 (1), 2015, pag. 98, ISSN 2066 – 1797, www.journal-hfb.usab-tm.ro

DOBREI A., NAN ROXANA, NISTOR ELEONORA, DOBREI ALINA, 2021 - Comparative research on the influence of some technological sequences from conventional and organic viticulture, Scientific Papers. Series B, Horticulture. Vol. LXV, No. 2, 2021, ISSN 2285-5653, http://horticulturejournal.usamv.ro/pdf/2021/issue_2/vol2021_2.pdf

DRAGOESCU URLICA, A. A., & STEFANOVIĆ, S., 2018 - Ecolinguistic qualities of the optimal English language learning experience. International Journal for Quality Research, 12(2), 537-546.

DRĂGĂNESCU E. – Pomologie. Editura Mirton, Timişoara, 2002.

FLOREA N.,MUNTEANU I., 2012 – Sistemul român de taxonomie a solurilor (SRTS). Ed. Sitech, Craiova, 2012;

IANOŞ GH., PUŞCĂ I., GOIAN M., 1997 – Solurile Banatului-condiţii naturale şi fertilitate, Editura Mirton, Timişoara, 1997;

MĂLĂESCU MIHAELA: 14. VAN LEEUWEN C., LAURE DE RESSÉGUIER, SÉVERINE MARY, CORALIE E., MOUSSET-LIBEAU E., MARGUERIT ELISA, JEAN- PHILIPPE R., QUIQUERZ AMÉLIE, 2018 – Soil type and soil preparation influence vine development and grape composition through its impact on vine water and nitrogen status, E3S Congreso Internacional Terroir Web of Conferences 50, 01015 https://doi.org/10.1051/e3sconf/20185001015 XII

MIHUȚ, C., 2018 – Fizica solurilor agricole. Edit. Agroprint, Timișoara 208;

MIHUȚ CASIANA, RADULOV ISIDORA, 2012 - Științele Solului. Ed. EUROBIT, Timișoara, 2012;

Mircov V. D. , Okros A, Casiana Mihuț,S. Jercimovici,M. Dudas, Sorin Ciulca, 2021 -Interpretation And Analysis Of The Rainfall Regime In The Western Part Of The Country For Timis And Caras Severin In 2015-2019, Research Journal of Agricultural Science, 53 , 2021

NIȚĂ, L., GROZAV, A., ROGOBETE, GH., 2019 - Natural and Anthropic Soil Acidification in the West of Romania, Chemistry Journal, Vol. 70(6), 2237-2240.

OKROS, A., 2015 - Fertility status of soils in western part of Romania Journal of Biotechnology, Vol. 208(S63), 3-14.

ROGOBETE GH., 1994 – Ştiinţa solului, Editura Mirton, Timişoara, 1994;

RUSU RAUL ARIAN, 2007 – Organizarea spațiului geografic în Banat, Editura Mirton, Timișoara 2007;

TOTI MIHAI ȘI COLAB., 2017 – Zonarea speciilor pomicole în funcție de condițiile pedoclimatice și socio-economice ale României. Ed. Invel Multimedia ISBN 978-973-1886-93-0;

TROCME S, GRAS R. – Solul şi fertilizarea în pomicultură. Ministerul Agriculturii şi Industriei. Centrala pentru legume şi fructe. Bucureşti, 1977.

ȚĂRĂU D. ȘI COLAB., 2007 – Particularități ale condițiilor ecologice și de restaurare a fertilității solului în vestul României. Ed. Eurobit, Timișoara, 2007.