

ANALYSIS OF THE EXISTING SOILS IN THE ROOTSTOCK PLANTATION AND IN THE VINE PLANTATIONS SUPPLYING THE SHOOTS OR CANES IN THE DRĂGĂȘANI VINEYARD

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ABSTRACT

The study was carried out in the years 2023-2024 at SCDVV Drăgășani, in the plantation of „SO4-4” rootstocks and in the vine plantations supplying the shoots or canes of the „Victoria”, „Alutus”, „Vilarom” and „Crâmpoșie Aromată” grape cultivars. These grape cultivars are considered varieties of certain value, they were created at the Drăgășani Viticulture and Winemaking Research-Development Station. The object of study of this paper is the soil cover, researched in its maintenance with the other geographical factors in order to establish the agro-productive capacity of the plantations, to highlight the main negative attributes and the ameliorative measures. The study followed the contents of phosphorus, potassium and nitric nitrogen, in three repetitions, the soil samples being taken from the depths of 0-20 cm, 20-40 cm, 40-60 cm from the lower, middle and upper slopes of the plantations, in order to the fertilization corresponding to the fertilizing of the soil from the plantation of SO4-4 rootstocks and from the vine plantations providing of the shoots or canes necessary for the improvement of the production technologies of the viticultural propagation material in the current context of climate change. The samples taken from these plantations were analyzed at OJSPA Râmnicul Vâlcea, Romania.

INTRODUCTION

The Drăgășani Viticulture and Winemaking Research Development Station is part of the Drăgășani vineyard area, the oldest vineyard in Romania, also called the great grandmother of viticulture. The research station is the first research station in the country founded in 1936. The most famous and important grape cultivars created at this research station are the grape cultivars for table grapes „Victoria” and „Azur”, the seedless apyrene grape cultivar „Călina”, the grape cultivars for white wines „Crâmpoșie Selecționată”, „Vilarom” and „Crâmpoșie Aromată” and for red wines the most important ones are „Negru de Drăgășani”, „Novac” and „Alutus”. Clones of some value for viticulture were also obtained, namely „Tămăioasă Românească clone 104 Dg”, „Sauvignon clone 62 Dg”, „Cabernet Sauvignon clone 7 Dg” and two rootstock varieties—„Drăgășani M70” and „Drăgășani 57” (Cichi & Costea 2008).

The climatic data existing in the Drăgășani vineyard during this study period and throughout time show us an area favorable to the cultivation of vines with average annual temperatures over 10°C, sufficient precipitation to obtain quality and quantity productions, a good oenoclimatic index (4656), (I.N.M.H. Drăgășani Weather Station,2023) and regarding climatic accidents, they do not represent a danger regarding the vine culture (Costea 2006).

The climatic changes existing in the Drăgășani vineyard over time demonstrate the fact that the average temperatures recorded have an increasing tendency, but which currently do not affect the existing vine production (Cichi et al. 2009)

The results of laborious studies, published a little earlier (Condei et al., 1986), presented the following types of soils: different eroded eumezobasic brown, regosol, vertisol, argillic brown, clay-iluvial podzolic brown, psamosol, alluvial soil (Ferretti 2019).

The categories of wines that can be obtained on the different types of soil existing in the Drăgășani vineyard have also been specified. Thus: DOC, IG and VS wines can be obtained on the eumezobasic brown type of slope; wines, DOC and VS can be obtained on regosol; DOC and IG wines can be obtained on vertisol. On the other types of soil, products from the VC current consumption wine category are obtained (Costea, 2010).

The soils, as a whole, have clay-sandy, clay-clay and clay-clay texture. Other characteristics are as follows: the degree of saturation in bases (V%) is between 77 and 100%; The pH in the aqueous extract is between 5.7 and 8.0; humus is present in proportions between 0.8 and 2.4%; Mobile P₂O₅ shows a wide variability, with limits between 10 and 264 ppm; accessible K₂O is also found in highly variable contents, between 96 and 456 ppm (Nicolaescu, 2007).

MATERIAL AND METHODS

The study followed the contents of phosphorus, potassium and nitric nitrogen (mg/100 g), in three repetitions, in the years 2023 and 2024, the soil samples being taken from the depths of 0-20 cm, 20-40 cm, 40-60 cm from the lower, middle and upper slope of the plantations, with a view to the fertilization corresponding to the fertilization of the soil from the SO₄-4 rootstock plantation and from the vine plantations supplying the shoots or canes necessary to improve the production technologies of the viticultural propagation material in the current context of climate change.

The climatic conditions in the year 2023 were followed, in order to highlight the possible negative climatic effects. The samples from these plantations supplying the shoots or canes were taken in 2023, and in the rootstock plantation the samples were taken in 2024. After taking the samples, they were analyzed at OJSPA Râmnicu Vâlcea, Romania.

RESULTS AND DISCUSSION

From a climatic point of view, the year 2023 is confirmed as the warmest year since systematic weather records have existed since 1850.

In 2023 the global mean temperature was 14.98°C, 0.17°C higher than the previous highest annual value recorded in 2016.

The year 2023 was 0.60°C warmer than the 1991-2020 decade average and 1.48°C warmer than the pre-industrial level of 1850-1900.

Every month from June to December in 2023 was warmer than the corresponding month in any previous year.

July and August 2023 were the two warmest months on record. Boreal summer (June-July) was also the warmest season on record. In September 2023, the temperature deviation above the 1991-2020 average was larger than in any month in any year (0.93°C higher than the 1991-2020 average). October, November and December 2023, each with a temperature of 0.85°C above average, ranked second in temperature deviation above the 1991-2020 average.

The year 2023 marks for the first time a year in which each day exceeded the pre-industrial 1850-1900 level by 1°C for that time of year.

Almost half of the days were over 1.5°C warmer than the 1850-1900 level, and two days in November were over 2°C warmer for the first time (Copernicus Service, 2023).

The orography of the Drăgășani Vineyard, being very disturbed, determines pedological formations such as extent, mineral content, degree of maturation, glaciation, age and different texture.

We will find a pedological mosaic with uneven depths, extents, physical-chemical-biological characteristics as dictated by the geomorphological formations at the origin.

The soil formed on the base substrate is characterized by a heavy texture, strongly hydrated and rich in mineral elements of primitive soils: aluminum silicates, iron oxides, formations of various sizes and mixed with mineral silicon resulting from geological disturbances and the effect surface climatic factors.

On the slopes of the hills and hills, the soils are represented by diluvial "heavy clays", the valleys by layered compositions of eroded colluviums (clays, coarse sands, cold marly clays, heavily leached).

In the Olt meadow and to a lesser extent on the first alluvial terrace, we encounter alluvial soils with a lighter texture but in uneven combinations both in terms of area and depth (Măcău and Gorjan, 2016).

In table 1, in the year 2023, following the determinations made, from the samples taken from the plantations supplying the shoots or canes to the grape cultivars „Victoria” and „Alutus” we have good average values in the 3 repetitions analyzed. In the upper third of the slope, in the „Victoria” plantation, we observe average values between 18 and 15.67 mg/100 g of nitric nitrogen NO₃ and from 6.33 to 9.16 mg/100 g in the middle third of the slope. We observe a significant decrease in nitric nitrogen in the lower third of the slope with nitric nitrogen contents up to 2 mg/100 g. We also observe the same finding in the P₂O₅ phosphorus contents with good values in the upper and middle third of the slope and with a decrease in the lower third of the slope. The potassium K₂O contents are generally good, table 1 shows good average values in the upper, middle and lower third of the slope.

In the „Alutus” plantation, the average nitrogen, phosphorus and potassium contents are very good also in the upper and middle third of the slope and less good in the lower part, except for the potassium K₂O content where we find good average values in the lower third of the slope in the three repetitions analyzed (Table 1).

Table 1

The average contents of nitrogen, phosphorus and potassium in the plantations supplying grafted cords in 2023

Repetition	Slope	The depth	„Victoria”			„Alutus”		
			NO ₃ mg/100g	P ₂ O ₅ mg/100g	K ₂ O mg/100g	NO ₃ mg/100g	P ₂ O ₅ mg/100g	K ₂ O mg/100g
R1	1/3 the upper	0-20	46,49	19,35	30	27,44	7,50	12
		20-40	3,65	13,90	25	14,75	5,75	12
		40-60	3,86	14,00	23	26,99	4,00	10
Average			18	15,75	26	23,06	5,75	11,33
R2		0-20	5,98	28,25	42	18,99	24,00	19
		20-40	8,49	27,30	40	20,35	9,90	17
		40-60	6,43	15,00	25	24,77	2,85	8
Average			6,96	23,51	35,66	21,37	12,25	14,66
R3		0-20	16,08	21,85	26	15,89	9,00	12
		20-40	15,05	17,75	24	14,89	2,50	6
		40-60	15,90	15,00	20	12,34	3,00	8
Average			15,67	18,20	23,33	14,37	4,83	8,66
R1	1/3 the medium	0-20	10,64	9,50	21	10,84	9,35	22
		20-40	9,87	7,75	17	11,70	4,00	12
		40-60	6,99	6,00	18	15,81	5,50	7
Average			9,16	7,75	18,66	12,78	6,28	13,66
R2		0-20	7,90	13,60	7	12,78	4,10	5
		20-40	5,42	6,35	18	11,90	2,25	6
		40-60	5,69	4,35	18	12,87	4,75	5
Average			6,33	8,10	14,33	12,51	3,70	5,33
R3		0-20	9,90	9,60	19	13,90	6,50	12
		20-40	8,80	5,75	15	12,31	4,25	5
		40-60	5,20	8,50	16	12,89	5,00	4
Average			7,96	7,95	16,66	13,03	5,25	7
R1	1/3 the lower	0-20	2,24	4,75	18	7,22	8,60	20
		20-40	2,13	5,75	19	7,71	5,25	21
		40-60	2,16	7,00	20	6,55	6,60	14
Average			2,17	5,83	19	7,16	6,81	18,33
R2		0-20	2,56	5,00	17	2,43	12,15	18
		20-40	2,54	7,50	13	2,22	9,25	18
		40-60	2,52	7,35	14	2,29	12,60	19
Average			2,54	6,61	14,66	2,31	11,33	18,33
R3		0-20	2,23	7,35	18	2,11	4,65	8
		20-40	2,10	7,50	17	2,10	5,65	17
		40-60	2,00	6,35	18	2,09	4,80	18
Average			2,11	7,06	17,66	2,10	5,03	14,33

In the plantations of the grape cultivars „Vilarom” and „Crâmpoșie Aromată”, the nitrogen, phosphorus and potassium contents are generally good in all points of the studied slope. We observe in table 2, better contents of K₂O mg/100 g in the analyzed lower part of the slope, than in the middle part of the slope, in the two plantations supplying the shoots or canes analyzed. Therefore, in the lower part of

the plant, we have average contents of 21 to 26 K₂O mg/100g in the grape cultivar „Vilarom” and 26 to 29 mg/100g in the grape cultivar „Crâmpoșie Aromată”(Table 2).

Table 2

The average contents of nitrogen, phosphorus and potassium in the plantations supplying grafted cords in 2023

Repetition	Slope	The depth	„Vilarom”			„Crâmpoșie Aromată”		
			NO ₃ mg/100g	P ₂ O ₅ mg/100g	K ₂ O mg/100g	NO ₃ mg/100 g	P ₂ O ₅ mg/100 g	K ₂ O mg/100g
R1	1/3 the upper	0-20	20,03	27,25	42	19,50	6,50	21
		20-40	6,97	14,65	32	20,90	5,75	23
		40-60	12,22	13,40	27	19,40	20,50	24
Average		13,07	18,43	33,66	19,93	10,91	22,66	
R2		0-20	10,33	14,75	32	12,40	3,25	16
		20-40	12,72	13,50	35	12,78	4,75	15
		40-60	11,88	8,50	26	11,90	3,25	13
Average		11,64	12,25	31	12,36	3,75	14,66	
R3		0-20	10,85	32,35	37	10,78	9,50	15
		20-40	10,98	21,15	32	10,20	7,25	13
		40-60	11,02	11,10	35	11,40	11,00	25
Average		10,95	21,53	34,66	10,79	9,25	17,66	
R1	1/3 the medium	0-20	10,23	23,50	18	10,24	9,50	20
		20-40	10,12	19,00	22	11,20	5,85	15
		40-60	10,11	9,60	20	10,24	9,10	16
Average		10,15	17,36	20	10,56	8,15	17	
R2		0-20	9,42	13,50	21	9,90	3,25	7
		20-40	8,94	10,75	19	8,88	3,00	7
		40-60	9,61	8,50	19	9,20	2,50	8
Average		9,32	10,91	19,66	9,32	2,91	7,33	
R3		0-20	8,93	9,80	20	7,80	8,00	8
		20-40	10,90	9,35	20	7,20	9,50	9
		40-60	12,66	7,50	17	7,11	12,25	5
			10,83	8,88	19	7,37	9,91	7,33
R1	1/3 the lower	0-20	11,48	9,35	23	10,32	10,70	32
		20-40	12,27	7,40	24	11,90	9,75	25
		40-60	10,99	8,50	24	11,50	13,10	23
Average		11,58	8,41	23,66	11,24	11,18	26,66	
R2		0-20	5,98	8,40	25	7,10	23,25	41
		20-40	5,91	10,52	25	7,20	8,50	24
		40-60	6,67	11,52	30	6,90	7,00	24
Average		6,18	10,14	26,66	7,06	12,91	29,66	
R3		0-20	4,90	10,25	25	5,21	20,85	23
		20-40	5,20	12,25	21	3,22	10,25	25
		40-60	4,10	12,25	18	4,11	11,10	30
Average		4,73	11,58	21,33	4,18	14,06	26	

In the „SO4-4” rootstock plantation we can observe, following the determinations carried out at the beginning of 2024, good contents with higher values in nitric nitrogen, phosphorus and potassium than in the plantations supplying the shoots or canes.

Table 3

The average nitrogen, phosphorus and potassium contents in the rootstock plantation in 2024

Repetition	Slope	The depth	Rootstock „SO4-4”		
			NO ₃ mg/100g	P ₂ O ₅ mg/100 g	K ₂ O mg/100 g
R1	1/3 the upper	0-20	24,80	25,88	20
		20-40	32,32	15,20	22
		40-60	21,50	13,48	24
Average			26,20	18,18	22
R2		0-20	27,25	14,40	16
		20-40	24,75	13,76	15
		40-60	23,80	14,54	15
Average			25,26	14,23	15,33
R3		0-20	22,51	28,90	13
		20-40	24,68	27,23	13
		40-60	23,24	20,44	11
Average			24,37	25,52	12,33
R1	1/3 the medium	0-20	22,52	18,40	25
		20-40	22,73	9,60	23
		40-60	21,45	9,20	20
Average			22,23	12,40	22,66
R2		0-20	22,88	12,50	15
		20-40	19,54	13,45	17
		40-60	20,48	10,75	16
Average			20,96	12,23	16
R3		0-20	22,44	10,68	8
		20-40	21,61	12,88	9
		40-60	20,72	17,20	8
Average			21,59	13,58	8,33
R1	1/3 the lower	0-20	10,27	10,25	6
		20-40	12,27	10,20	5
		40-60	12,45	8,40	5
Average			11,66	9,61	5,33
R2		0-20	8,22	8,90	6
		20-40	7,44	8,60	7
		40-60	7,92	9,20	7
Average			7,86	8,90	6,66
R3		0-20	5,80	10,27	12
		20-40	6,49	10,50	14
		40-60	5,22	10,25	15
Average			5,83	10,34	13,66

Therefore, in the three repetitions analyzed, we have average values of 24.37 to 26.20 mg/100 g in nitric acid (NO₃) in the upper third of the slope, between 20.96 to 22.23 mg/100 g in the middle third of the slope, and in the lower third of the slope from 5.83 to 11.66 mg/100 g. Regarding the contents in (P₂O₅) we have the following determinations: in the upper third of the slope we have average values of

14.23 to 25.52 mg/100 g (P_2O_5), 12.23 to 13.58 mg /100 g (P_2O_5) in the middle third of the slope and from 8.90 to 10.34 K_2O mg/100 g in the lower third of the slope. Average potassium K_2O contents ranged from 12.33 to 22 mg/100 g K_2O in the upper third of the slope, from 8.33 to 22.66 mg/100 g in the middle third of the slope, and from 5.33 to 13.66 mg/100 g in the lower part of the slope (Table 3).

CONCLUSIONS

The area under study rests on a foundation belonging to the Wallachian Platform and functioned as a sedimentation area until the end of the Pliocene when there was a sharp retreat of the waters, the proof being the fact that the lower Pleistocene deposits that follow in continuity of sedimentation over the Levantine are of fluvial-lacustrine nature. At the end of the Lower Pleistocene, the area was completely removed from the influence of water.

From the point of view of the relief, the studied perimeter offers favorable conditions for the culture of the vine because the surface of the land does not have a large slope and is easily mechanized.

The deep mobilization of the soil simultaneously with the administration of organic and chemical fertilizers is the best measure to increase the productive potential.

The pedological conditions of the vine plantations and rootstocks in the Drăgășani vineyard correspond from a pedological point of view, this fact proving very useful for new plantations of autochthonous and international noble vines.

The parental material has the property of increasing the total volume of the soil with the increase of its humidity and of contracting strongly in drought conditions, a fact that contributed to the formation of soils with vertic characters, with a fine texture, relatively little permeable to water and air and with poor internal drainage. These characteristics of the soils in the studied area presuppose the taking of appropriate technological measures from the preparation of the soil for planting and a series of specific soil works throughout the existence of the vineyard plantation.

The climatic conditions in the Drăgășani vineyard do not endanger the soil structure, there have been no changes in the pedological structure of the soil over time and no landslides with negative consequences.

Following the determinations made at these samplings, we can see a high degree of soil supply with nitric nitrogen, phosphorus and potassium in all the plantations supplying grafting cords as well as in the plantation of SO4-4 rootstocks.

It can be seen that the slopes of the vine plantations and the rootstock plantation studied are very suitable for the cultivation of vines, the ones in the upper third and those in the middle third are obviously noticeable, and those in the lower third require correspondingly administration of complex fertilizers.

In the future, we recommend that these soils within the Drăgășani vineyard be properly fertilized with doses that must not exceed 150 kg/ha/year s.a. P_2O_5 and K_2O (s.a.-active substance).

Regarding the application of nitrogen-based fertilizers, we recommend establishing the appropriate dose of nitric nitrogen based on measures to comply with the rules for applying fertilizers.

It is necessary to carry out some experimental devices in the field in the viticultural areas characterized by a major impact on the preservation of the structural state and to improve the nitrogen balance in the soil.

In the future, it is recommended to develop some technological links of grapevine culture adapted to the current state of soil nutrition, which will ensure long-term productivity and sustainability of wine plantations.

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