

# The influence of soil resources in the school of vines in the Drăgășani research and development station for viticulture and winemaking viticultural nursery

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## Abstract

The research was carried out during the wine year 2021-2023 in the nursery viticulture Research and Development Stations for Viticulture and Winemaking Drăgășani. The object of study of this work is the influence of soil resources on the development of the root system and the aerial part of vine cuttings on the alluvicentricombosol soil type. Although culture technologies are still perfectible, they must be constantly adapted due to the continuous dynamics of this sector of activity, which must always be related to climatic conditions, economic and social situation. In this regard, research in the field was numerous and focused on aspects that were priorities at the time. All vine grape cultivars have a very high production potential, which in current conditions and with classical technologies is very little transposed into the yields obtained. The loss of nutrients from the soil through their absorption into the plant, through leaching through various agricultural works or other processes related to the natural dynamics of soils, entail the gradual decline of soil production capacity. It is necessary to compensate by applying mineral and organic fertilisers. The prolonged application of exaggerated doses of fertilizers or unbalanced combinations of chemical fertilizers with nitrogen, phosphorus and potassium often leads to nutritional deficiencies or physiological imbalances in the vine.

**Keywords:** vine cuttings, leachage, fertilizers, production, soil nutrients

## Introduction

The presence of air in the soil is also necessary, ensuring the normal growth and development of the vine and the proper functioning of the roots. The soil together with the climate constitutes the natural environment in which vines grow, fructify and develop. The importance of knowing the soil in a certain area also lies in the fact that, depending on its characteristics, a judicious choice can be made of rootstocks (resistant to limestone, resistant to chlorosodium salts) [3]. The great plasticity of the root system of the vine allows to adapt as easily as possible to almost all types of soil, except salt marshes and marshes. The soils for the vines should be deep, with enough limestone, fertile, rich in potassium mineral substances and warmer than cold. The use of fertilizers in vine schools is an important link for increasing the percentage of grafted quality I, vine schools falling within a rotation of 3-5 years, being important to know the influence of soil factors for regulating the feeding regime, affinity, obtaining good results on catching.

The physical properties of the soil have a major influence on how the soil functions within the ecosystem, through technical means these characteristics can be improved to compete for the development of the soil's capacity to ensure optimal vegetation conditions. It has been found that the use of microelements contributes to the activity of a number of metabolic processes. The content of pigments in leaves is one of the important indices of plant condition during the growing season. According to literature data, microelements have a positive effect on the content of carbohydrates and free amino acids. The application of microelements in the soil and foliar improves the growth and development of cuttings [1]. The intensity of metabolic processes has a positive impact on the processes of growth and maturation of shoots, the degree of woodification increases. The need for fertilizers depends not only on the nutritional reserves in the soil, but also on many factors, humidity, temperature, tillage, the collaboration of which makes the absorption of feed vary greatly. Since the soil nutrient reserve and different vegetation factors vary, fertiliser needs to be determined for each

type of land. With the help of experiments, it is possible to guide more precisely the assurance of soil fertility, increasing it.

### **Material and Method**

The research was carried out within the Drăgășani Research and Development Station for Viticulture and Winemaking, during three consecutive years, 2021, 2022 and 2023. Within the research, a series of measurements and analyses were carried out that were divided into categories: measurements made at grafting, respectively, measurements made in the vine school.

The measurements made in the vine school followed the behaviour of grafted vines both during the growing season, where biometric measurements were made on growths vegetative products and biochemical determinations of chlorophyll pigment content, and carotenoids, as well as after harvest, at which time a series of measurements were made biometrics and biochemical determinations. [4]. There are presented data on the content of nutrients in soil and organs of vine plants depending on fertilization with complex of microelements and bio-fertilisers, analysis of obtained results [5]. The analysis of the obtained results and conclusions regarding the action of microelements and bio-fertilisers on agrochemical and biometric parameters are presented [2].

In order to carry out the research, the following grape cultivars of fruitful vines created and approved within SCDVV Drăgășani were chosen: 'Negru de Drăgășani', 'Vilarom', 'Alutus', 'Victoria' and 'Crâmpoșie Aromată', and as a witness was chosen the grape cultivar 'Crâmpoșie selecționată'.

In order to carry out this research, three grape cultivars of rootstocks were also chosen on which the five fruitful vine varieties were grafted: 'M 70', 'Selecția Crăciunel 2', and 'Selecția Oppenheim 4 (SO4)'.

Having established the fruitful vine grape cultivars, respectively the rootstock grape cultivars on which they were grafted, a number of 15 working variants were created (table 1). For each variant of work, 100 cuttings were grafted.

**Table 1. Experimental variants**

Variety	Rootstock	Alternative
'Negru de Drăgășani'	SO 4	V 1
	C 2	V2
	M 70	V3
'Vilarom'	SO 4	V4
	C 2	V5
	M 70	V6
'Alutus'	SO 4	V7
	C 2	V8
	M 70	V9
'Crâmpoșie Aromată'	SO 4	V10
	C 2	V11
	M 70	V12
'Victoria'	SO 4	V13
	C 2	V14
	M 70	V15
'Crâmpoșie selecționată'	SO 4	V 16
	C 2	V 17
	M 70	V 18

Soil conditions during the experimental period

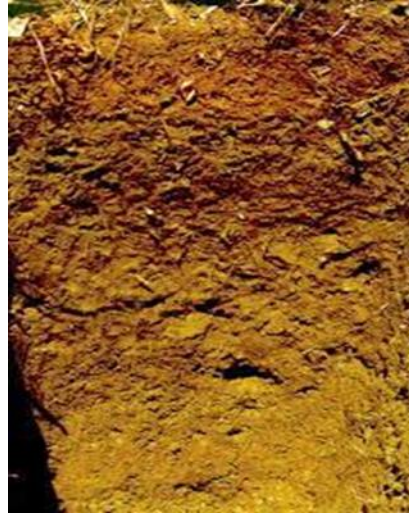
Name of soil: 'EUTRICAMBOSOL ALUVIC ' - hedgehog character, with soil buried at shallow depth, fine loamy / medium loam / medium sandy loam / medium sandy loam on sandy fluvial deposits.

Formula: Ecal- Xad, X01 – u/u –Tfg – t

Terrain layout: flat, slightly uneven

Natural conditions in which it occurs: very wide meadow, extreme sector [6].

The main soils with which it is associated: Eutric, ethnic, and gleyic alluvial (Figure 1).



**Figure 1. Soil profile**

**Table 2. Morphological characteristics of the soil**

Horizon	Depth (cm)	Morphological description
Ad	0 – 28	Medium loamy sand, colour 10 YR 5/3.5 destroyed structure, wet, strongly compact, rare grassy roots, gradual passage
A + ABd	28 -38	Medium clay sand, faintly yellowish-brown colour 2.5 YR 4/3, destroyed structure wet, moderately compact, step passage
Bvd	38 – 65	Medium loamy sand, light yellowish-brown colour 2.5 YR 4/4, medium to large polyhedral structure with poor development, wet, weakly compact, clearly straight transition.
Ao	65 – 95	Medium sandy loam, colour 10 YR 4/3, small to medium polyhedral structure with moderate development, moderately to strongly compact, wet-silty.

Physical Characteristics: the texture is coarse up to an average depth of 65 cm, after which, in an interval of approx. 40 cm becomes moderately coarse, loamy-sandy, the apparent density has high values in the first 28 cm of waves and destroyed structure, gradually decreases towards depth where it increases, the degree of subsidence is strong on the surface and decreases towards depth.

**Table 3. Analytical data of the soil**

Specification	Method	0-10 cm	28-38 cm	45-55 cm	75-85 cm
Coarse sand	Kacinski	0.85	11.30	7.54	15.50
Dust		20.02	18.04	13.32	12.95
Fine sand		61.36	63.18	69.10	56.98
Clay		11.12	7.98	9.77	13.94
Physical clay		22.65	18.99	21.21	23.56
Texture		NL fine	NL medium	NL medium	LN medium
CH	Mitscherlich	3.99	2.85	3.12	4.65
CO	CHx 1.5	5.46	4.11	4.72	6.86
DA (g/cmc)	By weighing in cylinders	1.61/1.73	1.59	1.51	1.67
PT (% Volume)	100 (1 DA/D)	35.9	39.9	42.8	40
PMN (% v)	45+0.163x clay	46.321	46.456	46.526	48.001
GT % v	PMN-PT.100 PMN	+22.3	+13.8	+8	+19
Estimated CC (% weight)	17.4+0.271x clay	21.15	19.597	20.5	21.201
CT (% weight)	PT : DA	20.258	25.064	27.9	23.208
CCDm (% weight)	CT -CC	0.984	5.354	8.4	2.321

PA or/ and PD in soil without water table wetting	CCDm x DA	1.65	8.34	12.987	4.74
Useful water capacity	CC – CO	14.61	14.996	15.39	15.023
Pm	CO+1/3 din Cu	11.01	9.481	8.99	12.02
Wg	Weighing	12.24	13.92	15.635	13.99
Wv	Wg x DA	23.99	24.09	23.201	24.897
Humus	%	1.51	1.51	1.45	1.57
SH	Me/100 gr. Sol	3.01	2.5	1.9	-
SB	Me/100 gr. Sol	17.99	19.08	19.21	-
Vsh	%	87.24	87.99	91.04	-
T	Me	22.23	22.09	21.63	-
K ppm	E.R.D.	136	136	130	130

### Results and Discussion

Climatic conditions. The climatic conditions during the experimental period present the following differences. The years 2021 - 2023 were characterized by a sum of temperature degrees.

**Table 4. Climatic elements analysed during annually and the vegetation period of experimental years**

Climatic elements		Years		
		2021	2022	2023
Medium temperature(°C)	Annual	16.5	17.8	18.2
	Vegetation period	18.5	19.1	19.4
Maximum temperature abs. shelter(°C)	Vegetation period	41.2	42.3	43.1
Absolute maximum temperature at the ground surface(°C)	Vegetation period	53.2	54.3	55.1
Precipitation (mm)	Annual	510	512	516
	Vegetation period	340.1	345.1	344.2
Sunstroke (hours)	Annual	1901	1912	1918
	Vegetation period	1410	1402	1428
The global heat balance(°C)	Annual	4299.2	4377.2	4355.2
	Vegetation period	3410.1	3444.2	3412.6
Active thermal balance (°C)	Annual	4065	4098	4097
	Vegetation period	3635.8	3645.8	3678.2

The effect of organic and mineral fertilizers in the vine school.

From the soil analyses to the variants of the experience to which the fertilizers were applied, it is found that at the main pheno-phases of the vines in the nursery, the vines were well supplied with nitrogen and potassium and less with phosphorus. During the phase of intense growth of the vines in June and July, the ammonium nitrogen fluctuated. In the second half of the vegetation period, in August nitrogen shows decreases, which are more pronounced for nitric nitrogen. At the end of the vegetation period, in October, increased values are recorded again compared to the control.

**Table 5. The content of assimilable forms**

Alternative	NH <sub>4</sub> (mg/100 g soil)		
	Moments I	Moments II	Moments II
Witness evidence	0.187	0.261	0.182
V1	0.280	0.201	0.288
V2	0.278	0.206	0.277
V3	0.266	0.199	0.256
V4	0.254	0.201	0.199
V5	0.234	0.200	0.202
NO <sub>3</sub> (mg/100 g soil)			
Witness evidence	1.735	1.368	1.402

V1	2.420	1.450	2.634
V2	2.201	1.201	2.450
V3	1.981	1.302	1.841
V4	1.987	1.299	1.403
V5	1.982	1.301	1.387
P <sub>2</sub> O (mg/100 g soil)			
Witness evidence	2.15	0.9	1.30
V1	2.40	1.30	1.60
V2	2.02	1.10	1.93
V3	2.22	1.19	1.87
V4	2.14	1.18	1.78
V5	2.13	1.17	1.28
K <sub>2</sub> O (mg/100 g soil)			
Witness evidence	11.20	8.45	10.25
V1	11.23	14.00	15.06
V2	12.02	12.65	14.08
V3	11.32	11.39	14.09
V4	11.21	11.32	14.08
V5	11.19	11.27	14.06

Soluble phosphorus shows insignificant differences from one variant to another. However, the differences compared to the witness are significant in this period. At the end of the vegetation, the phosphorus content remains low, and the excesses compared to the control are moderate. Assimilable potassium was found in the soil in relatively small amounts. These results prove that the applied fertilizers increased the amount of assimilable elements in the soil.

The effect of organic and mineral fertilisers on vines in the nursery. Average shoot length and stem weight. In the first year of experimentation, it was found that the applied fertilisers favoured both the growth and development of the vines and their quality.

**Table 6. Data on the effect of fertilizers on vines during the growing season**

Alternative	Average shoot length		Stem weight		Root length		Root weight	
	(cm)	(%) to the witness	(g)	(%) to the witness	(cm)	(%) to the witness	(g)	(%) to the witness
Witness evidence	80.1	100	15.2	100	101.45	100	5.00	100
V1	107.60	114.46	23.89	151.1	169.00	166.50	6.35	125.00
V2	129.70	109.14	23.58	149.14	152.70	150.44	5.76	115.20
V3	102.60	137.97	15.4	97.40	151.00	140.00	6.66	133.20
V4	103.62	135.72	15.1	98.2	152.01	141.21	5.82	134.12
V5	102.10	134.45	14.8	97.2	149.23	141.0	6.72	134.2

The average length of the shoot shows higher values than the control in the experimental variants. The biggest overruns were recorded at V2. The growth and vigour of the plant under the action of fertilizers is reflected in the weight of the stem that exceeds the control.

Development of the root system. Determining the length and weight of the roots, it was found that in all variants of the experiment the root system developed better than in the control. The root system was equally influenced by all the experimental variants, the differences in addition to the control range in root length and weight.

The positive relationship between the intensity of metabolic processes, vegetative growth, the total length and maturation of the shoot is perfected by the degree of maturation of the wood of the shoot as well as the level of reserve substances in the stem and roots.

**Table 7. Average reserve substances**

Years	Vine cords			Vine stem			Roots		
	2021	2022	2023	2021	2022	2023	2021	2022	2023
Sugars	7.44	7.43	7.51	6.77	6.73	6.87	6.67	6.54	6.75
Starch	8.76	8.65	8.73	10.26	10.24	10.51	10.21	10.22	10.31
Carbohydrates	16.20	16.0	16.21	17.01	17.02	17.10	16.68	16.70	16.71

Wood ripening of vine cuttings. The qualitative aspect of the vines in the viticultural nursery under the influence of the fertilizers applied experimentally, it is proven that the fertilizers acted positively in the viticultural school of vines as seen in the table.

**Table 8. The qualitative aspect of the vines in the viticultural nursery**

Alternative	Shoot length		Quality I vine	
	(cm)	Difference from the witness (%)	Number of qualities I vines	Difference from the witness (%)
Witness evidence	94.0	100	39.72	100
V1	107.6	144.46	57.57	130.08
V2	129.3	116.27	56.00	115.81
V3	102.6	109.14	50.09	116.03
V4	102.7	132.21	49.9	114.21
V5	101.2	110.0	40.8	110.10

### Conclusions

The principles of sustainable viticulture cannot be fully respected without precision horticulture through which the vegetation factors (water, nutrients, tillage, and fertilization) correlate as closely as possible with the biological needs of each individual variety.

Production is the essential element on which the economic efficiency of wine plantations depends to the greatest extent. Production varies a lot depending on the grape cultivar but is influenced by climatic conditions and cultivation technologies.

Starting from the general objective of the research, that of obtaining viticulture planting material from the newly created grape cultivars within the Research and Development Station for Viticulture and Vinification Drăgășani, in order to highlight the best association between fruiting vine grape cultivars and rootstocks, in order to be propagated in culture, we can formulate the following recommendation:

The 'Negru de Drăgășani' and 'Vilarom' grape cultivars had good results regarding the vegetative growth of the shoots during the vegetation period in the V2 variant, that is why they can be recommended for expansion in cultivation, because we will have a vigorous plantation that will quickly defoliate, but also for the fact that they are valuable grape cultivars with very good properties for obtaining quality wines and quality grafted vines.

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