

EVALUATION OF THE QUALITY OF SOME VINE GENOTYPES WITH TABLE GRAPES IN THE SANDY SOILS CONDITIONS OF SOUTHERN OLTENIA

Cristina BÎRSOGHE¹, Maria-Florentina BĂJENARU^{1*}, Alina-Nicoleta PARASCHIV¹

⁽¹⁾Dăbuleni Research and Development Station for Plant Culture on Sandy Soils, 217 Petre Baniță street, Călărași, România
dragomircristina20@yahoo.com

Corresponding author email: mariaciuca92@yahoo.ro

Abstract

The objective of this study is to present the biochemical composition of 6 table grapes genotypes: Victoria, Prima Cl. 1022, Otilia, Napoca, Transilvania, Splendid, in the conditions of sandy soils in southern Oltenia. The observations were made during 2022-2023 at SCDCPN Dabuleni. The climatic conditions at SCDCPN Dabuleni were favorable for the development of vine culture. The following observations and determinations were made: the soil content in: total nitrogen, extractable phosphorus, exchangeable potassium, organic carbon, pH; the biochemical content of the grapes: total dry matter, water, dry soluble substance, simple soluble carbohydrates, titratable acidity, vitamin C; the weight of 100 grains. The soil content in total nitrogen and exchangeable potassium was reduced, and in extractable phosphorus it was normal. Following the determinations carried out in the period 2022-2023, the best results regarding the quality of the grapes were obtained for the genotypes: Transilvania (21.09% total dry matter, 16% simple soluble carbohydrates, 3.97 g/l H₂SO₄ titratable acidity, 18.6% soluble dry matter), Otilia (19.13% total dry matter, 16.86% simple soluble carbohydrates, 4.97 g/l H₂SO₄ titratable acidity, 19.6% soluble dry matter). The grape varieties with a content of soluble simple carbohydrates higher than 15% were: Otilia (16.86%), Splendid (16.43%), Transilvania (16%).

Key words: total nitrogen, vitamin C, sandy soils.

INTRODUCTION

The expansion of wine plantations and the ever-increasing consumption of table grapes imposes the problem of obtaining high-quality products. The determining factor in the utilization of table grapes is their quality, conditioned primarily by appearance. The quantity and quality of grape production correlates positively, depending on the variety, with the level of grape production and the technological works applied during the growing season (Cucu V., 2013). The profitability of table varieties differs depending on their demand on the market, which is largely conditioned by several factors: the ripening period of

grapevines, the quality of the grapes and the production cost price. More in demand on the market are the grapes with an attractive external appearance, with large and medium grain, beautiful pink, amber and black color with an integral layer of pruin, with a pulp consistency that is more crunchy than juicy and the content of seeds is reduced or even without seeds (apirene). The taste depends on the content of sugars and acids, on the ratio between them, supplemented with different nuances conditioned by aromatic substances, dyes, etc. Grapes of apirine varieties and those cultivated with reduced

chemical treatments, ecologically harmless, are particularly in demand. Grapevine is a highly productive perennial crop. The period of intensive exploitation of commercial vineyards reaches an average of 20-25 years and more. For these reasons, the productivity and longevity of vineyard plantations largely depends on the land and the agrophytotechnics applied to care (Nicolescu G., 2008). What characterizes viticulture, distinguishing it from other technical-agricultural activities, consists in the fact that it is a food crop with perennial and polycarpic plants, which begin to bear fruit in the second year after planting, develop a strong root and aerial system. The vines freeze at temperatures of - 15 °C...- 20 °C, which makes it necessary to protect them in places with harsh winters, they capitalize better than any other plants on pedoclimatic conditions of low fertility. Grapes belong to the category of food products indispensable to life. Ripe grapes contain 150-280 g of sugar and even more per liter of must. Along with sugar, grapes contain acids, acid salts and vitamins, which complete their nutritional value (Oprean M., 1975). Of all the organic substances that enter into the chemical composition of the berries, the sugars and organic acids are the most important for the constitution of the taste and nutritional qualities of the grapes and their suitability for technical processing, and they undergo important changes depending on the biological characteristics of the varieties and in they are especially influenced by ecological factors and vine cultivation methods (Șerban D., 2008). Climatic changes in recent years, and especially the increase in air temperature, definitely influence the biochemical composition of grapes regardless of the variety grown. For the northern vineyards, this warming will be a beneficial one, while for the southern ones it will be

disadvantageous due to the too hot climate (Kenny G. J., Harrison P. A., 1992). Negative effects of climate change have already been observed in some vineyards around the world, such as: earlier ripening of grapes, loss of acidity through respiration and a greater accumulation of sugar. Also, if the harvest occurs earlier than usual (August or September instead of October in the northern hemisphere), and the crop is not irrigated, dehydrated grapes will result (Jones V. G. et al., 2005). The quality of grapes is often influenced by soil and climatic conditions. (Deloire A. et al., 2005, Sadiye Peral Eyduvan et al., 2015). Proper fertilization and biostimulation of table grapes is the way to achieve high goals in terms of quantity and quality. The yield of table grape cultivation depends significantly on sprouting, one of the stages with the highest nutritional requirements. the most important elements in this stage are zinc, boron and calcium, without overlooking the ratio between nitrogen and potassium. Good post-harvest properties are obtained through an optimal supply of calcium, potassium and magnesium. A modern strategy of fertilization of table grapes is based on two very important pillars: The form with controlled release of nitrogen to avoid imbalances, with the integration of mineral and / or organic-mineral fertilizers. Biostimulation is also important because it helps support the plant's needs in the most critical phenological phases, minimizing problems and improving quality and quantity. The most important element, nitrogen, should also be applied in the post-harvest stage to build up reserves for the next growing season. Potassium is an extremely important element for the bouquet and leaves; it should be applied in larger quantities during the first phases of vegetative growth or fractionally during the cycle. Biostimulation is very important in

three main stages: during vegetative growth to improve bud development and new root production, before flowering to enhance good fruit set, and during the ripening stage to obtain the highest result (<https://www.compo-expert.com/ro-RO/culturi/fructe/struguri-mese>).

In general, table grape varieties grow faster than wine grape varieties. Therefore, they need a better supply of nutrients. In addition to macronutrients (especially magnesium), the micronutrients iron and boron play an important role in table grapes (<https://www.lebosol.de/ro/culturi/struguri-de-masa>).

MATERIALS AND METHODS

In order to determine the biochemical composition of grapes, 6 genotypes of vines with table grapes were studied, under conditions of thermal and water stress from SCDCPN Dabuleni. The ampelographic collection was established in 2010. The form of driving the vines was the classic (low), the planting density was 3787 vines/hectare and the planting distances were 2.2/2.1 meters.

The genotypes studied were: *Victoria*, *Prima Cl. 1022*, *Otilia*, *Napoca*, *Transilvania*, *Splendid*. The climatic conditions at SCDCPN Dabuleni were favorable for the development of vine culture. The following observations and determinations were made:

- soil content in:

* total nitrogen (%) – Kjeldahl method;

* extractable phosphorus (ppm) – Egner – Riehm – Domingo method;

* exchangeable potassium (ppm) – Egner – Riehm – Domingo method;

* organic carbon (%) – titrimetric method;

* pH – potentiometric method.

- the biochemical content of the grapes:

* total dry matter and water (%) – gravimetric method,

* dry soluble substance (%) – refractometric method;

* simple soluble carbohydrates (%) – Fhling Soxleth method;

* titratable acidity (g sulfuric acid /100 g fresh substance) – titrimetric method;

* vitamin C (mg/100 g fresh substance) – iodometric method.

- the weight of 100 grains.

RESULTS AND DISCUSSIONS

The existing climatic conditions in the area of sandy soils in the south of Oltenia offer favorable conditions for the development of vines with table grape genotypes, if all the technological links of culture are applied. The experiment was located on a soil low supplied in total nitrogen, exchangeable potassium, and normally supplied in extractable phosphorus. The obtained results highlight an unevenness of the soil, specific to sandy soils. The supply state of the soil in organic matter was reduced, and the pH of the soil on which the experiment was located was 6.59 value showing a slightly acidic reaction (table 1).

Table 1. Analysis of sandy soil composition from experimental field of RDSPCS Dabuleni

The variant	The depth (cm)	Total nitrogen (%)	Extractable phosphorus (ppm)	Exchangeable potassium (ppm)	Carbon organic (%)	pH
Experimental field	0-90	0.03	70.43	41.95	0.48	6.59
Fertility status		Low	Normal	Low	Low	Slightly acidic

The climatic conditions in the two years of the study were differentiated, with higher average air temperature values in the months of June-September compared to

the multi-annual average values, and the average of the April-September period was 20.2 °C, compared to 19.3 °C as was the multiannual average (Table 2).

Table 2. Climatic conditions during the vegetation period of the vine
2022-20

Climate element/ The month		IV	V	VI	VII	VIII	IX	Average/ Sum
Average temperature (°C)	2022	11.7	18.3	22.9	25.2	25.1	17.9	20.2
	2023	11.1	16.8	21.2	25.4	25.4	21.2	20.2
Minimum temperature (°C)	2022	-3.1	3.5	11.8	12.5	14.1	3.9	-3.1
	2023	0	7.4	11.4	10.2	10.6	9	0
Maximum temperature (°C)	2022	26.3	31.8	35.7	41.6	40.8	34.1	41.6
	2023	23.5	29	37.6	42	41.6	36.5	42
Rainfall (mm)	2022	73.6	38.4	67.4	15	49.4	56.4	300.2
	2023	57.8	81.6	81.4	73.6	22.3	46.8	363.5
Multiannual mean monthly temperature (°C)		11.87	18.45	21.55	23.31	22.68	17.96	19.3
The sum of multiannual monthly precipitation (mm)		47.05	62.53	69.92	54.14	36.65	44.94	315.22

The amount of precipitation was 300.2 mm in 2022 and 363.5 mm in 2023. Although in 2023 the amount of precipitation between April and September exceeded the multiannual amount by 48.28 mm, it was poorly distributed, and in July the drought phenomenon which, against the background of air temperatures with maximums of 42 °C, influenced the ripening of the grapes and implicitly their biochemical composition. The results obtained regarding the biochemical

composition of grapes in the studied genotypes are presented in table 3. During the phenophases of growth and ripening of the berry, all the organic substances in the grape berry are subject to variations. Most of the time, the increase in the amount of some substances is accompanied by the decrease of others, at the same time these processes are synchronized in the skin and the core, but often they have an antagonistic character.

Table 3. Biochemical composition of table grape varieties, on the sandy soils of southern Oltenia – the average of 2 years

Genotype	The weight of 100 grains (g)	Water (%)	Total dry matter (%)	Simple soluble carbohydrates (%)	Dry soluble substance (%)	Titrateable acidity (g sulfuric acid / 100 g fresh substance)	Vitamin C (mg/100 g fresh substance)
<i>Victoria</i>	696.50	81.70	18.29	12.64	14.7	3.14	8.39
<i>Prima Cl. 1022</i>	500,50	81.40	18.6	14.54	16.9	5.27	12.38
<i>Otilia</i>	364,50	80.87	19.13	16.86	19.6	4.97	9.24
<i>Napoca</i>	459.50	81.41	18.60	14.02	16.3	2.86	10.17
<i>Transilvania</i>	568.50	78.91	21.09	16.00	18.6	3.97	9.4
<i>Splendid</i>	661.50	82.25	17.76	16.43	19.1	4.61	8.7
<i>Media</i>	541.83	81.09	18.91	15.08	17.53	4.14	9.71

The weight of 100 grains was between 364.5 g in the *Otilia* genotype and 696.5 g in the *Victoria* genotype, with an average of the genotypes of 420 g. The genotypes that presented a berry weight higher than the average of the genotypes were: *Victoria* (696.5 g), *Transilvania* (568.5 g), *Splendid* (661.5 g).

The total dry matter in grape berries ranged from 17.76% in *Splendid* to 21.09% in *Victoria*, with a cultivar average of 18.91%. The genotypes *Otilia* (19.13%) and *Transilvania* (21.09%) stood out above the average of the varieties (table 3).

According to Gherghi A. et al., 1983 the amount of total dry matter in grapes is in the range of 17 - 25%. It is observed that in the conditions of the sandy soils of the south of *Oltenia*, the varieties of vines with table grapes accumulate a quantity of total dry matter according to the specialized literature. With the accumulation of the total dry substance in the grapes, the water

content decreases, which showed an average of 81.09%, a value that falls within the limits provided by the specialized literature, which provide for a water content between 75% and 83%.

The content in soluble carbohydrates showed different values depending on the genotype and the climatic conditions in the 2 years of the study. The carbohydrate content was between 12.64% in the *Victoria* genotype and 16.86% in the *Otilia* genotype, with an average of 15.08%. The genotypes that showed higher values above the average were *Otilia* (16.86%), *Transilvania* (16%), *Splendid* (16.43%).

A correlation, given by a polynomial equation, with a significant correlation factor ($r=0.82^*$) was established between the amount of total dry matter in the grape and their weight. The weight of the grains decreases up to values of 19.5% after which it starts to increase (fig. 1).

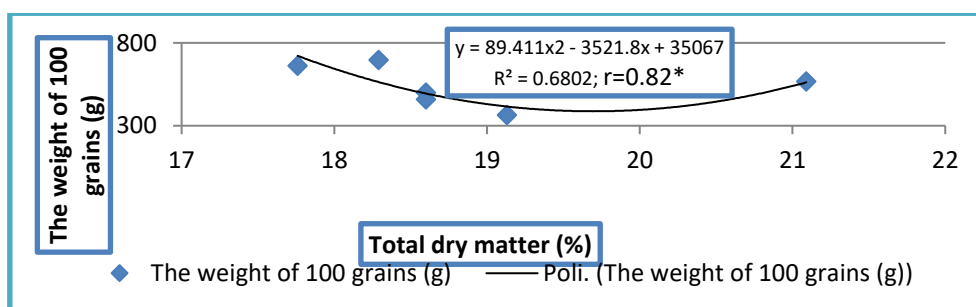


Figure 1. Correlation between total dry matter (%) and the weight of 100 grains (g)

The acidity of the grapes showed values between 2.86 g/l H_2SO_4 for the *Napoca* variety and 5.27 g/l H_2SO_4 for the *Prima* variety, with an average of the varieties of 4.14 g/l H_2SO_4 . The content in vitamin C showed close values in the 2 years taken in the studio (figure 2). The highest vitamin C content was recorded in 2023, in the *Prima* genotype (12.44 mg/100 g fresh substance), and the lowest content was recorded in 2022 in the *Victoria* and *Otilia* varieties (7.92 mg/100 g fresh substance). The average of the varieties was 9.47

mg/100 g f.s. in 2022 and 9.96 mg/100 g f.s. in 2023, and the specialized literature provides a range between 3 mg and 20 mg. Higher values of vitamin C compared to the average were determined in the varieties: *Prima* (12.44 mg/100 g f.s.), *Napoca* (10.56 mg/100 g f.s.) and *Otilia* (10.56 mg/100 g f.s.), (table 4). The content of grapes in different biochemical components is influenced by numerous factors: the biological particularities of the variety, growing conditions, insolation, soil conditions, humidity, agricultural

techniques, etc. From a climatic point of view, in the year 2022 which was slightly warmer, there were better conditions for the accumulation of the studied biochemical components in the grape

seeds. In most varieties, a higher amount of total dry matter, soluble dry matter, carbohydrates, and a lower acidity compared to 2023 were determined (Table 4).

Table 4. The biochemical composition of grapes during the two years of study

Year	Genotype	The weight of 100 grains (g)	Water (%)	Total dry matter (%)	Dry soluble substance (%)	Simple soluble carbohydrates (%)	Titrateable acidity (g sulfuric acid/ 100 g fresh substance)	Vitamin C (mg/100 g fresh substance)
2022	Victoria	690	77,84	22,16	16	13,76	2,94	7,92
	Prima Cl.1022	510	80,44	19,56	18,8	16,17	4,9	12,32
	Otilia	375	79,85	20,15	21,6	18,58	4,41	7,92
	Napoca	445	78,75	21,25	18,6	16	2,54	10,56
	Transilvania	725	77,37	22,63	20,2	17,37	3,92	9,2
	Splendid	730	83,52	16,48	20,8	17,89	5,39	8,9
Media		579	79,63	20,37	19,33	16,63	4,02	9,47
2023	Victoria	703	85,58	14,42	13,4	11,52	3,33	8,86
	Prima Cl.1022	491	82,36	17,64	15	12,9	5,63	12,44
	Otilia	354	81,89	18,11	17,6	15,14	5,53	10,56
	Napoca	474	84,06	15,94	14	12,04	3,18	9,78
	Transilvania	412	80,45	19,55	17	14,62	4,01	9,6
	Splendid	593	80,97	19,03	17,4	14,96	3,82	8,5
Media		505	82,55	17,45	15,73	13,53	4,25	9,96

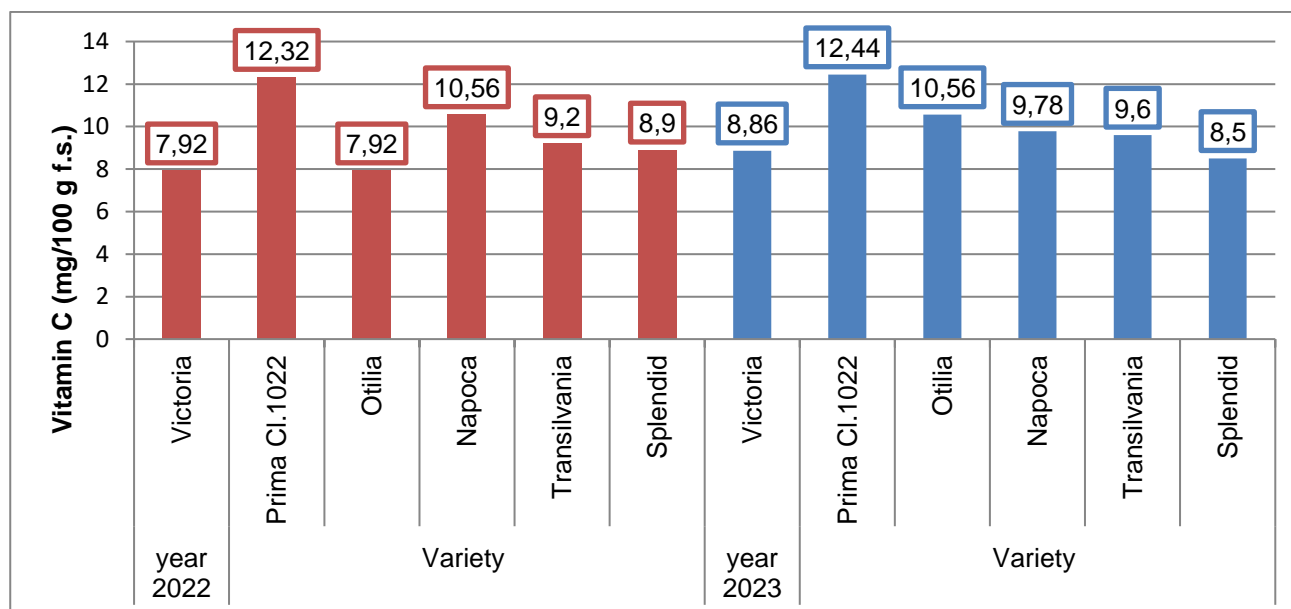


Figure 2. Vitamin C values in the 2 years studied

CONCLUSIONS

In the 2 years under study, the vine culture endured temperatures of over 40 °C

recorded at the RDSPCS Dabuleni, the quality of the fruits not being affected. The best results regarding the quality of the grapes were obtained for the genotypes:

Transilvania (21.09% total dry matter, 16% simple soluble carbohydrates, 3.97 g/l H₂SO₄ titratable acidity, 18.6% soluble dry matter) and *Otilia* (19.13% total dry matter, 16.86% simple soluble carbohydrates, 4.97 g/l H₂SO₄ titratable acidity, 19.6% soluble dry matter).

During the 2 years under study, vitamin C varied between 8.8 mg/100 g fresh

substance in the *Victoria* genotype, in 2022, and 12.44 mg/100 g fresh substance in the *Prima Cl. 1022*, in 2023.

The highest dry soluble substance was recorded in the *Otilia* genotype (21.6%), in 2022.

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