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RESEARCH ON THE BEHAVIOR OF SOME AUTOCHTHONOUS GRAPEVINE CULTIVARS WITH RED WINE GRAPES IN THE SANDY SOILS OF SOUTHERN OLTENIA

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ABSTRACT

The research carried out in the period 2021-2023 followed the behavior of four red wine grape cultivars (ˈBăbească neagrăˈ, ˈHaiducˈ, ˈNovacˈ, ˈPandurˈ), studied in the ampelographic collection of the Research and Development Station for the Culture of Plants on Sands Dăbuleni. The obtained results showed that the beginning of bud burst phenophase of these red wine grape cultivars started in the period April 17-24, the earliest being ˈNovacˈ, which beginning of bud burst in the period April 17-May 10. In terms of productivity, the Novac cultivar stood out with a grape yield of 20931 kg/ha, registering a difference of 5061.5 kg/ha compared to the control, statistically assured as significant. The quality recorded at harvest maturity of the grapes showed total sugar content values ranging from 182 g/l for the ˈPandurˈ cultivar to 201 g/l for the ˈBăbească neagrăˈ and ˈNovacˈ cultivars.

INTRODUCTION

In the region of Oltenia, the concern with the study of vine cultivars has a long history, even millennia old, and it can be affirmed, on the basis of the existing archaeological and documentary evidence, that this is one of the places where the foundations of national viticulture were laid. It was also here, on the territory of Oltenia, that the first attempts to preserve autochthonous cultivars or to obtain the grafted planting material necessary to replant the plantations after the phylloxera disaster materialized (Perț, 2018).

The identity of Romanian viticulture has been ensured throughout the ages by the wines made from autochthonous and local vine cultivars. Today when our country belongs to the European community, viticulture joins this unity in diversity. In order for the identity of our viticulture to remain unmistakable, it is necessary to rely primarily on the cultivation of autochthonous vine cultivars, including the newly created ones, to which we should add foreign ones, which have proven to prefer our soil and climatic conditions (Popa et al., 2020).

Studies on the assortment of local varieties of Vitis vinifera grown on the sands of southern Oltenia have revealed that the wines produced here are generally poorly extractive, sometimes low in alcohol, low in acidity, low in fruitiness and prone to illness. These deficiencies are more pronounced in white wines. Red wines are more balanced and qualitatively superior to whites. Red wine cultivars have been particularly noted for their higher acidity, which, in contrast to white wine cultivars, is better preserved and produces more balanced, pleasant and higher quality wines (Vlădoianu, 1984).

The impact that climate change in recent decades has had on grapevine is highlighted in a number of scientific papers in the field. The environmental factor with the greatest influence on the phenological development of grapevine is temperature, the climatic parameter with the greatest impact (Ciobanu C., et. all, 2023).

Rising temperatures primarily lead to the initiation and early onset of phenophase (Chuine I. et. all., 2014; Van Leeuwen C.et. all 2016; Duchêne E.et. all 2005), a trend observed in many regions of the world; early onset of phenophase can lead to early exposure of buds to climatic events (Molitor D. et all. 2019), high temperatures can remove certain cultivars from the optimal areas to grow them (Lereboullet A.- L. et all., 2014), this tendency can lead to excessive accumulations of sugars, decreased acidity and loss of flavors.

Climate change leads to the exposure of vines to drought, either due to reduced precipitation or evapotranspiration due to increased temperatures. This leads to decreased crop yield, especially through reduced berry size (Ojeda H. et all., 2002; Van Leeuwen C. et all., 2009) and reduced shoot fertility (Guilpart N. et all., 2014).

The purpose of this work was to assess the climatic conditions in the period 2021-2023 and their influence on grapevine phenology. Evaluation of yield and quality in some indigenous red wine grape cultivars.

MATERIAL AND METHODS

The study was carried out on four grape cultivars for red wines (ˈBăbească neagrăˈ, ˈHaiducˈ, ˈNovacˈ, ˈPandurˈ), from the ampelographic collection of the Dăbuleni Research - Development Station for Plant Culture on Sands. The ampelographic collection was established in 2010. The form of driving the stumps was the classic (low), the planting density was 3787 stumps/ha and the planting distances were 2.2/1.2 m. The experiment was located on a sandy soil with low natural fertility, with an organic carbon content within the limits of 0.24-0.74%, poorly supplied with nitrogen (N_{total}= 0.02-0.03%), well supplied in phosphorus ($P_{extractable}$=74.42-85.56 ppm) and with a low potassium content ($K_{exchangeable}$=36.26 - 46.93 ppm), according to the supply range established by Davidescu (1981). The viticultural climate parameters analyzed were: air temperature, thermal balances and precipitation, recorded at the Weather Station of Dăbuleni Research - Development Station for Plant Culture on Sands. The global thermal balance represents the sum of the average daily degrees during the vegetation period; The active thermal balance represents the sum of average daily temperatures higher than 10 °C during the vegetation period; The useful thermal balance represents the sum of the differences between the average daily temperature higher than 10 °C, and 10, which represents the biological threshold (Georgescu et al., 1986).

Observations and determinations were made regarding the phenological stages: beginning of bud burst, flowering, beginning of ripening, berries ripe for

harvest, shoot fertility, grape production and quality. The phenological determinations consisted in the visual observation and noting the initiation of the vegetation phenophases, when they were recorded in at least 30% of the stumps studied within the cultivar.

Production determinations were carried out by weighing the grapes in 4 repetitions, for each cultivar at technological maturity. For quality determinations, samples were taken from the harvested grapes parameters were analyzed in the laboratory: the weight of 100 grapes, by the gravimetric method, the sugar content using the KRUSS digital portable refractometer 0-32% brix and titratable acidity, by the titrimetric method. The obtained results were analyzed statistically using analysis of variance (ANOVA).

RESULTS AND DISCUSSIONS

From the analysis of the main climatic elements carried out in the period 2021-2023, it can be seen that the temperature values, expressed by the heat balances, recorded increasing values from 2021 to 2023, exceeding the limits presented in the literature. The average of the analyzed period of the global heat balance recorded the value of 4074 °C, the active heat balance recorded 3806 °C, and the average of the useful heat balance recorded 1900 °C (Figure 1).

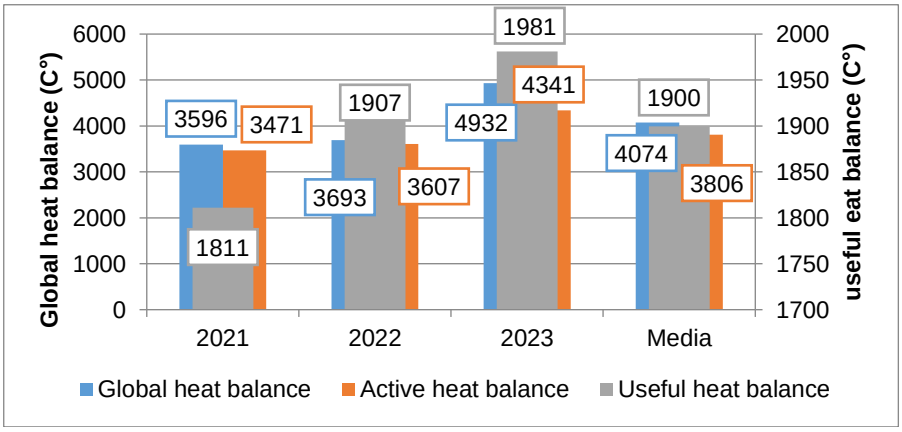

Figure 1. Heat balance between 2021-2023

The average temperature during the period analyzed was 12.9 °C, 1.4 °C higher than the multi-year average from 1956 to 2023 (11.5 °C). The maximum temperature has been increasing since 2021 when 41.2 °C was recorded, reaching the maximum of 42.0 °C in 2023 (Table 1). Growing season precipitation ranged from 173.6 mm in 2021 to 363.5 mm in 2023. The average annual precipitation from 2021-2023 (574.9 mm), was 13.5 mm higher than the multiannual average from 1956-2023 (561.4 mm), and its correlation with increasing air temperature emphasizes the increasing drought.

Table 1.

The main climatic elements recorded at the weather station* of RDSPCS Dăbuleni during 2021-2023

Climatic elements	Year		
	2021	2022	2023
Average temperature (°C)	12.5	12.7	13.4
Minimum temperature (°C)	-10.6	-10.2	-11.8
Maximum temperature (°C)	41.2	41.6	42.0
Multiannual mean temperature (1956-2023) °C	11.46	11.49	11.51
Multiannual average precipitation (1956-2023) mm	562.08	560.06	562.10
Annual precipitation (mm)	544.6	547.2	632.9
Precipitation during the vegetation period April-September (mm)	173.6	300.2	363.5
Number of days with rain	114	111	133
Number of days with maximum temperatures > 30°C	68	79	79

In the period 2021-2023, in the red wine grape cultivars, the de budding phenophase started from April 17-24, the earliest de budding ˈNovacˈ cultivar. Flowering took place in the period 25-28 May, about 39 days after budding (Table 2). Harvesting was earliest for the cultivar ˈBăbească neagrăˈ in the period 13.09-22.10, and the latest for the cultivar ˈPandurˈ in the period 22.09-23.10 (Table 2).

The climatic conditions can cause a delay of 17 to 23 days before de-stemming. The fruit is almost sudden, in about 24 hours and is marked by changes in the appearance and composition of the berry: the mesocarp loses its firmness, the skin becomes thinner, elastic and translucent in white grape varieties, or reddish in black grape cultivars, and the carbohydrate content increases rapidly (Irimia, 2012).

Table 2.

The main phenophases in the period 2021-2023

Cultivar	Beginning of bud burst	Flowering	Berry growth (beginning)	Beginning of ripening	Harvesting grapes
ˈBăbească neagrăˈ	24.04-10.05	27.05-12.06	05-16.06	19.07-03.08	13.09-22.10
ˈHaiducˈ	24.04-07.05	28.05-14.06	06-18.06	26.07-05.08	19.09-19.10
ˈNovacˈ	17.04-10.05	25.05-12.06	04-16.06	26.06-07.08	19.09-19.10
ˈPandurˈ	23.04-05.05	26.05-10.06	03-13.06	29.07-08.08	22.09-23.10

In the period 2021-2023 for the red wine grape cultivars, the average yield ranged from 15869 kg/ha for the cultivar ˈBăbească neagrăˈ to 20931 kg/ha for the cultivar ˈNovacˈ, which achieved the highest difference (5061.5 kg/ha) compared to the cultivar ˈBăbească neagrăˈ, taken as a control, a difference statistically ensured as significant (Table 3).

Table 3.

Grape production of some vine cultivars in the period 2021-2023

Cultivar	Average production (kg/ha)	Difference from the witness (kg/ha)	Signification
ˈ*Băbească neagră*ˈ	15869	Witness	
ˈ*Haiduc*ˈ	19271	3401.9	-
ˈ*Novac*ˈ	20931	5061.5	*
ˈ*Pandur*ˈ	18560	2690.6	-
DL 5%=4719,6 DL 1%=7146,9 DL 0.1%=11481,2			

Quality analyses consisted of determinations of 100 berry weight, total sugar content and total titratable acidity at harvest. In the period 2021-2023, the 100 berry weight ranged from 223 g for the cultivars ˈBăbească neagrăˈ and ˈHaiducˈ to 283 g for the cultivar ˈNovacˈ, with a difference from the control of 60.3 g, statistically significant. Sugar content ranged from 182 g/l for cultivar ˈPandurˈ to 201 g/l for cultivars ˈBăbească neagrăˈ and ˈ Novacˈ. The titratable acidity at harvest expressed in g/l H_2SO_4 ranged from 3.50 g/l for the ˈBăbească neagrăˈ cultivar to 4.13 g/l for the ˈNovacˈ cultivar (Table 4).

Table 4.

Grape quality of some vine cultivars in the period 2021-2023

Cultivar	Weight of 100 berries		Total sugar content		Total titratable acidity H_2SO_4	
	(g)	Difference from the witness (g)	(g/l)	Difference from the witness (g/l)	(g/l)	Difference from the witness (g/l)
ˈ*Băbească neagră*ˈ	223	Witness	201	Witness	3.50	Witness
ˈ*Haiduc*ˈ	223	-0.3	196	-5.0	3.54	0.03
ˈ*Novac*ˈ	283	60.3**	201	-0.3	4.13	0.62
ˈ*Pandur*ˈ	273	50.3*	182	-18.7	4.05	0.55
	DL 5%	34.6	DL 5%	18.9	DL 5%	1.34
	DL 1%	52.4	DL 1%	28.5	DL 1%	2.02
	DL 0.1%	84.2	DL 0.1%	45.9	DL 0.1%	3.25

CONCLUSIONS

The climatic conditions recorded in the area of sandy soils in southern Oltenia were favorable for the development of the metabolism of table grape and red wine grapevine cultivars, the active heat balance (3471-4341 °C) and useful heat balance (1811-1981 °C) exceeding the limits presented in the literature.

It is observed that due to climate changes, temperature increase (active heat balance 3471-4341 °C), vine cultivars entered into vegetation later and the vegetation period was shortened in grape cultivars cultivated in the south of Oltenia.

In the period 2021-2023, in the red wine grape cultivars, the de budding phenophase started between April 17-24, the earliest de budded ˈNovacˈ cultivar.

Of the red wine grape vine cultivars tested on sandy soils, the ˈNovacˈ cultivar stood out with the best yield (20931 kg/ha) and quality (283 g/100 berry weight and 201 g/l sugars).

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