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STUDY OF THE BEHAVIOR OF SOME WHITE WINE VARIETIES GROWN IN THE BLAJ WINE-GROWING CENTER

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ABSTRACT

The study analyses the behaviour of four white wine grape varieties —Italian Riesling, Fetească Regală, Muscat-Ottonel, and Sauvignon —grown in the Blaj-Cenade wine-growing area. The research was conducted between 2019 and 2021 and consisted of assessing the climatic framework and the productive and qualitative potential of these varieties in the context of climate change. The year 2019 was hot and dry, with positive temperature deviations and low precipitation; 2020 was close to normal in terms of temperature, with high rainfall between August and October; and 2021 was normal in terms of temperature, with moderate precipitation. Climate indicators and wine production quality indicate that the Blaj-Cenade wine-growing centre is suitable for growing white varieties for high-quality wines. The study provides useful data for the sustainable management of vineyards in the context of climate change.

INTRODUCTION

Regions, vineyards, and wine-growing centres are characterised by their specific natural environments —climate and soil properties —and by the human factor, which determines the use of grape varieties and wine-growing practices. Oprea (1995) emphasises that climatic factors are the main factors that define the specific conditions for each wine-growing area, and Giugea (2001) considers that climatic factors are the first to impose restrictions on the economic cultivation of vines. Various meteorological variables, such as solar radiation, temperature, and precipitation, influence the development of vines, the ripening of grapes (van Leeuwen et al., 2004), and the quantity and quality of wine production (Sun et al., 2023; Căpruciu &Gheorghiu, 2025). The effects of changing climatic conditions on vines are often evident in phenology, the length of the growing season, and metabolism, determining the quality and quantity of production (Costea et al., 2023).

The use of vines as an effective indicator of climate change is justified by the crop's high sensitivity to climatic variations, which could have serious consequences and cause significant economic damage to the wine sector (Ollat et al., 2017). In Romania, viticultural climatology studies have highlighted trends in the evolution of certain climatic factors. For example, in the Dăbuleni wine-growing center, the average annual temperature has been on an upward trend over the last 12 years (Mărăcineanu et al., 2025). In addition, higher winter temperatures have steadily reduced the annual temperature range, and rainfall during the vine-growing period is in decline. The current climate, dominated by rising temperatures, directly

affects the production of table grapes (Cichi et al., 2023) and wine, the biochemical composition of grapes, and the organoleptic characteristics of wine (Koufos et al., 2020). As a result, studies aimed at assessing the productive potential of vines in the current climate are functional to winegrowers for the sustainable management of their plantations.

MATERIAL AND METHODS

The study was conducted in Podgoria Târnavelor, the wine-growing center of Blaj, in an unirrigated plantation in the village of Cenade. The research was conducted between 2019 and 2021 and consisted of assessing the climatic conditions and production elements for four varieties of white and aromatic wines: Italian Riesling, Fetească Regală, Muscat-Ottonel, and Sauvignon. The meteorological data were provided, upon request, by local weather stations and were processed and interpreted in accordance with the specialized literature (Mărăcineanu, 2011; Patriche, 2009). To determine the quality elements of production, samples were collected from three plots for each variety, each with an area of 93 m^2. The grape samples were processed and analyzed by FTIR using a multiparameter analyzer for wine and must, FOSS Winescan. Grape production, a quantitative indicator, was determined at harvest.

RESULTS AND DISCUSSIONS

The viticultural climate parameters for the three years of the study, based on which the viticultural climate in the Blaj-Cenade centre is characterised, are presented in Table 1. From a thermal perspective, 2019 was a warm year, with a deviation of 2.0 °C from normal. In terms of rainfall, it can be considered deficient, with prolonged drought setting in from July onwards. The year 2020 was closer to normal for the period in terms of temperature, but rainfall was higher, especially during August-October. The last year of the period was typical in terms of temperature, with no excess rain during the growing season.

Table 1

Climatic characteristics of the study period

Parameter	Year			Average
	2019	2020	2021	
Annual precipitation (l/m^2)	431.6	641.2	675.4	582.7
Precipitation during the growing season (l/m^2)	275.8	435.0	379.2	363.3
Actual insolation during the growing season (hours)	1172.1	1164.5	1498.2	1278.3
Average annual temperature (°C)	11.8	10.9	10.2	11
Average temperature in July (°C)	20.3	20.1	22	21
Overall heat balance (°C)	3204.7	2726.4	3112.4	3014.5
Active heat balance (°C)	3156.7	2716.3	3091.3	2988.1
Useful heat balance (°C)	1406.7	1266.3	1462.1	1378.4
Hydrothermal coefficient	0.9	1.6	1.2	1.2
Heliothermal index	1.6	1.5	2.2	1.8
Oenoclimatic suitability index	4303.0	3695.8	4460.3	4153
Dantin-Revenga Index	2.7	1.7	1.5	2

According to the above, the wine-growing climate in the Blaj-Cenade area is favourable for the cultivation of varieties for white, aromatic, sparkling wines, and wine distillates. The temperatures and rainfall during the growing season are favourable for carbohydrate accumulation, allowing the wines to be classified in all quality categories, including those with Controlled Designation of Origin.

Overall, in the three years of the study, the average Dantin-Revenga index indicates a humid climate. The climate chart for the period 2019-2021 (Figure 1) also shows the same thing, with the possibility of a slight excess of heat at the beginning of the growing season. For example, April 2020 was extremely dry, with a negative monthly deviation of 79.6 % from the normal for the period.

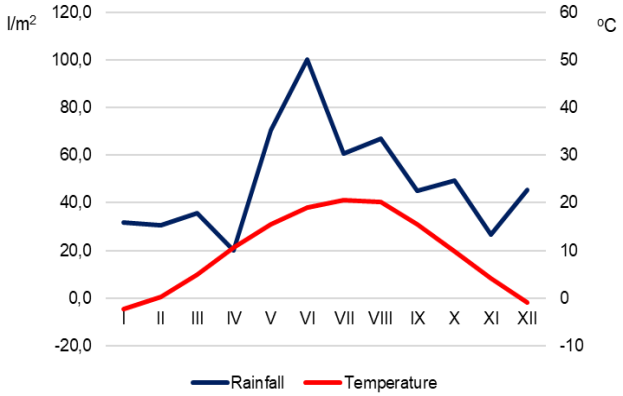

Figure 1. Cenade climate chart

In terms of grape production quantity, the average for the period exceeds 10,000 kg/ha for all the varieties studied. This value is important in light of the provisions in the Specifications for the production and marketing of wine with the controlled designation of origin "Târnave". Among the rules is one that limits wine production to a maximum of 14,000 kg/ha for the Italian Riesling and Fetească Regală varieties, and 12,000 kg/ha for the Muscat-Ottonel and Sauvignon varieties (Figure 2).

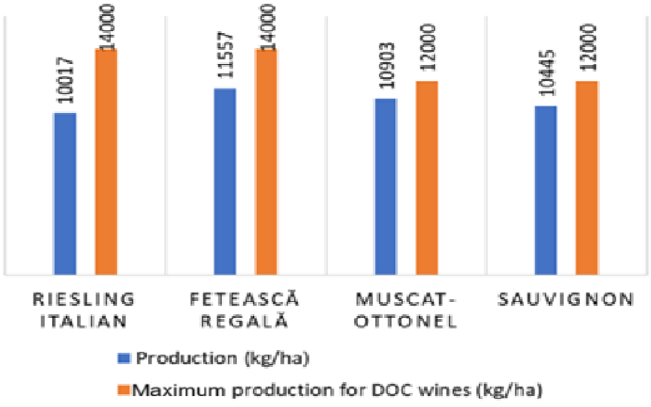

Figure 2. Grape production levels (2019-2021) reported in the specifications for the production and marketing of DOC "Târnave" wine

In terms of quality, grape production must have a minimum carbohydrate content of 155 g/l at harvest. In general, this content is achieved across all varieties and harvest years (Figure 3). Further details on the quality level of grapes at harvest are presented in Table 2.

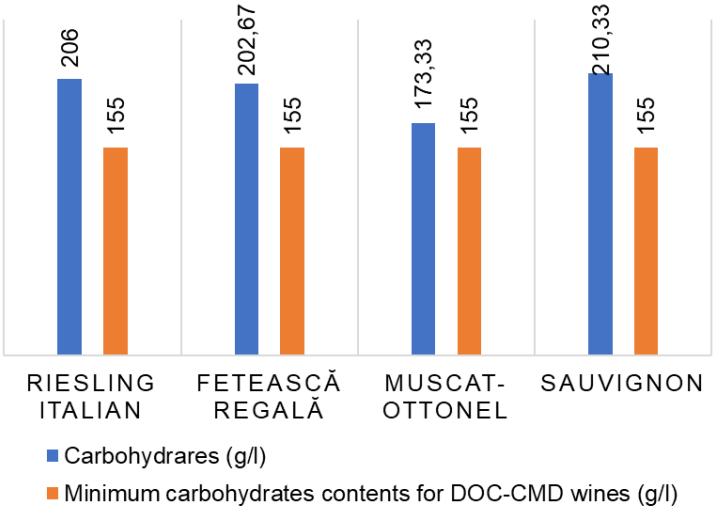

Figure 3. Carbohydrate content at harvest (2019-2021), reported in relation to the conditions in the Specifications for the production and marketing of DOC "Târnave" wine

Table 2

Quality parameters of grapes at harvest in the Blaj-Cenade wine-growing centre

Variety	Year	Parameter		
		Total acidity (g/l tartaric acid)	Weight of 100 berries (g)	Carbohydrates (g/l)
Italian Riesling	2019	5.70	140	204
	2020	5.77	143	203
	2021	5.96	158	211
	Average	5.81	147	206
Royal Fetească	2019	6.88	166	208
	2020	6.68	170	202
	2021	6.79	176	198
	Average	6.78	170.67	202.67
Muscat-Ottonel	2019	5.86	124	188
	2020	5.80	134	145
	2021	6.12	142	187
	Average	5.93	133.33	173.33
Sauvignon	2019	6.00	150	209
	2020	5.99	154	210
	2021	6.00	162	212
	Average	6.00	155.33	210.33

The Sauvignon variety has the highest carbohydrate content, both as an average and an annual level. At the opposite end of the spectrum is the Muscat-Ottonel variety, which, in the 2020 wine year, accumulated only 145 g/l of carbohydrates. This was also the year with the highest rainfall during the growing season. The acidity level ranged from 5.81 g/l tartaric acid in the Italian Riesling variety to 6.79 g/l tartaric acid in the Fetească regală variety.

In terms of the variability of the physical and chemical parameters of the grapes at harvest in the Blaj-Cenade wine-growing center, Table 3 shows a greater variation in the weight of 100 berries compared to the accumulated acidity and carbohydrates. However, we can also appreciate that, in this case, the sample is relatively uniform, with low variability in both acidity and carbohydrates, and in the weight of 100 berries.

Table 3

Statistical indicators of the grape sample at harvest

Indicator	Coefficient of variation (%)	Sample of sample	Standard deviation	Absolute amplitude	Relative amplitude (%)
Acidity (g/l tartaric acid)	6.74	6.13	0.41	1.18	19.28
Carbohydrates (g/l)	9.43	198.08	18.68	67.0	33.82
Weight of 100 beans (g)	10.28	151.58	15.58	52	34.30

CONCLUSIONS

Annual rainfall met the vines' water requirements but was unevenly distributed, sometimes exceeding the vines' needs.

The low temperatures in September protected the sensitive acids and aromas accumulated in the grapes.

The climatic conditions during the three years of the study were favourable only for white wine varieties of all quality categories.

REFERENCES

Căpruciu R,. Gheorghiu C.N. 2025, Methods for Synthesis and Extraction of Resveratrol from Grapevine: Challenges and Advances in Compound Identification and Analysis. Foods. 202, 14(7):1091.

Cichi D.D., Căpruciu R., Gheorghiu N., Stoica F., 2023, Agrobiological and technological characteristics of table grape varieties grown in the temperate-continental climate of southwestern Romania. Scientific Papers. Series B. Horticulture, 67(1).

Costea D.C., Căpruciu R., Cichi D.D., Băducă-Cîmpeanu C., 2023, Research concerning the reaction of vines to variable climatic conditions. Scientific Papers. Series B, Horticulture. Vol. LXVII, No. 2, 224-229.

Giugea, N., 2001, Research on how certain biopedoclimatic factors influence the chemical composition of grapes. Craiova, Doctoral thesis. University of Craiova.

Koufos G. C., Mavromatis T., Koundouras S., Jones, G. V., 2020, Adaptive capacity of winegrape varieties cultivated in Greece to climate change: Current trends and future projections. OENO ONE, 54, 1201–1219.

van Leeuwen C., Friant P., Choné X., Tregoat O., Koundouras S., Dubourdieu, D., 2004, Influence of Climate, Soil, and Cultivar on Terroir. Am. J. Enol. Vitic., 55, 207–217.

Mărăcineanu L.C., 2011, Applications of ecology in viticulture. Ed. Universitaria Craiova.

Mărăcineanu L.C., Băjenaru M., Diaconu A., Giugea N., Căpruciu R., 2024, Climate trends in Oltenia. Case study: Dăbuleni wine center. Scientific Papers. Series B, Horticulture. Vol. LXVIV, No. 1, 820-828.

Ollat N., van Leeuwen C., de Cortazar-Atauri I.G., Touzard J.M., 2017, The challenging issue of climate change for sustainable grape and wine production. OENO One, 51, 58–60.

Oprea S., 1995, Grapevine cultivation. Dacia Publishing House, Cluj-Napoca.

Patriche C.V., 2009, Statistical methods applied in climatology. Terra Nostra Publishing House, Iași.

Sun Q., Granco G., Groves L., Voong J., van Zyl S., 2023, Viticultural Manipulation and New Technologies to Address Environmental Challenges Caused by Climate Change. Climate, 11, 83.

*** Specifications for the production and marketing of wine with the controlled designation of origin "Târnave".