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QUALITY CHARACTERISTICS OF THE WHITE WINE GRAPE VARIETY DIMYAT UNDER CONTINENTAL CLIMATE CONDITIONS

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Abstract. *The Dimyat (V. vinifera L.) variety is one of the oldest and most widespread white wine grape varieties in Bulgaria, with deep historical and cultural roots in traditional viticulture. The aim of this study is to assess the technological potential and quality indicators of the grapes and wines produced during the 2023 and 2024 harvests. The proportion of normally developed berries in the bunches is 95.20% and the theoretical yield reaches 85.32%. The average bunch dimensions are 17.82 × 12.25 cm, and the dimensions of the berries are 18.05 × 16.10 mm. Chemical composition of the grape juice is characterized by a lower sugar content of about 20.35% and a higher titratable acidity (6.67 g/l), representing a well-balanced technological grape ripeness. The main physicochemical indicators of the wines produced from two harvests analyze the correlation with the degree of grape ripeness. Differences in the alcohol content were observed, ranging from 12.21% in 2023 to 11.44% in 2024. The content of total phenolic compounds was higher in the first year (231.68 mg/l) compared to 177.80 mg/l in the second year and pH values of 3.14 remain relatively stable. The Dimyat variety has good technological potential for producing quality white wines, as variations in climatic conditions in different years have a significant impact on the raw material and final product. Results can be used to optimize technological practices in grape processing and to improve the quality and stability of wines.*

Keywords*: alcohol, color intensity, Dimyat, mechanical composition of the bunch and berry, physicochemical analysis of wine, sugars, titratable acidity, total phenols, white wine*

INTRODUCTION

Climatic conditions are a key factor influencing grape quality. Year-to-year variations in temperature and precipitation lead to differences in sugar content, acidity and phenolic composition within a single variety. Consequently, the assessment of technological potential should be conducted within a specific agro-ecological region and across multiple vintages (COSTA et al., 2020). Continental climates are characterized by significant annual and seasonal temperature fluctuations and distinct differences between winter and summer periods. This creates specific conditions where low winter temperatures can pose a risk to the perennial parts of the vines, while high summer temperatures can accelerate grape development and ripening (HALL et al., 2016; MIRA DE ORDUÑA, 2010). Varietal diversity represents one possible mechanism for adapting to climate change (MORALES-CASTILLA et al., 2020). Warmer autumns can accelerate ripening, whereas cooler conditions could extend the period of sugar accumulation. Therefore, the same variety may reach technological ripeness at different times in different years, depending on the accumulated temperature and conditions during the ripening period (MIRA DE ORDUÑA, 2010; COLA et al., 2017). This is particularly important for late-ripening varieties, such as Dimyat.

The mechanical composition of the bunch and berry involves the quantitative ratio between stems, berries, skins, seeds, mesocarp and is linked to must yield and the potential for extracting various chemical substances during processing. The relative proportions of skins and seeds are of particular importance, as they are significant sources of phenolic compounds (FERNÁNDEZ DE SIMÓN et al., 1993; YONCHEVA et al., 2023). Sugar accumulation is a key indicator of grape ripeness (LU et al., 2024), while grape quality is a complex concept

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encompassing physical, chemical and biochemical characteristics that determine suitability for producing specific wine types (PONI et al., 2018). In white wine production, higher sugar content at harvest can lead to higher potential alcohol levels, whereas excessive sugar accumulation combined with insufficient acidity can disrupt the wine's balance (JORDÃO et al., 2015; MIRA DE ORDUÑA, 2010). Cooler, wetter seasons may be associated with higher total acidity and lower pH compared to warm, dry years (DUCHÊNE et al., 2018). The amount and timing of precipitation can also influence grape quality, rainfall during the ripening period can alter the vine's water status and lead to the dilution of certain grape juice components. At the same time, humid conditions can increase the risk of fungal diseases, further affecting grape quality (COSTA et al., 2020).

Changes in sugars, organic acids, phenolic compounds and aroma components subsequently affect the alcohol content, acidity balance, aroma, color and flavor characteristics of the wines (MIRA DE ORDUÑA, 2010). In warmer years, higher sugar concentrations can lead to higher alcohol content. A simultaneous reduction in acidity can result in diminished freshness and an altered flavor balance. This is particularly significant for white wines, where acidity is a key component determining the perception of freshness and structure (JORDÃO et al., 2015). Climate change imposes new demands regarding the choice of grape varieties and viticultural practices. Rising temperatures, altered precipitation patterns and an increased frequency of extreme weather events lead to earlier ripening, higher sugar content, lower acidity, and changes in the phenolic and aromatic grape profiles (VAN LEEUWEN et al., 2024).

This study aims to investigate the quality parameters of grapes and wine from Dimyat variety under continental climate conditions characterized by sharp temperature fluctuations.

MATERIAL AND METHODS

The study utilized Dimyat variety, planted in 2005 at the Eastern Thracian Lowland region of the Republic of Bulgaria. The vineyard is in full bearing, the planting distance is 3.20 m between rows and 1.00 m between vines within the row (3,125 vines per ha). The vines are trained using a high-stem and bilateral cordon system. The bud load for all variants was established through spur pruning with two buds, resulting in a total of 6 spurs (12 buds) per vine. The inter-row spaces are cultivated mechanically and the vineyard is cultivated under non-irrigated conditions.

Dimyat is a mid to late-ripening variety, with a period of approximately from 180 to 200 days from budburst to technological ripeness. The variety is sensitive to low winter temperatures; consequently, its cultivation is feasible only in regions where winter temperatures do not drop below -16°C and the autumn is dry and prolonged. The vines demonstrate excellent recovery capacity following frost damage, though this capacity is poor after drought periods. It is a dual-purpose variety (Figure 1). The berry proportion in the cluster is 97.70%, while the stems (rachis) account for 2.30%. Skins constitute 6.40%, seeds 2.10% and the mesocarp 91.50% of the berry structure. The theoretical must yield is 89.40%. The grapes possess excellent flavor qualities like sweet with pleasant acidity and a subtle vanilla note, making them suitable for both fresh consumption and for production of dry white wines, given a sugar content of 19–21% and titratable acidity of 6–7 g/dm³. The variety holds a significant place among white wine cultivars. It is best suited to regions and micro-regions where there is no risk of frost damage and the grapes can achieve full maturity. It was included in the official variety list of the Republic of Bulgaria in 2010 (ROYCHEV, 2012).

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Figure 1. Dimyat variety bunch

For determination of the parameters characterizing grape quality following analyses were performed:

- Determination of sugar content using an Abbe laboratory refractometer (%);
- Determination of titratable acidity via titration with 0.1 N NaOH (g/dm³);
- Analysis of the mechanical composition for grape bunch and berry.

Sugar and acidity levels were measured to determine the time of technological ripeness, following the methodology described in the Handbook of Winemaking Exercises (BAMBALOV, 2009).

The mechanical composition of the grape bunch and berry was analyzed using the standard methodology described in the Handbook of Ampelography Exercises (ROYCHEV, 2014).

Harvesting took place once the grapes reached technological ripeness. Wines from each vintage were produced using the same technological process for dry white wines like follow: grape reception, sorting, destemming, pressing, must separation, sulfiting/protection against oxidation, clarification, alcoholic fermentation, separation from gross lees, completion of fermentation, stabilization, filtration, bottling and storage. Physicochemical analysis was performed on the finished wines (BAMBALOV, 2009). The following parameters were analyzed: relative density (g/dm³), alcohol (%), sugars (g/dm³), total extract (g/dm³), sugar-free extract (g/dm³), titratable acids (g/dm³), volatile acids (g/dm³), free sulfur dioxide (mg/dm³), total sulfur dioxide (mg/dm³), total phenols (mg/dm³) and color intensity.

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Climatic data for the period were obtained from meteorological station located within the vineyard. The parameters presented include mean monthly air temperature (°C) and precipitation (mm), characterizing the climatic conditions of the study area (Figures 2 and 3).

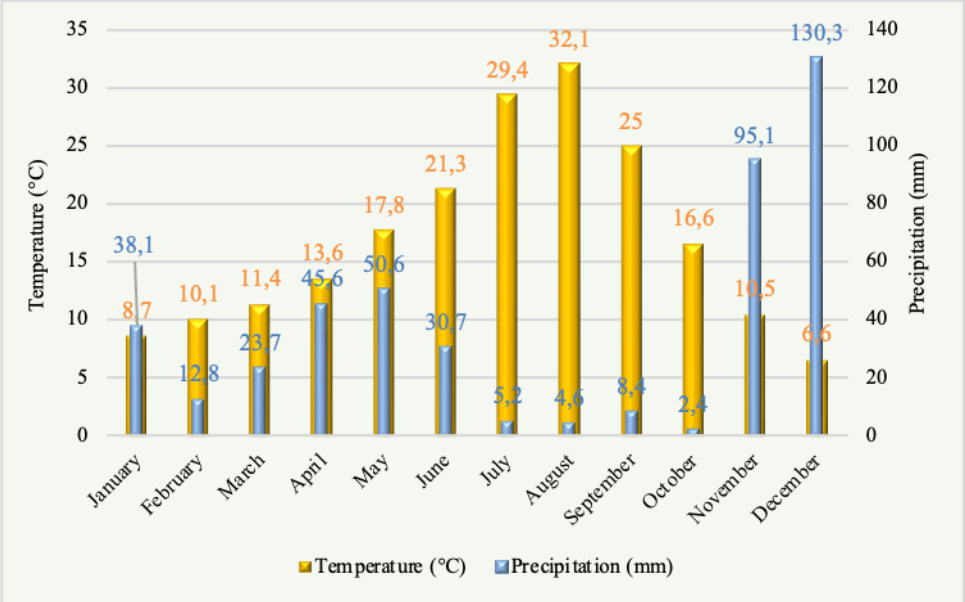


Figure 2. Average temperatures (ºC) and precipitation (mm), 2023

High average annual air temperatures were recorded over the two-year period: 16.9°C in 2023 and 16.3°C in 2024. A significant decrease in total annual precipitation was observed in 2024, compared to the 447.5 mm recorded in 2023, the amount dropped to 282.9 mm which is a reduction of 164.6 mm. Such a trend could limit the natural water supply to the grapevines, particularly during periods of elevated temperatures and intense evaporation. Distinct seasonal variations in temperature patterns and precipitation levels were also observed. In both years, the highest average monthly temperatures were recorded in August, reaching 32.1°C in 2023 and 28.9°C in 2024. The 3.2°C difference indicates that August 2023 was warmer than the same month in 2024. This may be attributed to differences in atmospheric circulation and the duration of high-temperature periods across the two years.

Regarding precipitation patterns, the highest amounts in both years were recorded during November and December. In 2023, precipitation levels reached 95.1 mm in November and 130.3 mm in December, whereas in 2024, the figures were 40.4 mm and 90.8 mm, respectively. A comparison shows that 54.7 mm more precipitation was recorded in November 2023 than in the same month of 2024, while the difference for December was 39.5 mm. Consequently, a higher volume of precipitation was recorded during the last two months of 2023 compared to the same period in 2024.

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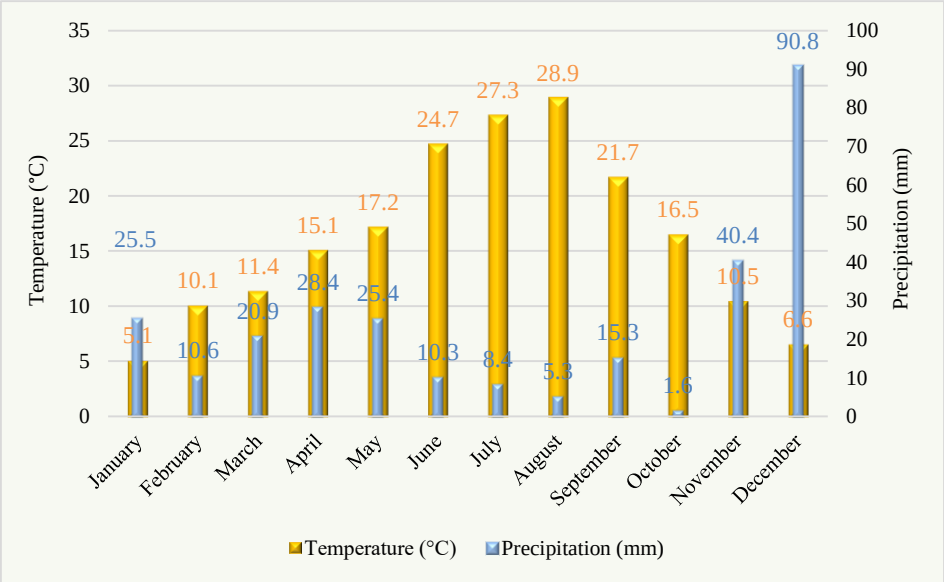


Figure 3. Average temperatures (ºC) and precipitation totals (mm), 2024

RESULTS AND DISCUSSIONS

The study was conducted in a region where climatic conditions are a significant factor influencing growth, development and formation of the grapevine's productive and morphological characteristics.

Mechanical analysis reveals that in 2023, normally developed berries accounted for 96.10% of the bunch, whereas in 2024 this figure dropped to 94.30%. Concurrently, the proportion of rachises increased from 3.90% (2023) to 5.70% (2024). This shift indicates a trend toward a lower proportion of normally developed berries within the bunch structure in 2024, a year marked by significantly lower annual precipitation.

The percentage of milleranded (shot berries) and shriveled berries remained low in both years. The theoretical yield dropped from 86.63% in 2023 to 84.02% in 2024, a decline associated with the smaller bunch dimensions observed in the second year (16.90 cm/11.90 cm). Regarding the structural composition of the berry in 2024, an increase was observed in the relative share of skins from 7.50% (2023) to 8.15% (2024) and seeds from 2.35% (2023) to 2.75% (2024) while the share of mesocarp decreased from 90.15% (2023) to 89.10% (2024).

This shift is significant from a technological standpoint, as the ratio of the berry's structural components influences grape juice yield and potential wine characteristics. In terms of berry size, a decrease in length and width was recorded in 2024 (17.90 mm/15.90 mm). These results indicate a trend toward smaller average bunch and berry sizes during the second study year.

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Table 1

Bunch structure and construction, 2023-2024

Period (Year)	Normal berries,%	Skins, %	Milleranded berries, %	Dry berries,%	Theoretical mass,%	Average bunch size, cm	
						Length	Width
2023	96,10a	3,90a	0,09a	0,67a	86,63a	18,75b	12,60a
2024	94,30a	5,70b	0,14b	0,89b	84,02a	16,90a	11,90a
Average	95,20	4,80	0,11	0,78	85,32	17,82	12,25

** Mean values denoted by different letters differ statistically significantly at p < 0.05 (one-way ANOVA)*

The chemical composition of the must is characterized by similar sugar content values, ranging from 20.50% (2023) to 20.20% (2024). At the same time, titratable acidity increased from 6.54 g/l (2023) to 6.80 g/l (2024). In 2024, a slight decrease in sugar levels was observed alongside higher acidity in the grape juice. This combination is significant when assessing the technological ripeness of the grapes, a factor directly influenced by temperature conditions and annual precipitation during the ripening process.

Table 2

Berry structure and construction, 2023-2024

Period (Year)	Skins, %	Seeds, %	Mesocarp, %	Average berry size, mm		Chemical composition of grape juice (must)	
				Length	Width	Sugars, %	Titratable acids, g/l
2023	7,50a	2,35a	90,15a	18,20a	16,30a	20,50a	6,54a
2024	8,15a	2,75a	89,10a	17,90a	15,90a	20,20a	6,80a
Average	7,82	2,55	89,62	18,05	16,10	20,35	6,67

** Mean values denoted by different letters differ statistically significantly at p < 0.05 (one-way ANOVA)*

Physicochemical analysis of the wines shows that for the 2024 vintage, the alcohol content decreased from 12.21% to 11.43%, while total extract increased from 17.20 to 19.60 g/dm³ and sugar-free extract rose from 15.92 to 17.96 g/dm³. Differences were observed in the extract composition of the wines from the two vintages, the decrease in alcohol content followed the same trend as the change in must sugar levels, although the relatively small difference in sugar content does not fully account for the change in alcohol levels.

The acidity profile of the wines remained relatively stable. The pH value changed insignificantly from 3.13 to 3.14, while titratable acidity increased from 6.29 to 6.53 g/dm³. Volatile acidity also showed a moderate increase, rising from 0.71 to 0.83 g/dm³. Levels of free and total sulfur dioxide were higher in 2024 from 29.80 to 130.10 mg/dm³, respectively compared to 26.70 and 123.30 mg/dm³ in 2023.

Table 3

Physicochemical analysis of the wine, 2023–2024

Vintage/ Year / Indicators	2023	2024
Relative density	0,9983	0,9941
Alcohol, %	12,21	11,43
Sugars, g/dm^3	1,28	1,84
Total extract, g/dm^3	17,20	19,60
Sugar-free extract, g/dm^3	15,92	17,96
Ph	3,13	3,14
Titratable acids, g/dm^3	6,29	6,53
Volatile acids, g/dm^3	0,71	0,83
Free sulfur dioxid, mg/dm^3	26,70	29,80
Total sulfur dioxid, mg/dm^3	123,30	130,10
Total phenols, mg/dm^3	231,68	177,80
Color intensity	1,144	1,030

The total phenol content decreases from 231.68 to 177.80 mg/dm³ and color intensity drops from 1.144 to 1.030. This indicates differences in the phenolic and color profiles of the wines from two vintages. These parameters cannot be explained solely by the structural characteristics of the grapes, as they are also influenced by the processing method, contact with solid grape parts, oxidative processes and the technological practices employed.

CONCLUSIONS

Drought conditions are associated with trends toward reduced bunch and berry sizes, a decrease in theoretical yield and changes in the relative proportions of the cluster's structural components. An increase in the relative proportion of skins and seeds, combined with a decrease in the mesocarp fraction indicates a shift in the berry's structural composition which is significant for assessing its technological characteristics.

Must sugar content remained similar across both years, whereas titratable acidity increased in 2024. Differences in climatic conditions did not manifest uniformly regarding sugar accumulation and formation of the grape's acid composition.

Wines from 2024 vintage exhibited lower alcohol content and higher extract levels, suggesting differences in grape chemical composition and/or the fermentation process.

The relative stability of pH, combined with increased titratable acidity indicates that active acidity and total titratable acidity evolved differently between the two vintages. The reduction in total phenolics and color intensity in 2024 points to differences in the wines phenolic profiles, which may be attributed to both grape composition and processing or vinification conditions.

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