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VITICULTURAL TECHNOLOGICAL LINKS TO MAXIMIZE THE COLOR POTENTIAL OF QUALITY RED WINES AT SCDVV BUJORU

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ABSTRACT

Climatic conditions of the study years reveal a dry climate, both atmospheric and pedological through the large number of days with maximum temperatures > 30°C, of 69 days in 2020 and 37 days in 2021, compared to the multi-year average of 40 ,7 days, maintaining the same trend. These conditions left their mark on the phenolic and technological ripening of black grapes as raw material for winemaking. The red wines were made by applying a technological scheme, previously verified, and the resulting wines present a potential of intense color and aromas, realized through coloring intensity, high anthocyanins and polyphenols. Maturation of red wines in barriques insignificantly decreases the coloration, and the coloring intensity decreases by only 4-11%. This technology has proven to be reliable for obtaining quality red wines.

INTRODUCTION

Today, wine occupies an important place in the national economy. Romania is one of the largest wine producers in the world occupiing sixth place among European countries - in 2021 it produced around 530 million liters (OIV, 2021). Tannins are very complex compounds with a high molecular weight. Condensed tannins are derived compounds from grapes having great importance for the quality of red wine due to their astringency and bitter properties (Peleg et al., 1998) and their role in long-term color stability (Somers, 1971).). Phenols are the main volatile compounds responsible for all the differences between red and white wines, especially for the color and aroma of red wines. They are the most abundant constituents present in grapes, after sugars and acids. Among the phenolic compounds, anthocyanins and tannins are of particular importance for red wine (Harbertson et al., 2003;). Studies related to the concentration of polyphenols in grape beans depends on the grape variety and is influenced by viticulture and environmental factors (Downey et al., 2006). Moreover, this country has an impressive viticultural landscape created by the eight viticultural regions, being areas of high extension, especially in hilly areas, on sands, as well as in other areas with favorable conditions (Soare et al., 2010).

Anthocyanins are the pigments responsible for the color of red wine, being located mainly in the epicarp of the grape seeds. The content of anthocyanin

compounds in red grapes can vary considerably depending on the variety, agronomic practices and microclimate of the plantation (Chorti et al., 2010).

MATERIAL AND METHODS

The biological material used consisted of four varieties of vines for red wines of established quality, as follows: Fetească neagra, Merlot, Burgund mare and Cabernet Sauvignon

Apart from the classic technological links of grapevine culture, we intervened with the regulation of the fruit load at 28 points per vine, the evolution of the ripening of the grapes was monitored and the time of harvesting was established which coincided with the phenolic maturity, at a concentration in sugars of approx. . 240-250g/Kg.

The technological scheme was created and implemented with new products, specific to red wines and 4 technological sheets for the elaboration of quality red wines, obtaining 4 red wines from the varieties proposed in the project; In processing and maceration-fermentation, we intervened with adjuvants (addition of specific selected yeasts, pectolytic enzymes, maceration-fermentation temperature (17-21°C), addition of malolactic bacteria) to maximize the extraction of color from the epicarp of the grape berries in order to obtain intensely colored wines. The main physico-chemical components that define red wines were analyzed.

The evaluation of the physico-chemical stability compounds in red wines was done in stages during the preparation of the raw wine and at the end of the barrel aging period.

RESULTS AND DISCUSSIONS

The ripening process of the grapes in Bujoru viticultural center was carried out in climatic conditions specific to the area, which is rated as very dry, with little rain during the growing season and a large number of days with maximum temperatures above 30°C, a fact that inhibits physiological processes of biosynthesis and speed up the ripening of the grapes. (*Table 1).*

Analyzing thermal indicators, the global thermal balance, (Σt°g). Active heat balance, (Σt°g) Useful heat balance, (Σt°g) compared to the multi-year average, these parameters from the years 2020/2021 are at a lower level. Σ hours of insolation per vegetation period, an indicator that favors the accumulation of grapes, was at a higher level than the multi-annual average, but Σ precipitation during the vegetation period, in the two years under study, it was at a level lower than the multiannual level, being considered dry years.

Monitoring grape varieties for red wines in Bujoru wine-growing center.

To establish the grape varieties for red wines by monitoring the black varieties from the Bujoru wine growing center, as follows: Feteasca neagra, Merlot, Burgund mare, Cabernet Sauvignon and three parameters were determined that define the evolution of grape ripening in order to establish full maturity in correlation with climatic factors and their implications on vegetative phenophases. The technological maturity in terms of the phenolic maturity of the grapes in the climatic conditions of 2020/2021 was achieved at a sugar concentration of over 243 g/Kg of grapes.

Table 1

Synthesis of the main climatic elements of the years 2020 – 2021 compared to multi-year averages

Climatic elements analyzed	Multiannual average	2020	2021
Global heat balance, (Σt°g)	3627	3454	3195
Activ heat balance, Σt°a)	3565	3337	2944
Useful heat balance, (Σt°u)	1798	1667	1426
Σ precipitations during the vegetation period, mm	292,9	289,4	276,6
Σ hours of insolation per vegetation period, hours	1328,8	1652,4	1542,3
Average maximum temperatures in August,°C	29,5	31,0	29,1
Number of days with maximum temperatures > 30°C	40,7	69	37
Duration of the bioactive period, no. days	181,9	180	184
Real heliothermic index (Ihr)	2,3	2,75	2,20
Hydrothermal coefficient (CH)	0,9	0,84	0,94
Bioclimatic index of grapevine (Ibcv)	9,7	10,6	8,92
Oenoclimatic suitability index (IAOe)	4705,3	4950	4460

The optimal time to harvest the grapes at technological-phenolic maturity, which is essential in obtaining a quality raw material, has been established, approximately 1-2 weeks after reaching full maturity in order to guarantee the quality of the raw material used in processing and the maximum accumulation of grape color. The experimentation was carried out in a modernized technological laboratory through a project with European funds for research, the POSCCE PROGRAM, O 2.2.1 /2012-2015, which offered modernized equipment and facilities which made possible the implementation of the proposed technologies to have the results expected, as shown in figures 1-4:

Fig. 1 Destemmer

Fig. 2 Maceration-fermentation

Fig. 3 Wine maturation in barrels

Fig. 4 Bottling line battery

Identifying the techniques for maximizing the polyphenolic potential of black grapes and the implementation of modernized technologies in the elaboration of quality red wines.

Technological sheets creation quality red wines elaboration. Several technological variants were developed and implemented, among them the technological sheet applied in 2020-2021 was highlighted (according to table 2).

A series of determinations has been involved in this activity during the process of making red wines by monitoring the maceration-fermentation process, determining daily the metabolism rate of sugars by densimetry coupled with temperature required for this process, in order to establish the optimal moment of pressing and separation solid/liquid phases (raw wine).

Table 2

Technological sheet 2020 -2021 Merlot variety

Harvest date/ fermentation	**Quantity**		**Sugar Con.**	**Total Acidity Tartric Acid /pH**	**Alcoolic Ferm. Nutri.**	**Grape Juice Sulfitation dose mg/Kg**	**Enzyme Inocul. dose g/hl**	**Ferment. Yeasts 20g/hl**	**Fermentation Temperature-time**	
	Gross	**Net**							**Tem**	**Dens.**
07.10	500	400								
08.10 Vinified			256	6,06/3,64		SO2 18% 50 mg/L	Zymorouge super EG 3g/L	Zymoflore FX 10-30 g	16	1.106
09.10									17	1.105
10.10									18	1.103
11.10									20	1.098
18.10.			hydraulically pressed + malolactic fermentation test;							**……..**
29.10	Inoculation of malolactic bacteria – Viniflora CH 16, 2 500 lt envelopes									1.010
				Sulfitation to 100mg SO_2 total wine						

The same technological scheme was used for all varieties, the grapes were harvested at approximately 240-250 g/L sugars.

Analyzing the analytical tables (3,4) in the two phases, - raw wine and matured by barricading, from the production of the years 2018; 2021, the following was found:

Table 3

Barreled wine evolution 2020 harvest

Nr. crt.	Variety	Alcohol % vol.	pH	Int. col. (1 cm)	Antocyanins mg/L	Total Polyphenols g/L
1	Fetească neagră	16.7	3.31/3,37 +2%	9.9/8,8 -11%	850/720 -15%	3.2/2,5 -22%
2	Merlot	15.4	3.31/3,31 +0%	9.8/8,8 -10%	498/415 -17%	3.3/2,7 -18%
3	Burgund mare	14.3	3.06/3,23 +6%	9.4/8,5 -10%	690/636 -8%	2.7/2,3 -15%
4	Cabernet Sauvignon	15,0	3.32/3,43 +3%	9.7/8,9 -8%	785/658 -16%	3.3/3,0 -9%

Table 4

Barreled wine evolution 2021 harvest

Nr. crt.	Variety	Alcohol % vol.	pH	Int. col. (1 cm)	Antocyanins mg/L	Total Polyphenols g/L
1	Fetească neagră	15,9	3.56/3,60 +1%	8,9/8,4 -6%	664/510 -23%	2,3/2,1 -9%
2	Merlot	15.5	3.56/3,59 +1%	8,3/8,0 -4%	550/460 -16%	2,3/2,2 -4%
3	Burgund mare	15,6	3.61/3,65 +1%	8,4/8,1 -4%	659/505 -23%	2.4/2,2 -8%
4	Cabernet Sauvignon	15,7	3.42/3,44 +1%	9.5/9,0 -5%	780/630 -19%	3.0/2,6 -13%

The physical-chemical and organoleptic analysis of raw wine refers to the main components of red wines (alcohol, pH, color intensity, anthocyanins, polyphenols).

The wines produced in 2020-2021 have a high alcoholic strength, containing 16.7-15.9% alcohol by volume for the Feteasca neagra variety; 14.4-15.5% vol.alcohol for the Merlot variety; 14.3-15.6% vol. alcohol in the Burgund mare variety and 15.0-15.7% vol. alcohol in the case of the Cabernet Sauvignon variety, which is where the difference of grapes sugar accumulation at harvest can be seen.

The pH of the wines shows a slight increase in the evolution as a result of acidity decrease in wine. The coloring intensity of red wines presented in the evolution from raw wine to barrel-aged wine shows an insignificant decrease in both years under study. A more pronounced decrease is presented by the wines obtained in 2020, being 8% for the Cabernet Sauvignon variety and 11% for the Feteasca neagra variety. The wines obtained in 2021 present a relatively lower intensity, but the percentage decrease of this parameter is smaller during the evolution of the raw wine to the barrel one, being between 4-6%.

The anthocyanin compounds present a more accentuated decrease, which in the course of the wine evolution is presented as follows for each variety in the years reported in 2020/2021: in Fetească neagra variety, the anthocyanin

compounds show a decrease between 15/23%; in Merlot variety, the anthocyanin compounds show a decrease between 16/17%; in Burgund mare variety, the anthocyanin compounds show a decrease between 8/23%; in Cabernet Sauvignon variety, the anthocyanin compounds show a decrease between 16/19. The decrease of these compounds is explained by their polycondensation in macromolecules that are deposited by gravity. The content of the wine in total polyphenols shows an insignificant decrease, being between 8-22%, as a result of their deposition in macromolecular complexes.

CONCLUSIONS

In addition to the global cultural techniques in the studied climate context and its implications in the ripening of grapes, the load of eyes per vine was 28.

Technological links for maximizing the extraction potential of color compounds or focused on the addition of specific selected yeasts, pectolytic enzymes, maceration-fermentation temperature of 17-21°C, addition of malolactic bacteria.

Physico-chemical and organoleptic analyses, highlighted the quality of red wines obtained by applying these technological links as well as the great potential of the wine-growing areas in this region.

The technological process implemented and tested, as well as the regulation of the fruit load at 28 points per stem, gave the best results regarding the potentiation of the color compounds of quality red wines.

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