Scientific Papers. Series B, Horticulture. Vol. LXVI, No. 2, 2022
Print ISSN 2285-5653, CD-ROM ISSN 2285-5661, Online ISSN 2286-1580, ISSN-L 2285-5653

TĂMÂIOASĂ ROMÂNEASCĂ AND BUSUIOACĂ DE BOHOTIN GRAPES - VALUABLE SOURCES FOR WINE PRODUCTION

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Abstract

Varieties of Tămâioasă Românească (TR) and Busuioacă de Bohotin (BB) grapes were harvested in 2022 from Pietroasa Viticulture and Winemaking Research and Development Station that belongs to the University of Agronomic Sciences and Veterinary Medicine of Bucharest (USAMV). These grapes were taken in studies in order to highlight the quality of the grapes of the respective area following the analyzes carried out. These varieties are processed into aromatic wines at the Pietroasa. Sugar determination was performed by HPLC-RID analyzes on the grapes of the two varieties studied. The values of essential analyses such as soluble dry matter content (24,036% for TR grapes and 23,120% for BB grapes) and acidity content (0,477% for TR grapes and 0,537% for BB grape) are appropriate results for next step of wine production. While the glucose content is similar in both varieties of grapes, the fructose content in TR grapes (10.913%) is higher in comparison with the BB grapes (10.57%). The balance between constitutive (grains 96.8% and 98.9%, respectively) and structural (mesocarp 69.7% and 71.5%, respectively) uvological units for both varieties (TR and BB) with maximum economic potential in this area was demonstrated.

***Key words**: grapes, Tămâioasă Românească, Busuioacă de Bohotin*

INTRODUCTION

Grapes (*Vitis vinifera* L.) represent a major fruit crop worldwide. TR and BB grape varieties, which are considered one of the most aromatic wines of the world, are cultivated in Pietroasa vineyard Romania) for obtaining dry or sweet wine. The aromatic puzzle of a wine is particularly influenced by the interaction between grapes and fermentation agents (Romano et al., 2022). Grape varieties can be aromatic and semi-aromatic, TR and BB being aromatic varieties because they have the aromatic substances not only in the epicarp but are also present in the mezocarp. In addition to the high concentrations of terpenoid molecules, these constitute the key substances or signature to recognize the variety (Visan et al., 2018). The taste of wine is given by the *terroir*. The quality of the grapes depends on the soil, the climate, the positioning of the vineyard (Schusterova et al., 2021). Polyphenols act as antioxidants and have a positive role in human health. The phenolic composition of the wine also changes during the aging process of the wine, which is reflected in the color and degree of astringency of the wine, the final product. Phenolic compounds can also be used as markers to discriminate wine origin (Niculescu et al, 2017). Visan et al (2015) determined the aromatic compounds for the TR wines from two Romanian wine-growing areas: Stefanesti-Arges and Pietroasa vineyards.

Also, the wine-growing region influences the organoleptic characteristics of wine and the aromatic content. BB grape variety has been cultivated in Romanian vineyards such as Pietroasa Viticulture and Winemaking Research and Development Station, Dragasani, Murfatlar, Cotnari, Husi (Bohotin centre). BB and TR varieties have both a specific vinification process (Colibaba, 2015). In this paper two variety of grapes - BB and TR - were analized from the following parameters: the content in polyphenol compounds, soluble dry matter content, sugar content as well as the value of the uvological indices.

MATERIALS AND METHODS

-The grapes varieties Tamaioasa Romaneasca (TR) and Busuioaca by Bohotin (BB) (Figure 1) were harvested in 2022 from Pietroasa Viticulture and Winemaking Research and Development Station (Figure 2).

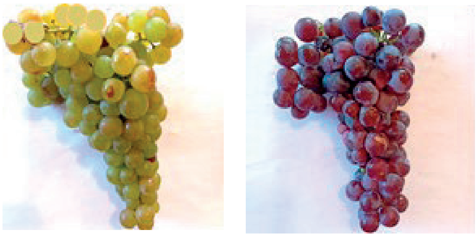

Figure 1. Grape varieties, TR variety on the left and BB variety on the right

Figure 2. Pietroasa vineyard

Physical-mechanical analysis of the TR and BB grape varieties

The technological potential of the studied grape varieties (TR and BB), grown in the Pietroasa vineyard, consisted in the determination of the uvological units (Matei et al., 2022). The percentages of each uvological unit of the grape and the berry and the yield in must and pomace of the grape were determined. With the help of these parameters, the uvological indices were calculated: structure index (SI), which is the ratio between berries (g) and clusters (g); the berry index (BI), which is the ratio between the number of berries and 100 g of grapes; the berry composition index (BCI), which is the ratio between the mesocarp (g) and the epicarp (g); the yield index (YI), which is the ratio between must (g) and grape marc (g).

Chemical analyses of the TR and BB grape varieties

Determination of soluble dry matter content - The dry soluble content (Brix value) was determined by refractometry using an Abbemat 550" refractometer (méthod Brix) and the results were expressed in g/100 g.

The sugar determination

Determination of sugars was performed by a HPLC method with refractive index detection (HPLC-RID), using a Shimadzu HPLC equipment with DGU-405 degassing unit; LC-40D pump; SIL-40autosampler/injector; CTO-40C column oven; RID-20A refractive index detector; Shimadzu LabSolutions software; Phenomenex Luna Omega SUGAR column, 105 x 4.6 m.

The folowing procedure was applied for samples preparation: 5 g of the sample was mixed with hot water in a 250 ml volumetric flask. In the solution cooled and then clarified solutions the Carez I and Carez II solutions were added, and then mixed and brought to boiling. The clarified solution was then filtered through a 0.45 mm filter and used for HPLC injection directly into the HPLC equipment. The elution was performed using acetonitrile/water mixture (80:20) as the mobile phase at a flow rate of 1.5 ml/min at a temperature of 25°C. The refractive index detector was maintained at 40°C, and the injection volume was 25µL.

The following external standards as 2% to 0.005% solutions were used for determinations: arabiosis, fructose, glucose, galactose, lactose, maltose, mannose, ribose, sucrosem xylose. The results were expressed as a percentage by mass/mass (g/100 g) of each sugar.

Acidity determination - Acidity determination was performed by titration with NaOH 0.1N in presence of phenolphthalein as indicator. The acidity value was expressed in NaOH 0.1N/ 100 g and in tartaric acid (g/100 g) respectively using the 0.075 conversion factor.

Total polyphenols determination - To determine the concentrations of total polyphenols, the Folin-Ciocalteu method was used (Stan A. et al., 2020). The method assumes that in an alkaline medium, polyphenols reduce the reagent resulting in a blue color with different intensities depending on the concentration of polyphenols. The analyzes were performed in triplicate, the final result being the average of the repetitions and expressed in mg GAE/100 g fresh sample.

RESULTS AND DISCUSSIONS

Physical-mechanical analysis of the grapes of the TR and BB varieties

The quality of the grapes determines the quality of the wine, in terms of constituents and their chemical composition. The composition and mechanical and chemical properties of grapes are studied by *uvology*, one of the viticultural sciences. The production of grapes (kg/vine or t/ha) is an important indicator for establishing the adaptability of the variety to the pedoclimatic conditions of the vineyard (Table 1). A very high production (12.5±1.4 t/ha) can be observed for the BB variety compared to the average obtained in Pietroasa for this variety (8.4 t/ha), demonstrating a high quantitative potential for this ecosystem (Ion et al., 2018).

The distribution of different chemical compounds in the constitutive parts of the grapes is particularly important, because they show changes during the ripening of the grapes as a result of the influence of external factors that have an effect on the quality of the grapes. Grapes are composed of clusters and berries. In table 2 the average weight of a grape for the varieties studied (TR and BB), as well as the percentage of each individual component (clusters, berries, skins, mesocarp, seeds) are presented.

Table 1. TR and BB production (kg/vine and t/ha)

Vine	Nº grapes		kg		t/ha	
	TR	BB	TR	BB	TR	BB
1	19	15	2.34	3,71	8.88	14.06
2	12	12	1.48	2,97	5.61	11.25
3	15	13	1.85	3,22	7.01	12.18
Media	**15.3±3.5**	**13.3±1.5**	**1.9±0.4**	**3.4±0.4**	**7.2±1.6**	**12.5±1.4**

Table 2. Average weight of a grape and the percentage of each individual component (clusters, berries, skins, mesocarp, seeds) (TR and BB)

Variety	average weight grapes (g)	% clusters	% berries	% mesocarp	% epicarp	% seeds
TB	123.4	3.0	96.8	69.7	25.8	4.5
BB	247.4	1.1	98.9	71.5	27.1	1.4

Regarding the average weight of a grape, it can be seen that BB grapes (247.4 g) are twice as developed as TR grapes (123.4 g), BB exceeding the average value (220 g), instead TR being below the average value from the literature (250 g) (Pomohaci et al., 2000). Regarding the percentage of components, the determined values are similar, except for the bunches (1.1%) and seeds (1.4%) in the BB variety, where the observed percentage values are below the known average value (2.2%, respectively 2.9%). On the other hand, for both varieties, a high value of the epicarp percentage was observed (25.8% for TR, respectively 27.1% for BB). The epicarp is composed of several layers of cells important in the wine-making process (epidermis and hypodermis), and pigments and flavors are accumulated in the hypodermis (Pomohaci et al., 2000).

Establishing the technological skills of the varieties can be done on the basis of uvological indices (Table 3).

Table 3 Values of the uvological indices in the varieties studied (TR and BB)

Variety	SI	BI	BCI	YI
	berries /bunches (g)	number of berries/100 g grapes	mesocarp/epicarp (g)	must/grape marc (g)
TB	29.9	73.7	2.7	3.1
BB	94.2	57.5	2.6	2.6

The structure index (SI) has high values for top quality wines, in the case of the BB variety, the value of this index is 94.2. Regarding the berry index (BI), its value varies between 45 and 100 (Pomihaci et al., 2000), high values suggest technological skills for branded wines, which can be seen in the TR variety (73.7). The berry composition index shows low values in the case of both varieties, which proves that superior quality wines can be obtained (2.7 TR, respectively 2.6 BB). The yield index must be correlated with the must volume and the sugar content. The values obtained (3.1 TR, respectively 2.6 BB) indicate varieties with a high potential for sugar accumulation in the Pietroasa area.

Chemical composition of the TR and BB grapes TR and BB

Acidity

- White grapes TR variety: 6.36 ml NaOH 0.1N/100 ml = 0.477% (as tartric acid)
- Red grapes BB variety: 7.16 ml NaOH 0.1N/100 ml = 0.537%

Dry soluble content (Brix value)

- White grapes TR variety: 24.036%
- Red grapes by BB variety: 23.120%

The sugar spectrum for the studied grape varieties is represented in the figures below (Figures 3 and 4), and the corresponding concentration of sugars in the Table 4.

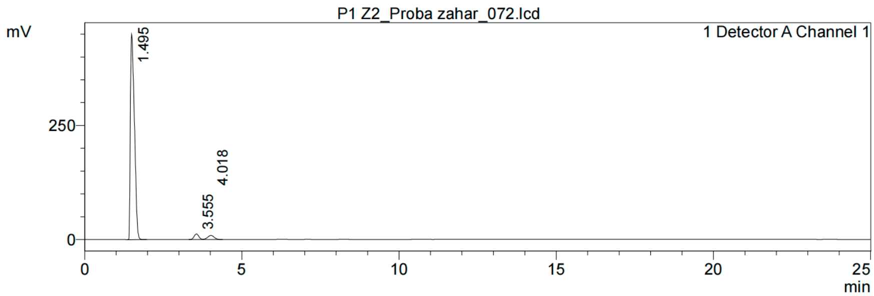

Figure 3. Chromatogram representing the sugar spectrum for the BB grape variety

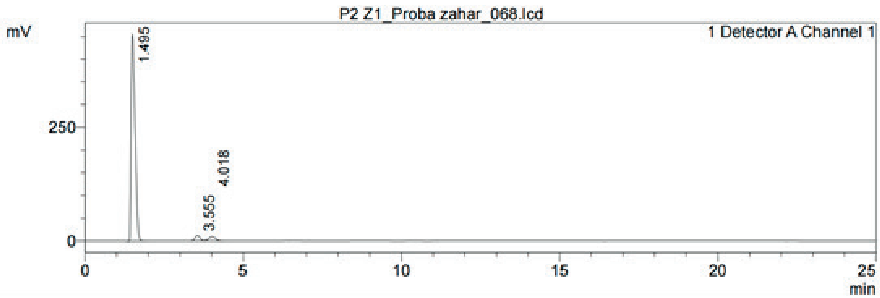

Figure 4. Chromatogram representing the sugar spectrum for the TR grape variety

Table 4. Sugars determination for grapes sample

Samples	Sugar analyzed	Concentration (%)
BB	Glucose	9.872
	Fructose	10.57
	Ribose	0
	Xylose	0
	Arabinose	0
	Manose	0
	Galactose	0
	Sucrose	0
	Maltose	**0**
	Lactose	0
	Glucose+Fructose	**20.442**
TR	Glucose	10.871
	Fructose	10.913
	Ribose	0
	Xylose	0
	Arabinose	0
	Manose	0
	Galactose	0
	Sucrose	0
	Maltose	0
	Lactose	0
	Glucose+Fructose	**21.784**

Busuioacă de Bohotin and Tămâioasă Românească grape varieties was higher in GAE compared to Merlot variety reported by Abe et al. (2007) who found 337 mg GAE 100 g^{-1} and also with Petite Syrah grapes reported by Abe et al. (2006) and (A. Franco-Bañuelos et al. (2017) (388 mg GAE 100 g^{-1}).

Table 5. Content in total polyphenols

Grapes variety	Total polyphenols	
	Average (mg GAE/100 g sample)	STDEV (mg/100 g sample)
BB 2022	453.77	±8.5
TR 2022	423.61	±8.19

CONCLUSIONS

- The technological suitability of the two analyzed grape varieties (TR and BB), in the Pietroasa area, based on the uvological indices analyzed, demonstrates the potential for obtaining wines with controlled designation of origin.
- The balance between constitutive (grains 96.8% and 98.9%, respectively) and structural (mesocarp 69.7% and 71.5%, respectively) uvological units with maximum economic potential in Pietroasa area was demonstrated.
- The sugar content from TR grapes was 21.784 % (10.871 % glucose + 10.913 % fructose) and for BB grapes 20.442 % **(**9.872 % glucose + 10.57 % fructose);
- The concentration for the rest of the sugars analysed was below the limit of quantification;
- Soluble dry matter content from TR grapes was 24,036% and for BB grapes 23,120%;

- The acidity content for BB grape (0,537% as tartric acid) was higher in comparison with TR grapes (0,477% as tartric acid);
- The content of total polyphenols for the BB grape variety was 453.77 ±8.5 (mg GAE/100 g sample), slightly higher than the TR grape variety showing 423.61 ±8.19 (mg GAE/ 100 g sample).
- These grapes varieties were used for the vinification process at Pietroasa winery.

ACKNOWLEDGEMENTS

This work was supported by the project 7PFE/2021 "Circular economy in USAMV farms - whole use of by-products resulting from fermentation processing", Program 1 - Development of the national research-development system, Subprogram 1.2 - Institutional performance - Institutional development projects - Projects to finance excellence in RDI.

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