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VITICULTURE AND WINEMAKING TECHNOLOGY FOR HIGH-QUALITY WINES AT SCDVV BUJORU

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ABSTRACT

This study focuses on technological interventions in order to reduce the sulfites addition in white wine production by using carbonic ice and nitrogen. The proposed winemaking technology include temperature-controlled fermentation of grapes must and further temperature-controlled storage of white wine, compared to classic techniques without temperature control.

The results revealed that by using technological interventions with carbonic ice and nitrogen protection the resulted wines are improved from chemical and sensorial point of view.

INTRODUCTION

Nowadays, the main objective to produce white wines with low SO_2 content is an ongoing concern for oenologists. One approach involves yeast strains for must fermentation that produce minimal SO_2, in accordance with pre-fermentative treatments using lower doses of sulfur dioxide, lysozyme, and enological tannins (Artem et al. 2022). These studies showed that reducing sulfur dioxide, along with lysozyme and enological tannin treatments, can offer a sufficient oxidative protection during alcoholic fermentation, enhancing the organoleptic properties of both white and red wines.

Other studies for SO_2 reduction in wine involves must saturation with CO_2, resulting in fruitier, more aromatic wines without affecting other characteristics. A study of Izquierdo-Cañas et al. (2021) concluded that saturating the white must with CO_2 could be an effective technique to reduce SO_2 during vinification, producing stable white wines over time with distinctive aromatic and sensory profiles.

Ultraviolet-visible (UV-vis) irradiation has also been tested as an innovative technology to reduce the amount of sulfur dioxide used in white wine production. Additionally, freezing must before processing has been explored. Wines were procesed without protective treatments, with standard SO_2 addition, or after UV irradiation. Results showed that UV-vis irradiation of must could prevent wine spoilage as effectively as SO_2, without altering other quality parameters like pH, tartaric acid, or alcohol content. However, a residual SO_2 addition is still necessary to completely inhibit polyphenol oxidase activity (Falguera et al. 2013).

The objective of the study was to evaluate the influence of using carbonic ice and nitrogen protection on chemical and sensorial parameters of white wines.

MATERIAL AND METHODS

Grapes

White grapes (Vitis vinifera var. *Fetească regală*) were harvested in September 2023 at full maturity and were provided by SCDVV from Dealu Bujorului vineyard, Galați County, Romania.

Technological variants

Variant 1 (V1). Grapes were manually collected, at a sugar concentration of 231 g/kg, acidity of 3.71 g/L in tartaric acid, with a pH of 3.60. Acidity was corrected to 6.3 g/L tartaric acid, with a pH of 3.22. Gallic tannin (10 g/100 Kg) and carbonic ice were added to the grapes, coupled with a reduced dose of SO_2 (25-30 mg/kg).

Then, the grapes were destemmed and crushed and enzyme preparations (Speed Up Flow + Zymovarietal aroma G + Zymoclaire DCG at 3 g/hL) were administered in the pneumatic press tank. After a gentle pressing with a short program, the must was separated and clarified under the nitrogen protection. For fermentation, yeast Zymoflore DELTA was administered at 30 g/hL. Assimilable nitrogen in white must was evaluated at 120 mg N and corrected with GO Ferm nutrient at 20 g/hL and GLUTA STAR at 20 g/hL. After fermentation at controlled temperature at 14-16^{o}C the new wine was racked under a nitrogen under the nitrogen protection.

Variant 2 (V2). For this variant no addition of carbonic ice and must and wine manipulation under the nitrogen protection. Winer fermentation was done at 14-16^{o}C.

Variant 3 (V3). Similar with V2, but the fermentation process was performed at temperature of 30-35°C, without temperature control.

Chemical characterization of young white wines

Analysis for chemical characterization of white wines were performed using the methods recommended by the Organisation Internationale de la Vigne et du Vin (OIV): alcoholic content (OIV-MA-AS312-01), total acidity (OIV-MA-AS313-01), volatile acidity (OIV-MA-AS313-02), SO_2 (OIV-MA-F1-07), Reduced extract (OIV-MA-AS2-03B), Residual sugar (OIV-MA-AS311-01A), pH (OIV-MA-AS313-15) (OIV, 2006).

Chromatic parameters of wines

The color parameters of the wines were determined by using a spectrophotometer (Libra S22, Biochrom, UK).

Total polyphenolic content

The total polyphenolic content was estimated using Folin Ciocalteu method and the content was expressed as gallic acid equivalents per mL.

Sensorial analysis of white wines

For the sensory evaluation of wine samples a trained panel including 8 certified wine tasters was used. They used a scale of 10 points with scores from 1 (very dislike) to 10 (very like), as reported by Hozoc (Nedelcu) et al. 2023. The wines were kept at 10 °C and served at room temperature. The sensory evaluation descriptors were used: luminosity, olfactory impression, gustatory impression, and global appreciation.

Statistical analysis

All measurements were done in duplicates, and the reported data are described as mean ± of the standard deviation.

RESULTS AND DISCUSSIONS

In Table 1 are presented the main chemical parameters for the resulted white wines from the Fetească regală grape variety are presented.

Table 1

Chemical parameters of resulted white wines, depending on the winemaking variant applied to the grapes

Parameters	Variants		
	V1	**V2**	**V3**
Alcohol, % v/v	13.0±1.4[a]	13.2±0.7[a]	12.8±0.6[a]
Free SO_2, mg/L	27.5±2.1[a]	30.6±1.1[b]	31.4±1.7[b]
Total SO_2, mg/L	131.2±1.2[a]	160.4±3.2[b]	179.6±2.1[c]
Total acidity, g tartaric acid/L	5.7±0.5[a]	5.7±0.3[a]	6.0±0.1[b]
Volatile acidity, g acetic acid /L	0.33±0.01[a]	0.36±0.02[a]	0.39±0.01[a]
Reduced extract, g/L	21.2±0.4[a]	21.3±1.2[a]	20.1±0.8[b]
Residual sugar, g/l	7.4±0.2[a]	7.0±0.1[a]	1.6±0.1[b]
pH	3.38±0.1[a]	3.47±0.3[a]	3.52±0.2[a]

Within a row, means values with different superscript letters are significantly different ($p<0.05$)

The results presented in Table 1 do not show significant differences between all studied variants (V1, V2 and V3) in terms of the alcoholic content, volatile acidity, and pH. Overall, the results indicated that wines produced under different technological conditions vary in their sulfur dioxide levels, total acidity, and residual sugar content, variant with the highest SO_2 content and volatile acidity being V3.

Measurement of optical density ($OD_{420\ nm}$) of studied variants

The white grape juice oxidation and browning phenomena due to the various technological steps application can be determined by reading the optical density of white grape juice at wavelength of 420 nm (Ribéreau-Gayon et al. 2017). Because of the oxidation of polyphenolic compounds followed by their transformation to quinones and further their polymerization during white grapes processing are responsible for the yellow-brown compounds formation (Baron et al. 2000).

The values of $OD_{420\ nm}$ measured for the studied technological variants are shown in Figure 1.

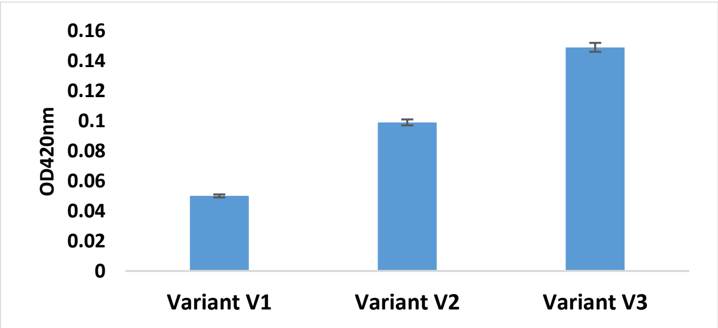

Figure 1. Values OD_{420nm} measured for the studied technological variants

At wavelength of 420 nm, the lowest value of optical density was recorded for variant V1, followed by variant V2 and the highest value was measured for variant V3.

This indicates that the application of protective measures and innovative technological processes can effectively influence the color characteristics of white wines, particularly in the context of the visible spectrum.

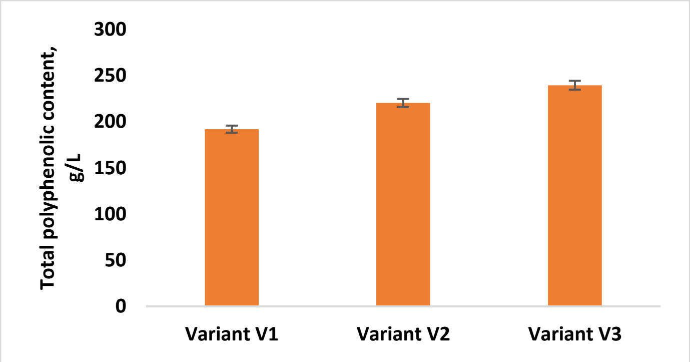

Figure 2. Total polyphenolic content measured for the studied technological variants

In Figure 2 are represented the total polyphenolic content measured for the studied technological variants.

The total polyphenol content presented the lowest value for the variant with nitrogen protection and carbonic ice addition. An increase in polyphenolic level was measured for variant V2 and the highest was found for the variant V3.

This trend suggests that using nitrogen and carbonic ice during the winemaking process can effectively minimize polyphenolic concentrations, potentially leading to a smoother and more refined wine profile.

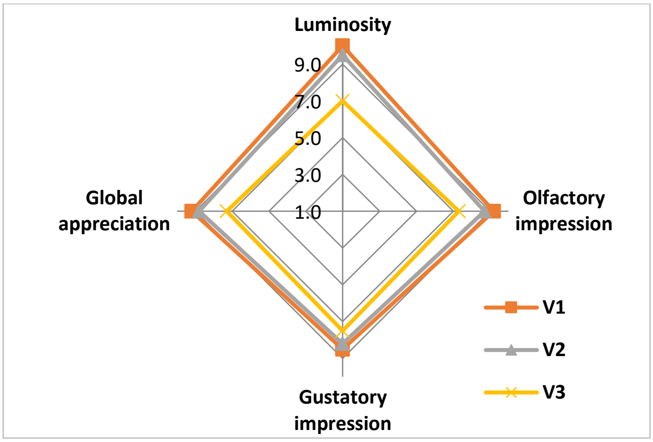

Figure 3. Sensorial profile of white wine samples

The contribution of the using of carbonic ice and nitrogen protection during winemaking of white grapes to the improvement of visual aspect, olfactory and gustatory impression and their influence on global appreciation is depicted in Figure 3.

In terms of quality, the wine produced using technological processes that contribute to reducing sulfite doses with nitrogen protection and addition shows significantly higher olfactory and taste quality, as well as a clearer appearance, compared to the variant V3. This approach also contributes to reduce the sulfite dose in the wine.

CONCLUSIONS

By applying appropriate technological processes, it is possible to reduce the sulfite dose in the obtained wines, but it cannot be completely replaced. The color intensity of the wines produced presented lower value for variant V1 compared with other two studied variants. Wines produced through these technological processes designed to reduce sulfites are visually and sensorily more expressive, with a more fruity and aromatic profile.

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