SOI: 1.1/TAS DOI: 10.15863/TAS

International Scientific Journal

Theoretical & Applied Science

p-ISSN: 2308-4944 (print) **e-ISSN:** 2409-0085 (online)

Year: 2024 **Issue:** 08 **Volume:** 136

Published: 23.08.2024 **http://T-Science.org**

Issue Article

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THE INFLUENCE OF GRAPE STEMS ON THE QUALITY OF KAKHETI WINES

Abstract: *The chemical composition and organoleptic properties of wines produced using the Kakheti method significantly differ from those of classic European wines. This divergence primarily stems from the involvement of the solid parts of the grape bunch during extended maceration and alcoholic fermentation. During this process, pectin compounds from the solid parts of the grape bunch enter the must, where they undergo depolymerization and demethylation. Additionally, phenolic compounds from the grapes, along with their transformation products, play a crucial role in shaping the wine's characteristic profile. These compounds are predominantly extracted from the grape skins and stems, both of which are rich in substances with high antioxidant activity, including polyphenols (such as anthocyanins, flavonols, flavan-3-ols, and procyanidins), phenolic acids, resveratrol.*

Key words: *Kakheti red wine, qvevri, stems, wine color intensity, phenolic compounds, classical technology.*

Language: *English*

Citation: Khomasuridze, N., Ormotsadze, M., Kotorashvili, L., Khositashvili, M., & Kiknadze, A. (2024). The influence of grape stems on the quality of Kakheti wines. *ISJ Theoretical & Applied Science, 08 (136),* 60-63.

Soi: http://s-o-i.org/1.1/TAS-08-136-7 ***Doi***: crossref https://dx.doi.org/10.15863/TAS.2024.08.136.7

Scopus ASCC: *1107.*

Introduction

Recent studies conducted by both Georgian and international researchers have demonstrated that wines made using traditional Kakheti technology are particularly rich in antioxidant compounds, phenols, and other substances that are beneficial to human health. Given these findings, investigating the

influence of stems on wine quality has become a more pressing issue.

The aim of this study was to investigate the impact of grape stems on the quality of Kakheti wine. To this end, the study focused on assessing the influence of phenolic compounds on the chemical composition and organoleptic characteristics of Kakheti wine produced from the Budushuri Safere grape variety.

Materials and Methods: The study was conducted using wines produced by the Kakheti method in various vessels, including qvevris and stainless steel tanks. Pectolytic enzymes and phenolic tannins were employed during the winemaking process. The wines were made using Kakheti technology, with varying amounts of grape stems added. Red wines produced by the classical method with cold maceration were used as controls. The Saperavi grapes were harvested in the village of Kurdglauri, located in the Sighnaghi region. Upon arrival at the winery, the grapes underwent both visual inspection and laboratory analysis. The grapes were processed immediately after arrival, within two hours of being harvested at 6 am. The study utilized two qvevris with a capacity of 800 liters each, as well as stainless steel tanks.

Sample 1: Grapes were processed by passing them through a destemmer, with the addition of potassium metabisulfite at a concentration of 100 g per tonne of grapes. The crushed grapes and grape juice were placed into a Qvevri, which was intentionally left 30% unfilled to allow for the mixing of the fermenting durdo (juice and solid grape components) during fermentation. The stems were air-dried for four days before being reintroduced into the fermenting durdo, constituting 20% of the total mass.

Since not all of the stems were added to the wine must, tannins were introduced to enhance the antioxidant properties, aid in the formation of a protein-tannate complex, and contribute to the purification and stability of the wine, without affecting its organoleptic properties.

For 800 liters of durdo, the following additives were used:70 g of Cadefit, 80 g of pure yeast culture (RED FLOWERS),60 g of XB nutrient,160 g of SUPREME tannin.

During alcoholic fermentation, the fermenting must was stirred every 3-4 hours to ensure uniform fermentation. The temperature was monitored daily to prevent overheating, as elevated fermentation temperatures can diminish varietal aromatic compounds. The fermentation process lasted for 20 days. Afterward, the Qvevri was filled and sealed with a specialized "plasteline" sealant. Throughout the fermentation process, standard laboratory tests were conducted, with the results compared to a control sample.

Sample 2 was prepared using traditional Georgian technology, which involves alcoholic fermentation with whole grape clusters in qvevri. The materials used for the preparation of the first and second samples were identical, except for the tannin. In Sample 2, as the fermentation occurred with the whole cluster, no additional tannin was added. The difference between the first and second samples lies in the fact that Sample 2 was fermented with the whole cluster. During grape processing, the cluster was not separated, and the must obtained from processing the whole grapes was placed in the qvevri. The wine underwent both alcoholic fermentation and aging in the qvevri. According to Georgian regulations on vine and wine, qvevris were opened after December 25, on February 2, to prevent the risk of hydrogen sulfide and mercaptan formation due to prolonged fermentation on the lees. Additionally, if the wine had been racked at temperatures above 20°C, there would have been a significant risk of oxidation. Before removal from the qvevri, the wine was treated with cadifit (to protect against oxidation), and it was pumped out. The remaining must was used for distillation and was not pressed. The wine from the qvevri was transferred to a mobile stainless steel tank for further aging.

Sample 3 was produced using an industrial method in a stainless steel reservoir. The same materials were utilized as in the preparation of Samples 1 and 2. Fermentation was carried out in a temperature-controlled system equipped with refrigeration, employing a preliminary cold maceration process. The fermentation temperature was maintained below 25°C. After fermentation, the free-run fraction was removed, sulfur dioxide was added at a concentration of 50 g/hl, and the pomace was pressed. The free-run fraction was subsequently combined with the 0.2-0.4 bar pressed first fraction.

Comprehensive laboratory analyses were performed at each stage of the technological process. The total phenolic content was quantified using the OIV Folin-Ciocalteu Index (OIV-MA-AS2-10: R2009) method. The results are summarized in Table N1.

Table N1.

Sample Name	Total Phenols (mg/L)
Saperavi Budeshuri, European Technology	2128
Saperavi Budeshuri, Qvevri, 20%	2855
Saperavi Budeshuri, Traditional Kakheti Technology	3380

During wine production in qvevri, wine remains in contact with the phenolic compound sources, such as the pomace, for extended periods. The ethanol present in the wine facilitates the extraction of phenolic compounds from this solid material. As the contact duration increases, the formation of complex compounds and the self-cleansing of the wine lead to a gradual reduction in the concentration of phenolic compounds. Our research data align with existing literature on this topic. Wine made with a full amount of pomace in the qvevri exhibits the richest phenolic profile. Adding 20% of the total pomace amount also increases the total phenolic content compared to wine produced using European methods.

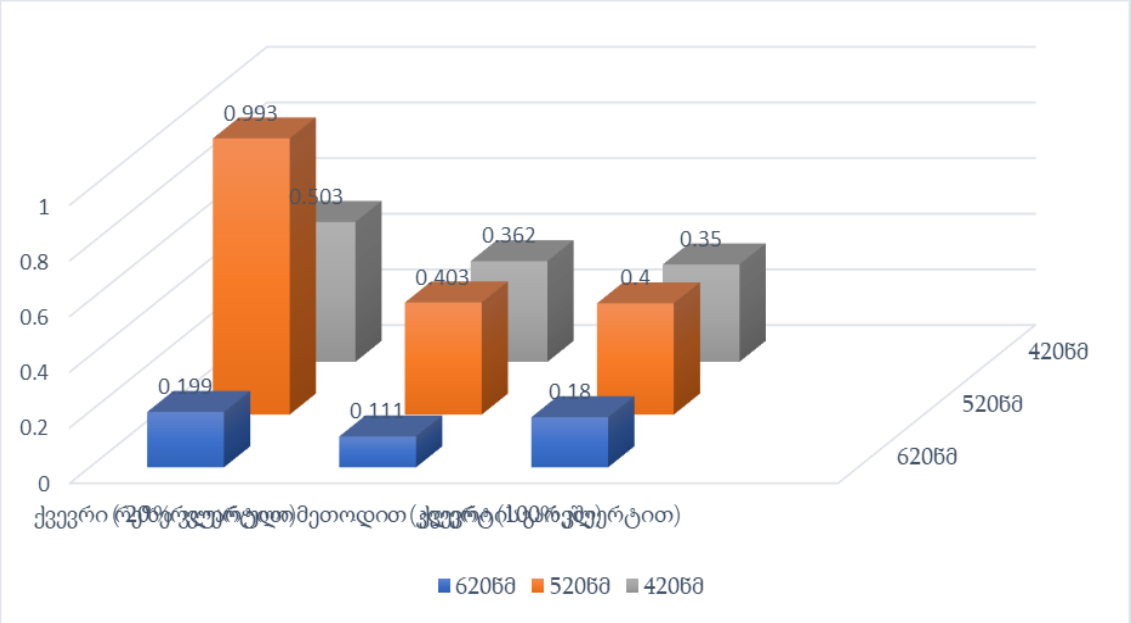
In the test and control samples, the total amount of nine key anthocyanins was determined. This determination was carried out using a high-performance liquid chromatograph from Knauer, following the OIV-MAAS315-11 method.

Based on the obtained results, the average anthocyanin content in qvevri wines is 26 mg/L higher compared to wines produced in tanks. Although this difference is not statistically significant, it is noteworthy that in industrial production, anthocyanins are separated from the skins immediately after fermentation. In contrast, qvevri wines undergo extended skin and pomace contact until February of the following year. The data suggests that, in wines produced using traditional qvevri methods, prolonged skin contact, or post-fermentation maceration, does not lead to a significant increase in anthocyanin levels.

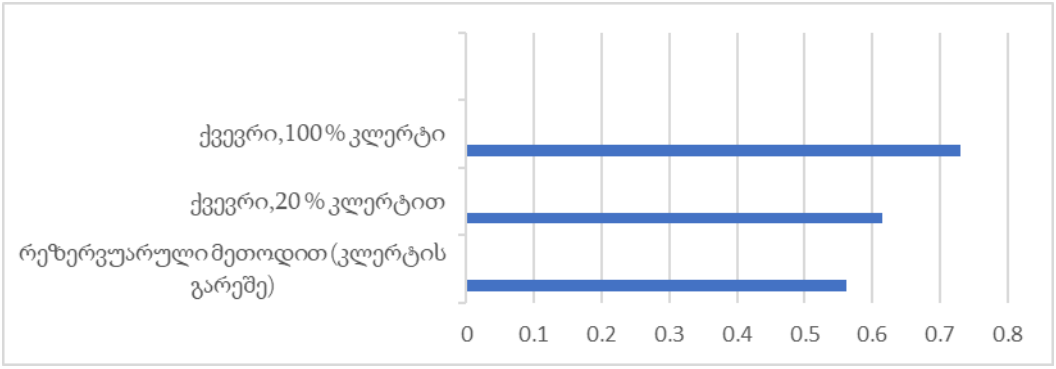
It is well-established that phenolic compounds significantly influence the color of wine. To characterize red wine, the color is assessed based on the proportion of three pigments: red, yellow, and blue, measured at different wavelengths.

The analysis was conducted using a Cary 300 spectrophotometer. The optical density at D420 (420 nm) is indicative of the concentration of tannins and anthocyanins. The optical density at D520 (520 nm) reflects the presence of anthocyanin-tannin complexes, particularly in aged wines.

Figure 1



In industrial winemaking conditions, the color intensity of wine produced using the reservoir method is lower compared to wines fermented in full or partial claret in a Qvevri. This observation indicates that pre-fermentation "cold" maceration, conducted for 24 hours, along with the use of enzymatic preparations, significantly enhances the anthocyanin content in the wine.



Diagrame 1

Conclusion: The inclusion of the full amount of claret during the fermentation of Saferavi in a Qvevri increases the concentration of phenolic compounds in the wine. Additionally, the use of the full amount of claret during fermentation in a pitcher contributes to a higher color intensity.

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