

Exploring the Untapped Winemaking Potential of the Grape Variety Nrneni (Haghtanaki Quyr)

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Conflict of Interest

The authors declare no conflict of interest concerning the research, authorship, and/or publication of this article.

ABSTRACT

Research indicates a rising demand for high-quality wines in Armenia. Our objective was to produce premium red and rosé wines using the relatively unexplored Nrneni (Haghtanaki Quyr) grape variety. Throughout the research, we used various winemaking technologies to produce red and rosé wines from the Nrneni (Haghtanaki Quyr) grapes. Concurrently, multiple physicochemical parameters and sensory attributes were investigated in the resulting must and wine. The results highlight the potential to craft unique wines from the Nrneni (Haghtanaki Quyr) grape variety, indicating potential market impact and consumer appreciation.

Introduction

Since the 19th century, our understanding of wine, wine composition and wine transformations has greatly evolved in function of advances in relevant scientific fields i.e. chemistry, biochemistry, microbiology. Each applied development has led to better control of winemaking and aging conditions and of course wine quality. In order to continue this approach, researchers and winemakers must strive to remain up to date with the latest scientific and technical developments in enology. It would be an error to think that the world's greatest wines are exclusively a result of tradition, established by exceptional natural conditions, and that only the most ordinary wines, produced in giant processing facilities, can benefit from scientific and technological progress. Certainly, these facilities do benefit the most from high performance installations and automation of operations. Yet, history has unequivocally

shown that the most important enological developments in wine quality have been discovered in ultra-premium wines. The corresponding techniques were then applied to less prestigious products (Ribereu-Gayon & Dubourdieu, 2006).

Red wines are made from red grape varieties, which differ from white wines not only in color but also in fleshiness and astringency. Red wines are richer in substances extracted from the solid parts of grapes and useful microelements (Gabrielyan, 2021).

Red wine should have a brilliant crimson hue, free of any brown undertones. It should possess a harmonious, full-bodied character, delicately velvety texture, and exhibit a subtle balance of acidity and astringency. The careful selection of grape varieties plays a pivotal role in red wine production. Grapes should contain an ample amount of coloring substances (Muradyan & Aghajanyan, 2012).

Rosé wines are made from red grape varieties. Several techniques are available for crafting rosé wines, including the following prominent methods:

- **“Gravity separation of grape must” (Saignée):** The production of top-quality rosé wines often relies on using of this technique. The essence of this method lies in the natural separation of grape juice, typically around 40-50% of the total volume, during grape processing, solely due to the force of gravity. This separated must was then fermented using the technique employed in white wine production. This particular style of winemaking finds significant popularity in France, especially in regions like Provence and Burgundy.
- **Pressing:** The core of the technique involves pressing red grapes, post destemming and crushing, until the must with the desired color and composition is achieved. Subsequently, the obtained must undergoes standard procedures for white wine fermentation.
- **Moderate infusion:** This is regarded as the most popular technique globally; it involves pouring the destemmed and crushed mass into a tank for maceration. The maceration continues until the winemaker determines that the desired amount of phenolic substances has been extracted. Following this process, the mass is pressed and proceeds to fermentation.

• **Separation of liquid mass during fermentation:** In this scenario, the grapes undergo destemming and crushing before being directed to the fermentation tank without immediate pressing. As the fermentation progresses and a satisfactory amount of phenolic substances is extracted, the winemaker decides to separate the liquid part of the fermentation mass. This separated liquid continues to ferment in a distinct tank (Ribereu-Gayon & Dubourdieu, 2006).

Materials and methods

Given the established goal, we have outlined the subsequent primary objectives:

- Investigate the Nrneni (Haghtanaki Quyr) grape variety.
- Evaluate the winemaking capabilities of Nrneni (Haghtanaki Quyr) grape by producing both red and rosé wines from this specific variety.
- Monitor the physicochemical parameters during the winemaking process.
- Assess the sensory characteristics of the finished wines.

This research focuses on the Nrneni (Haghtanaki Quyr) grape variety and the red and rosé wines produced from it. Despite its significance, relatively little information

is available about this variety. Presently, ampelographic and genetic studies conducted by our partners are still in progress (<https://vivc.de>). The main information about the grape variety is presented in picture 1.

During this research, we observed that Nrneni (Haghtanaki Quyr) grape variety features colored flesh, notably thick skin, relatively small berries, and compact clusters. The Nrneni (Haghtanaki Quyr) grapes were harvested from the national grape collection vineyard.

The grapes were harvested at their peak ripeness to ensure the production of high-quality wines. The harvested grapes were meticulously transported in small boxes to the winery to avoid any damage. Once at the facility, the grapes were destemmed and crushed using a horizontal roller crusher-destemmer. Next, using a screw pump, the crushed grape mass was transferred to a fermentation tank, where yeast was added to initiate fermentation. This process lasted for 7 days, followed by a 5-day maceration period with the skins. The fermentation temperature was 20-23 °C.

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Picture 1. Passport data of the grape variety Nrneni (Haghtanaki Quyr).

After fermentation and maceration, the pulp was pressed to extract the liquid. The resulting wine was then transferred to a tank, where malolactic bacteria were introduced to start malolactic fermentation. Subsequently, the wine was poured into 25-liter glass containers (see picture 2).

Rosé dry wine was produced from the Nrneni (Haghtanaki Quyr) grape variety using specialized equipment and auxiliary materials. The grapes were harvested at their peak technical ripeness and transported from the vineyards to the winery in small boxes. Upon arrival, the grapes were destemmed, crushed and then pressed. Only the free-run juice, or gravity fraction, was collected during pressing. Afterward, the must was transferred to a container where it was clarified using bentonite. The clarification temperature was 14-16 °C. Following this clarification, the must was racked for further processes. A yeast was added to the racked must. Three days into the fermentation, the wine was aerated. Throughout the fermentation process, the sugar content of the must was measured daily, allowing adjustments to the fermentation rate as needed to either accelerate or slow it down. The fermentation temperature was 18-20 °C. Once fermentation was complete, the wine was transferred, and potassium metabisulphite was added. For the rosé wine, the finished wine was also poured into 25-liter glass containers.

All research conducted during the grape ripening process, as well as studies related to must and wines, were performed in the educational laboratory of the EVN Wine Academy. The methodologies used are sanctioned by the International Organization of Vine and Wine (OIV) and adhere to international standards (OIV, 2016; ISO 5495:2005; ISO 4120:2021), as detailed in the "Compendium of International Methods of Wine and Must

Analysis" (International Organization of Vine and Wine, 2016, Muradyan, et al., 2017). The results of the conducted research were compared with the provisions of current legislation, including GOST 7208-93, GOST-32030-2013, GOST R 52523-2006, and GOST R 55242-2012. Additionally, they were assessed against the regulatory document set forth by the "International Organization of Vine and Wine" (OIV-MA-C1-01), which specifies the maximum permissible limits (Jackson & Ronald, 2008).

Results and discussions

In the final month of ripening for the Nrneni (Haghtanaki Quyr) grape variety, an analysis was performed to assess the levels and variations of key physicochemical indicators. It is important to mention that samples for each grape variety were collected at consistent 7-day intervals.

During the three-week observation period, the indicators changed as follows: sugar content increased from 130 g/l to 213 g/l, while total acidity decreased from 8.5 g/l to 7.3 g/l, and malic acid content reduced from 2.2 g/l to 1.5 g/l. Additionally, there was a noticeable rise in nitrogen compounds, with ammonium salts (NH_4^+) increasing from 108 mg/l to 143 mg/l, and yeast-assimilable nitrogen (YAN) rising from 220.8 mg/l to 334.5 mg/l.

Anthocyanins are pigments present primarily in the skin of grapes and occasionally in the fruit itself. Their color is highly dependent on pH levels: the lower the pH, the more stable the anthocyanins become, resulting in a deeper red coloration. Phenolic substances emerge during fermentation and undergo continuous changes (Jacobson, 2006; Moreno & Peinado, 2012).

Table 3 summarizes the data on the total phenol and total anthocyanin content of the wines investigated, highlighting their relatively high levels.

Several characteristics of wines produced from the Nrneni (Haghtanaki Quyr) grape variety were evaluated and compared using a numerical assessment method. The results are presented below. Fifteen specialists participated in the tasting process. Initially, the participants identified various features and descriptors using a descriptive approach, then grouped these features to highlight the most prominent ones. Subsequently, the intensity of these features was rated on a scale of 1 to 10. After consolidating the results, aromatic wheels for the organoleptic indicators of the wine were created, as detailed below (Gabrielyan, et al., 2024; Wang & Spence, 2019).



Picture 2. Wine storage containers.

Table 1. The levels of various chemical indicators and their changes over time in the grape variety Nrneni (Haghtanaki Quyr)*

Samples	Indicators					
	Sugar content, g/l	Total acidity, g/l	pH	NH4+, mg/l	YAN, mg/l	Malic acid, mg/l
1st sampling 12.09.2020	130	8.5	2.85	108	220.8	2.2
2nd sampling 18.09.2020	169	7.9	2.99	125	280	1.9
3rd sampling 25.09.2020	213	7.3	3.3	143	334.5	1.5

Table 2. The content of some chemical indicators in wines made of the studied Nrneni (Haghtanaki Quyr) grape variety*

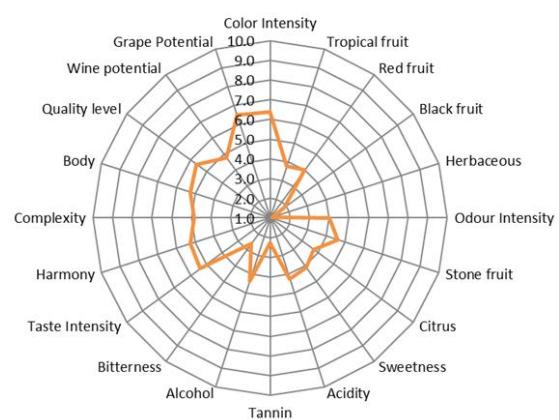
Physicochemical indications	Alc.	Totaal acidity	Volatile acidity	Residual sugar	pH	Free SO ₂	Total SO ₂	Reductones
Unit of measurement	Vol.%	g/l	g/l	g/l	-	mg/l	mg/l	mg/l
Red wine	12.8	5.3	0.51	0.2	3.4	20.5	85.3	1.69
Rosé wine	12.5	5.7	0.43	0.1	3.3	25.4	90.2	1.41

Table 3. Total phenols and anthocyanins content in the examined wines*

Samples	Indicators	
	Total phenols, mg/l	Total anthocyanins, mg/l
Red wine	2960	610
Rosé wine	2090	129,7

*Composed by the authors.

Based on the sensory characteristics, the wines made from the Nrneni (Haghtanaki Quyr) grape variety can be described as follows: The rosé wine exhibits an intense color and presents fruity aromas, predominantly of red fruits, with medium to low tropical notes. Herbal or green aromas are nearly absent. The overall intensity of the aromas is above average, with red berry notes also rated as above average in intensity. The wine's sweetness is considered very low, while its acidity is assessed as medium. The tannin content in the rosé wine made of the Nrneni (Haghtanaki Quyr) grape variety was assessed as low, which is ideal for a light rosé. The overall flavor intensity of the wine received a high rating. Based on the evaluations, it can be concluded that the rosé wine from the Nrneni (Haghtanaki Quyr) grape variety is notably harmonious and features an above-average complexity in its bouquet (see Diagram 1).

**Diagram 1.** The aroma wheel of Nrneni (Haghtanaki Quyr) rosé dry wine (composed by the authors).

The color intensity of the red wine was rated as notably high. The wine exhibits pronounced fruity aromas, predominantly featuring black fruit characteristics, with a significant presence of red fruit notes. Tropical fruit aromas are almost negligible. A moderate to low vegetal aroma is also present. The overall intensity of the wine's aromatic profile was assessed as above average. In terms of sweetness, the wine was rated very low, while acidity levels were found to be quite high. The tannins in the wine were rated as relatively high, alcohol sensitivity was

assessed as medium, and bitterness was rated as low. The overall flavor intensity of the red wine made from the Nrneni (Haghtanaki Quyr) grape variety was rated above average. This wine was generally evaluated as having medium harmony and above-average aromatic diversity. Based on these evaluations, the wine is classified as having medium potential. The potential of the Nrneni (Haghtanaki Quyr) grape variety was assessed as high (see Diagram 2).

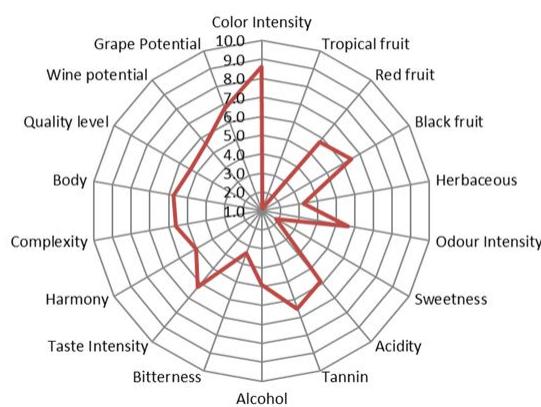


Diagram 2: The aroma wheel of Nrneni (Haghtanaki Quyr) red dry wine (*composed by the authors*).

Conclusion

The potential of the Nrneni (Haghtanaki Quyr) grape variety for production of rosé and red dry wines has been studied. The findings indicate that wines produced from this grape variety can meet international standards. The overall quality of both rosé and red wines was rated as above average, with their potential, based on sensory characteristics, also assessed as high. The research provides valuable insights into the winemaking potential of the Nrneni (Haghtanaki Quyr) grape variety. However, it is recommended that future studies be conducted on a more comprehensive and large-scale basis to further explore this potential.

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