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Natural sparkling wine pétillant naturel: technological features and sensory profile

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Abstract. The article presents the results of a study on the technological features of producing sparkling wines of the Pétillant Naturel (Pet-Nat) type, made using the ancestral method from the Muscat Ottonel and Pinot Noir grape varieties. The historical background of the emergence of this wine type, its evolution, and modern production trends, particularly in Ukraine, are analyzed. A detailed description is provided of the processes of primary grape processing, fermentation control, bottle fermentation, lees aging, and disgorgement. Sensory analysis of the obtained samples was carried out using the descriptive method and compared with sparkling wines produced by the Charmat method.

It was found that Pet-Nat wines are characterized by lower acidity, higher residual sugar levels, more pronounced fruity and floral aromas, greater body, and the presence of creamy and pastry notes due to prolonged contact with the lees. In contrast, sparkling wines made using the Charmat method are noted for their higher acidity, greater effervescence, and fresher taste profile. The results highlight significant sensory differences between the experimental samples, driven by both technological factors and grape varietal characteristics, and confirm the promising potential of Pet-Nat production in meeting the demand of consumers seeking natural and authentic wines.

1. Introduction

Pétillant Naturel (Pét-Nat) is a natural sparkling wine produced using the ancestral method (*méthode ancestrale*), the oldest known technique for making sparkling wines, predating the traditional Champagne method.

Pét-Nats are considered the earliest form of sparkling wine production in France, preceding the advent of Champagne (Robinson and Harding, 2006). One hypothesis suggests that wines in naturally cool regions of France underwent primary fermentation until the onset of winter, when falling temperatures naturally halted the process. Unaware that fermentation was incomplete, winemakers bottled the young wine, and with the return of warmer temperatures in spring, fermentation resumed inside the bottle. The earliest mentions of such wines come from the Gaillac region (north of Toulouse) and Limoux (a mountainous area in Languedoc-Roussillon) [1].

The term *pétillant* is typically used to describe sparkling wine with a lower level of carbon dioxide compared to traditional Champagne [3]. The traditional grape variety used for making Pét-Nats in Gaillac and Limoux is Mauzac, known in Limoux as *Blanquette*, which is characterized by a distinctive dried apple peel flavor. Production follows the so-called *méthode ancestrale* (or *méthode gaillacoise* in Gaillac), which involves a single primary fermentation that begins in a tank and finishes in the bottle. The result is a cloudy wine that retains natural carbon dioxide and varies in residual sugar content [2].

Since 2021, there has been a noticeable growth in the production of Pét-Nats in Ukraine. This development is mainly driven by small and medium-sized wineries adapting the traditional French technique to local conditions. Demand for this type of sparkling wine is rapidly increasing among Ukrainian consumers, particularly during the summer season. Key factors behind its popularity include its natural production, minimal intervention, and light, refreshing flavor

characteristics that distinguish Pét-Nats from traditional sparkling wines.

Ukrainian Pét-Nat producers primarily focus on creating white wines from indigenous grape varieties such as Citronnyi Magaracha, Sukholymanskyi Bilyi, and Telti-Kuruk, while also using European varieties like Muscat Ottonel. For the production of rosé Pét-Nats, Pinot Noir and Merlot are most commonly used, providing a broad spectrum of aromas and flavors in the final product.

2. Materials and Methods

The objects of the study were the white grape variety Muscat Ottonel and the red variety Pinot Noir.

Primary grape processing was carried out using the classical white winemaking method. The must was obtained by direct pressing of whole grape clusters followed by fractional pressing. Maceration on the pulp was performed at a temperature of 15 °C for 4 hours to enhance the extraction of aromatic and phenolic compounds.

The yield of must was limited to no more than 60 dal (decaliters) per ton of grapes. Clarification of the must was carried out through static settling in tanks at 10 °C for up to 12 hours. After clarification, the must was transferred to fermentation vessels, where fermentation took place at a temperature not exceeding 26 °C, using pure yeast cultures as the fermentation agent.

When the residual sugar concentration reached 30–50 g/dm³, the fermenting mass was cooled to 8 °C and held for 24 hours to stabilize it. The cooled must was bottled into 0.75 L glass bottles, sealed with corrosion-resistant crown caps. The bottles were placed horizontally in stacks and left for secondary fermentation at a temperature not exceeding 15 °C for up to 30 days.

The fermentation process in bottles was monitored at least once every 10 days. Upon completion of fermentation, when residual sugar levels reached 20–30 g/dm³, the bottles were left to mature at a temperature not exceeding 15 °C for 3 months.

During maturation, bottles were periodically shaken and repositioned to ensure even distribution of the lees. To improve the sediment structure and facilitate subsequent riddling, cold treatment at –3 °C was applied.

Riddling was conducted in facilities with temperature control not exceeding 15 °C, gradually collecting the lees at the neck of the bottle. For sediment removal, the bottlenecks were pre-frozen to form an ice plug.

After disgorgement, the Pét-Nat sparkling wine bottles underwent a final stabilization stage for 10 days at 20 °C to harmonize the organoleptic characteristics. After this, the product was subjected to quality control and classification.

Tastings were conducted in a specially equipped room with individual booths and climate control set to 20 °C. Two independent tasting panels carried out the evaluations.

A standard tasting glass made of thin, clean, transparent glass with a volume of 210–220 cm³ was used, allowing for a sample volume of 60–70 cm³ for a comprehensive sensory evaluation across all quality attributes.

Both alcoholic and dealcoholized wines were evaluated according to the Standards of the International Organisation of Vine and Wine (OIV) [4].

The maximum tasting score for the samples was 100 points, determined as the sum of the following categories:

– Appearance (clarity, color) – 14 points
– Aroma (authenticity, intensity, aroma quality) – 30 points
– Taste (authenticity, intensity, harmonious persistence, taste quality) – 44 points
– Harmony (overall impression) – 11 points

To create the aromatic profiles of the experimental samples, a descriptive method using a 10-point scale was applied. The following descriptors were evaluated: citrus, fruity, muscat, floral, sweetness, acidity, bitterness, body/fullness, intensity, and astringency.

Graphical representation of experimental data was performed using Microsoft Excel 2010.

Comparison of the profiles of the experimental samples enabled the identification of their differences and the formulation of conclusions about quality changes during dealcoholization.

3. Results and Discussion

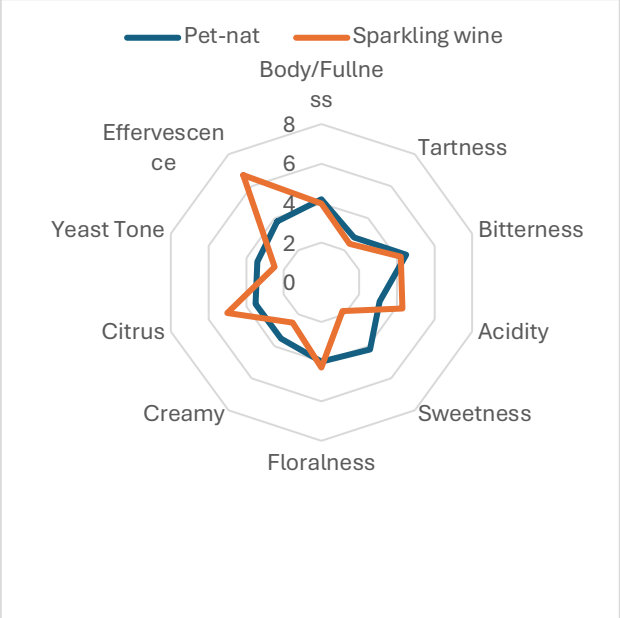

Figure 1. Aromatic profile comparison of Pét-Nat and Charmat-method sparkling wine made from Muscat Ottonel grapes.

Sensory analysis (Figure 1) of sparkling wine produced by the ancestral method (Pét-Nat) and that made from Muscat Ottonel grapes using the Charmat method revealed significant differences in the aroma and taste profile, primarily driven by the production technology.

The Pét-Nat showed softer acidity (3.1), higher sweetness (4.2), and a more pronounced fruity bouquet, especially peach (3.4) and floral notes (4.0). These features created a rounder, more harmonious flavor perception and gave the wine a sense of natural authenticity, characteristic of low-intervention styles.

In contrast, the Charmat-method sparkling wine exhibited sharper acidity (4.3), significantly greater effervescence (6.7), and a refreshing citrus aroma (5.0), emphasizing its technological clarity and structured profile. Both samples demonstrated a similar level of body (4.2 vs. 4.0) and muscat aromatic profile (2.5), preserving the varietal identity.

The Pét-Nat's advantages lie in its soft, fruity nature and naturalness, while the Charmat wine is distinguished by its cleanness, freshness, and pronounced sparkle. These results suggest that the taste and aromatic advantages of Pét-Nat may appeal more to consumers who value depth, individuality, and natural expression in wine.

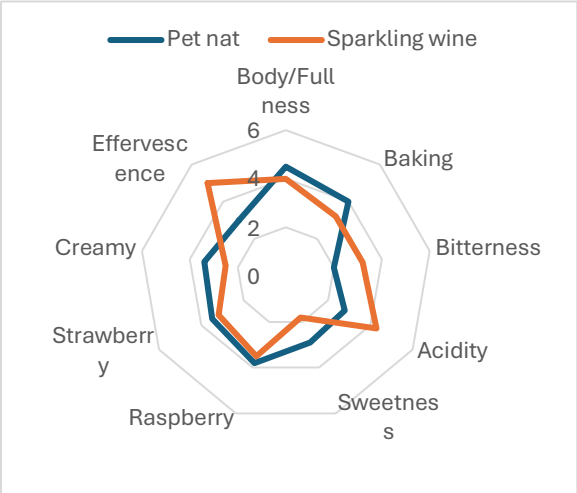

Figure 2. Aromatic profile comparison of Pét-Nat and Charmat-method sparkling wine made from Pinot Noir grapes.

Sensory analysis showed that the rosé Pét-Nat made from Pinot Noir exhibited greater body compared to its sparkling counterpart, indicating enhanced richness and structure. Pastry-like notes were also more prominent in the Pét-Nat, which can be attributed to fermentation and aging on the lees.

The sparkling wine had a more pronounced bitterness, likely due to both the grape variety and the production process. Additionally, its acidity was significantly higher, contributing to a crisper and more refreshing flavor.

Pét-Nat scored higher in sweetness, which may reflect either residual sugar or more intense fruit expression. Both wines had similar raspberry notes, though Pét-Nat had a higher level of strawberry character, suggesting a more pronounced fruity profile.

Creamy tones were also more developed in the Pét-Nat, probably due to extended contact with lees. The biggest difference between the two samples was in sparkle intensity, where the sparkling wine showed a markedly higher value, consistent with the Charmat method's pressure-controlled secondary fermentation.

Overall, the results demonstrate clear sensory differences between Pét-Nat and sparkling wines, influenced by both the technological process and the grape material used.

4. Conclusions

The study confirmed that the ancestral method (méthode ancestrale) of producing sparkling wine, known as Pét-Nat, results in a product with unique sensory characteristics distinct from traditional sparkling wines produced using the Charmat method.

Key differences between Pét-Nat and traditional sparkling wines were observed in terms of acidity, effervescence, intensity of fruity and floral aromas, body, and residual sugar content, which are all influenced by the specifics of the production process (e.g., lack of secondary fermentation under pressure, lees aging).

The findings indicate that Pét-Nat has the potential to meet the demands of consumers who value naturalness, minimal intervention, and individual taste, presenting strong opportunities for the continued development of this wine category in Ukraine.

5. References

1. J. Robinson, & J. Harding,). Oxford University Press. (2006).
2. G. Liger-Belair Princeton University Press. (2017).
3. R. S. Jackson. Academic Press. (2014).
4. Resolution OIV/Competition ECO 332A/200 (2009).