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ANALYSIS OF THE MUST AND WINE OF SEVERAL GRAPE VARIETIES IN THE PÂNCOTA WINE-GROWING AREA Mălăescu Mihaela¹, Dobrei Alin¹, Nistor Eleonora¹, Dobrei Alina Georgeta¹, Velicevici Giancarla¹, Cristea Cristina¹

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Abstract: The western region of Romania stands out as a significant wine-producing area with a rich tradition and deep expertise in viticulture. This region offers highly favourable conditions for cultivating wine grapes. Research conducted in the Miniş-Măderat viticultural area focused on the physicochemical properties of both local and noble grape varieties, including "Fetească Regală", "Mustoasă de Măderat", "Merlot", and "Cabernet Sauvignon". The analyses evaluated the physicochemical parameters of the grapes, grape must, and resulting wines, aligning with the quality standards required for Miniş controlled designation of origin wines. Grape samples were analyzed to establish the optimal harvest time and assess key quality indicators such as sugar accumulation, total acidity, pH, volatile acidity, malic acid content, alcohol volume, and the sensory characteristics of the wines. At harvest, red wine varieties exhibited a greater accumulation of sugars in the berries compared to the white varieties. Grapes from the "Mustoasă de Măderat" variety showed the highest acidity levels at harvest. For all varieties, the sugar content fell below 4 g/L during fermentation, placing the wines in the dry category. The resulting wines retained the distinct characteristics of each analyzed variety, displaying typicity and authenticity.

Introduction

The western region of Romania has a distinguished tradition in viticulture. High-quality wines meeting the criteria for the Miniş controlled designation of origin are produced within a geographically defined area in the Miniş wine center, where both natural and human factors play a direct role. In the Miniş-Măderat vineyard, predominantly noble grape varieties are cultivated, with a smaller proportion of local grape varieties, resulting in a diverse varietal assortment. The objective of this paper is to investigate the physicochemical properties of the grape varieties "Fetească Regală", "Mustoasă de Măderat", "Merlot", and "Cabernet Sauvignon", focusing on key components such as sugars, acids, and nitrogen compounds. These components are analyzed for their influence on wine quality, flavor, stability, and sensory attributes, particularly in the context of factors like acidity, pH, and nitrogen levels, which are critical to the fermentation process, shelf life, and the balance of sweetness and acidity in the wine. The study aims to deepen the understanding of how these elements contribute to the overall composition, aroma, taste, and aging potential of wines produced from these grape varieties.

Material and method

To conduct research on the physicochemical properties of certain wine grape varieties in the 2024 growing season, grape samples were collected from a vineyard located in Pâncota, within the Miniş-Măderat wine-growing region. The plots corresponding to each grape variety under study were situated relatively close to each other, benefiting from the same environmental conditions. The experiments aimed at assessing physicochemical parameters for producing typical and authentic wines with the controlled designation of origin (D.O.C.) Miniş were carried out on four varieties: two for white wines ("Fetească Regală" and "Mustoasă de Măderat") and two for red wines ("Merlot" and "Cabernet Sauvignon").

To determine the optimal harvest time, grape samples were taken from each plot within the vineyard. The plots with the selected varieties were divided into three equal sections, and two representative rows were chosen for sample collection. From each row, 10 vines were selected, and from each vine, two grape clusters were picked, ensuring one cluster was on one side of the row and the other on the opposite side to capture varying sun exposure. From each selected cluster, berries were sampled with their pedicels, clipped with scissors from the top, middle, and bottom, with 5-6 berries taken from each section. In total, 500-800 g of berries was collected. The berries were then placed in polyethylene bags, labeled with the variety, plot, and collection date, and promptly transported to the winery's oenology laboratory.

The grape berries were crushed using a manual press, and the resulting must was filtered through filter paper. A few drops of the filtered must were taken with a pipette and placed in the FTIR module of the OenoFoss device to determine sucrose concentration and pH.

Regarding must and wine, the physicochemical parameters studied included glucose/fructose, ethanol, pH, density, total acidity, volatile acidity, and malic acid. Sample collection was performed after homogenizing the must/wine in stainless-steel tanks. The values of the relevant physicochemical parameters (glucose/fructose, ethanol, pH, total acidity, volatile acidity, and malic acid) were automatically read by the instrument and stored in a specially installed program on a laptop connected to the OenoFoss module.

To determine free SO₂, 20 ml of the wine to be analyzed was placed in a Berzelius flask, and then 1 ml of 1:5 H₂SO₄ was added using a pipette, along with 5 drops of a 1% amine salt solution. The prepared Berzelius flask was placed over a light bulb emitting white light and agitated slowly, continuously, and consistently. During this process, a manual or automated pipette was used to titrate a 0.025 N-N/40 iodine solution until the colour of the wine began to change gradually to a violet hue. At this point, the titration was stopped, and the volume of iodine dispensed was read from the pipette. This value was multiplied by 40 to obtain the concentration of free SO₂ in mg/l. Bound SO₂ was released by treating the wine sample with a 4 N NaOH solution.

The technology used in the winery for fermenting the must involves vertical cylindrical tanks made of stainless steel, equipped with sensors to monitor temperature. This allows for the control of every stage of fermentation to ensure the production of quality wines (keeping the temperature below 20 °C for white wines and below 25 °C for red wines, in accordance with D.O.C. Miniş regulations). This technology influences the rate of the fermentation process and the growth rate of the yeast.

To determine the organoleptic properties of the wines produced from the varieties 'Fetească Regală', 'Mustoasă de Măderat', 'Merlot', and 'Cabernet Sauvignon' studied in the Miniş-Măderat vineyard area, a tasting session was conducted with ten local viticulturists and oenologists. They analyzed the following characteristics: appearance, colour, aroma, and taste for each wine variety.

Results and discussions

The analysis of grape parameters for the year 2024 was conducted on the variety "Fetească Regală" from August 18 to September 2. A significant increase in sugars was observed, rising from 19.70 to 21.90 °Brix. There was a decrease in the total acidity value from 5.25 to 4.30 g/l H₂SO₄, and the pH recorded values ranging from 3.12 to 3.31. Tartaric acid decreased from 8.2 g/l to 7.1 g/l, while malic acid declined from 1.8 g/l to 0.3 g/l. For the variety "Mustoasă de Măderat", the analysis of grape parameters in 2024 was performed from August 28 to September 8. An increase in sugars was noted, from 16.50 to 18.70 °Brix, along with a reduction in total acidity from 7.23 to 5.85 g/l H₂SO₄. The analysis of grape parameters for the variety "Merlot" took place between August 23 and September 7, 2024. Sugars increased over the two-week period from 21.00 °Brix to 23.20 °Brix, while total acidity decreased from 5.96 g/l to 4.60 g/l H₂SO₄. The pH values ranged from 3.06 to 3.25, with tartaric acid decreasing from 9.3 g/l to 7.2 g/l and malic acid ranging from 0.2 g/l to 0.6 g/l. For the variety "Cabernet Sauvignon", the analysis was conducted from August 23 to September 12, 2024. An increase in sugars was noted, from 18.20 to 22.80 °Brix, along with a decrease in total acidity from 5.98 g/l to 4.70 g/l H₂SO₄. The pH recorded values between 2.96 and 3.40, with tartaric acid decreasing from 9.2 g/l to 7.3 g/l, and malic acid decreasing from 2.4 g/l to 0.3 g/l.

The analysis of the physicochemical properties of wines from 2024 growing season revealed that the alcohol content was notably high in red varieties, measuring 13.72% vol. alc. for 'Merlot' and 13.43% vol. alc. for 'Cabernet Sauvignon', while it was within normal limits for 'Fetească Regală' at 12.86% vol. alc. and lower for 'Mustoasă de Măderat' at 10.98% vol. alc. The residual sugar remaining after fermentation indicates the production of dry wines; specifically, 'Merlot', 'Cabernet Sauvignon', and 'Fetească Regală', all with an alcohol content exceeding 11%, fall within the standards for D.O.C. Miniş wines. However, the wine produced from 'Mustoasă de Măderat' did not meet the D.O.C. criteria in 2024. The lowest total acidity was recorded in the wine from the 'Fetească Regală' variety (4.29 g/l H₂SO₄), followed closely by 'Merlot' and 'Cabernet Sauvignon', which had similar values (4.60 g/l H₂SO₄ and 4.64 g/l H₂SO₄, respectively). The highest acidity was noted in the wine from the 'Mustoasă de Măderat' variety (5.80 g/l H₂SO₄).

'Fetească Regală' young wine from 2024 was described as clear with a yellow-green colour, a subtle aromatic bouquet featuring notes of wildflowers and summer apples, and a taste that was characterized as savoury, fruity, floral, fresh, and balanced. 'Mustoasă de Măderat' was characterized as a white wine with a bright and clear appearance, displaying a yellow-green hue, and possessing a fresh flavour reminiscent of grapevine and green pears. Its taste was described as fresh and refreshing, attributed to its pronounced acidity, with herbaceous notes. The 'Merlot' wine was noted for its clarity and transparency, exhibiting a ruby-red colour with violet reflections, a pronounced flavour of forest fruits, cherries, and blueberries, and a very appealing taste that was slightly bitter, with soft tannins, a full body, and flavours of red fruits. 'Cabernet Sauvignon' was appreciated for its translucent appearance, featuring a red-currant colour, aromas of black forest fruits, and a complex, tannic taste with woody vegetal notes and hints of currants.

The relationship between various quality parameters in the studied grape varieties was illustrated through the configuration of a PCA diagram.

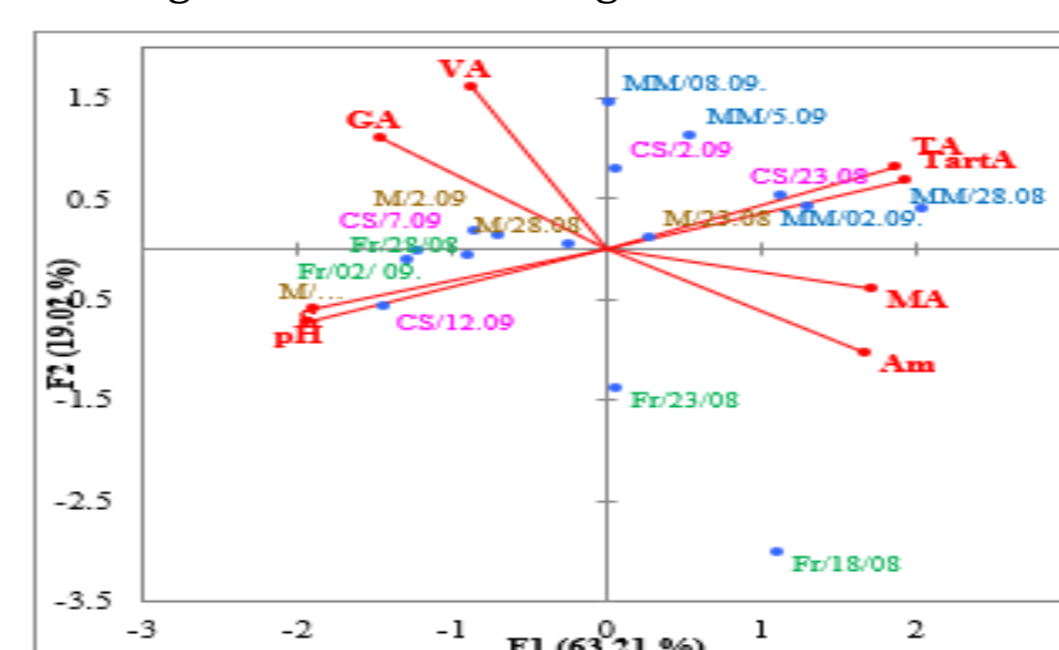


Figure 1. PCA diagram of quality parameters for Fetească Regală (Fr), Mustoasă de Măderat (MM), Merlot (M), Cabernet Sauvignon (CS) across different sampling dates; (S – sugars; TA – titratable acidity; TartA – tartaric acid; MA – malic acid; VA – volatile acidity; GA – gluconic acid; Am – ammonia)

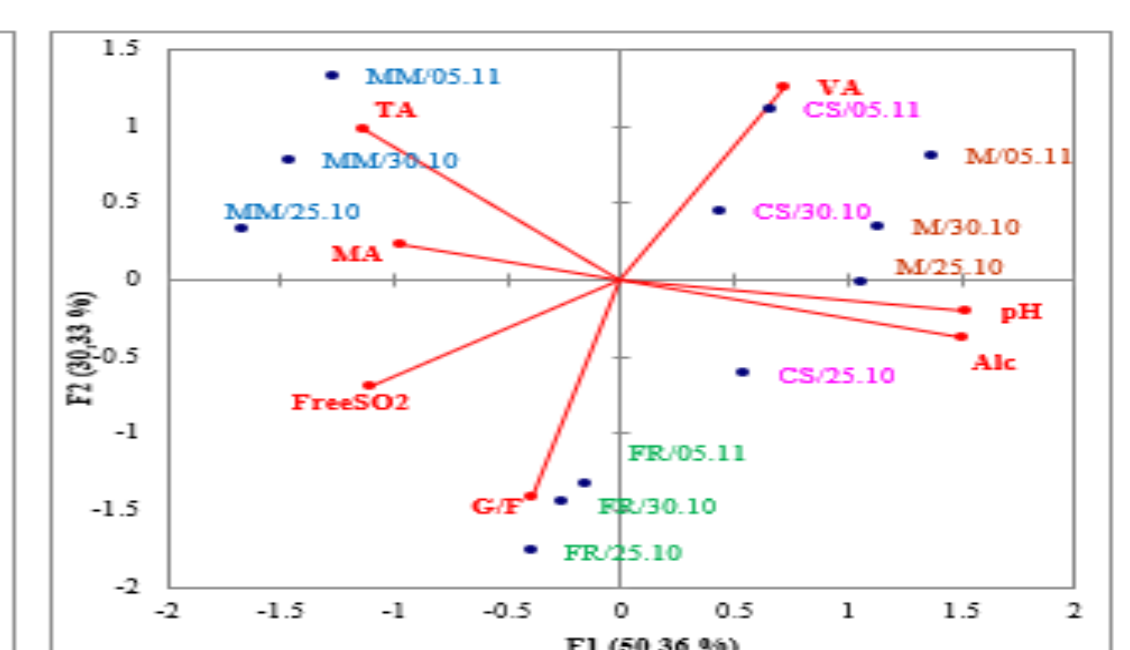


Figure 2. PCA diagram of quality parameters for Fetească Regală (Fr), Mustoasă de Măderat (MM), Merlot (M), Cabernet Sauvignon (CS) across different sampling dates; (G/F – Glucose/Fructose; TA – titratable acidity; MA – malic acid; VA – volatile acidity; GA – gluconic acid; Alc – alcohol)

Conclusions

Compared to red grape varieties, the dynamics of sugar accumulation in white grape varieties were lower. At the time of harvest, the sugar content in white varieties exceeded 187 g/l, while for red varieties it was over 204 g/l, values specified by the standards for grape quality at harvest in the specifications for the production of wines with controlled designation of origin (D.O.C.) Miniş. The sugars in the grape must decreased during the fermentation process to a residual value of 1.5–2.2 g/l, indicating the production of dry wines. The alcohol volume exceeded 11% for the varieties 'Fetească Regală', 'Merlot', and 'Cabernet Sauvignon', meeting the minimum natural alcohol strength required by the D.O.C. Miniş standards. However, the 'Mustoasă de Măderat' variety, with an alcohol content of 10.98% vol. alc., did not meet this criterion in 2024. The 'Mustoasă de Măderat' variety recorded the highest total acidity but remained within the typical characteristics of the variety and the cultivation area. Following the organoleptic evaluation of the resulting white and red wines, it was determined that the wines exhibited the characteristics and specificity of each analyzed variety. The PCA analysis provides valuable insights into the ripening process and quality profiles of different grape varieties. It reveals that sugar content increases while titratable acidity, malic acid, and ammonia decrease as grapes mature, following a typical ripening pattern. Each variety exhibits distinct compositional characteristics: Fetească Regală is marked by higher free SO₂ and residual sugars, Mustoasă de Măderat by high acidity, 'Cabernet Sauvignon' by elevated volatile acidity, and 'Merlot' by a balanced profile with moderate pH and alcohol levels. These findings can guide optimal harvest timing and winemaking strategies to enhance the quality of each grape variety.