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THE AROMATIC PROFILE OF WHITE WINES OBTAINED FROM BIODYNAMIC AND CONVENTIONAL GROWN GRAPES IN ROMANIA

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ABSTRACT. This study analyses the differences between wines obtained from grapes cultivated conventionally and those cultivated biodynamically. The wine samples studied were obtained from Rhein Riesling, Italian Riesling, Muscat Ottonel and Chardonnay grape varieties. Among these, four variants (one from each grape variety) were obtained from grapes following conventional cultural technologies, while the rest were from the same grape varieties cultivated biodynamically. All grapes and wines were produced in the Murfatlar vineyard, in south-east Romania. Basic chemical and sensorial analyses were applied to evaluate the differences appearing between the conventional and organic wine samples. All sets of data, PCA analysed, underlined that there are no systematic differences between the two grape cultivation methods and the obtained products.

Keywords: biodynamic grapes; organic vs. conventional wine; chemical composition; sensory profile.

INTRODUCTION

With extensive tillage practices and the use of synthetic pesticides and fertilizers, humans have destroyed the soil structure as well as the microbiota capable of maintaining an equilibrium between high-volume production and preservation of the beneficial properties of the environment (Waldin, 2016). As a solution to this problem, in the early 1920s, Steiner developed the idea of biodynamics in agriculture. It is very often compared to organic agriculture, but it has some distinctive traits. Biodynamic farming does not allow the use of synthetic pesticides and fertilizers in the same manner as certified organic farming and also focuses at the same time on creating a self-sufficient and healthy ecosystem. A biodynamic farm is thought to be a living organism, and its farming practices follow six guidelines: plant diversity, crop rotation, composting, homeopathic fertilizers, animal life and seasonal and planetary cycles (Steiner, 1993).

As the above-mentioned trend evolved, it was included in the viticultural field as well. Consumers that show interest in the issues of sustainability and health of food and beverages can now choose to drink wines that are products of sustainable practices, considerate of the ecosystem that surrounds them (Castellini *et al.*, 2017). Biodynamics is considered to be the closest approach to practising sustainable viticulture, but it is also considered quite extreme compared to organic viticulture. The difference between organic and biodynamic viticulture consists first of all in regulations. Organic viticulture functions according to a specific set of rules (EU Council Regulation EC No 834/2007 and EC Reg No 203/2012) that need to be respected, while biodynamic viticulture is a more voluntary process without external influences, although Demeter International requests that wine be organic before being biodynamic (Demeter Standard, 2021). Until 2012, the legislation permitted the grapes to be organic and the wine labelled as “derived from organic grapes” if the grapes were vinified as conventional wine, but at present this is no longer permitted.

Compared to organic and conventional wines, for which oenologists are allowed to intervene in the winemaking process, in biodynamic wines the oenologist’s intervention is minimal to none, but this does not mean that the wines are left to chance. The kinetics of the alcoholic fermentation is followed closely, and when necessary, a slight aeration of the wines is required, through an open racking to provide support for the yeasts. It is known that hygiene is very important in winemaking, but it is vital in the case of biodynamic wines. In the specific literature, certain requirements of biodynamic viticulture are mentioned rather than allowed processed for biodynamic wine (Delmas *et al.*, 2016). Although Demeter International has established a set of rules in this sense, a specific technology for these wines is not yet very precise.

The present study sought to analyse if there are any notable differences between the sensory profile of the organic and conventional wines analysed and if, in a larger sense, consumers would opt for organic wines because they taste better than conventional wines or not.

MATERIALS AND METHODS

Wine Samples

Eight wine samples were studied, as shown in *Table 1*.

Table 1 - Sample characteristics

Wine sample	Grape variety	Sugars in must (g/L)	Total acidity in must (g/L tartaric acid)
		Organic wines	
V1	Rhein Riesling	221	7.10
V2	Italian Riesling	217	6.80
V3	Chardonnay	240	8.54
V4	Muscat Ottonel	230	6.75
		Conventional wines	
V5	Rhein Riesling	224	7.83
V6	Italian Riesling	219	6.47
V7	Chardonnay	234	8.30
V8	Muscat Ottonel	227	7.10

The samples were classified into two categories according to the Law of Vine and Wine no. 164/2015: wines obtained from grapes grown in a conventional system and those grown in a biodynamic one.

For the organic wine, the European Union Regulation (EEC) No. 2092/91 was applied. The organic grapes were provided by certified organic vineyards with biodynamic viticultural practices. The main difference between organic and conventional viticulture practices is the avoidance of chemicals such as pesticides in organic viticulture practices. The conventional grapes were provided by wineries that did not specify or affirm the use of organic and/or sustainable agricultural practices.

All samples were obtained from grapes cultivated in Murfatlar vineyard, in SE Romania, an area that is rich in helio-thermal resources. The wines were all obtained in the same harvest year (2021). The same yeast was used for all samples, namely ZYMAFLORE® 011 BIO, at a dose of 20 g/hL.

V1; V5 - Rhein Riesling is a white grape variety used to obtain high quality wines. The common characteristics are light body and aromas of citrus, stone fruit and hints of petrol (Puckette, 2018).

V2; V6 - Italian Riesling is a white grape variety used to obtained qualitative wines, usually with a pleasant freshness, with Mediterranean fruitiness and aromas of fresh hay, peaches, with a slight, mellow bitterness in the end (Cotea *et al.*, 2003).

V3; V7 - Chardonnay is a white grape variety with French origins from Burgundy. Wines usually exhibit buttery notes, tropical flavours and yellow fruit hues (Oprea *et al.*, 2000).

V4; V8 - Muscat Ottonel variety accumulates the highest amounts of sugar, which helps to yield aromatic wines with a grapey taste as well as notes of apricot, honey and pear (McKenzie, 2021).

Approximately 50 kg of grapes were processed in individual batches, so that the resulting wines were 100% mono-varietal. In order for the experiment to have a chance of success, the eight variants were vinified using the same technologies. The grapes were harvested in the same day. They were passed through a destemmer-crusher, after which they were pressed. After 24 hours, the clear must was transferred into another tank, where fermentation continued. For the alcoholic fermentation, a neutral yeast, in dry form (ZYMAFLORE® 011 BIO from Laffort) was chosen, so as not to overly influence the aroma of the wine. The chosen yeast had to be accepted for the production of organic wines. The same yeast was used for all of the samples. The fermentation took place at 14-15°C for two weeks. The obtained wines were treated with sulphur dioxide as follows: 1 ml/L SO_2 in aqueous solution 6% for organic wines and 1.5 ml/L SO_2 for conventional wines.

At the end of the alcoholic fermentation, the wine was kept on fine yeast deposit for 20 days and sulphited with the following doses: 15 mg/L for organic wines and 20 mg/L for conventional wines. Spontaneous malolactic fermentation may have occurred in some samples. After *batonnage*, all wine samples were filtered and stored in stainless steel vessels from which oxygen was removed with the help of dry ice and then kept full. The wines were bottled after five months.

Chemical Analyses

As chemical composition can strongly influence the sensorial characteristics of wines, these analyses were performed first (Martin *et al.*, 2011). The basic chemical analyses of the organic and conventional wine samples, from the 2021 harvest, were performed at the Oenological Research Center of the Romanian Academy, Iași Branch, according to the International Organization of Vine and Wine Compendium methods of analysis (OIV, 2022): alcoholic strength (% vol.; OIV-MA-AS312-01B); total acidity (g/L tartaric acid; OIV-MA-AS313-01); free and total sulphur dioxide (mg/L; OIV-MA-AS323-04B); residual sugars (g/L; OIV-MAAS311-01A); density (OIV-MAAS2-01B); and free and total sulphur dioxide (mg/L; OIV-MA-AS323-04B). All chemical analyses were performed in triplicate, and the standard deviation was calculated.

Sensorial Analysis

Sensorial analysis of wine highlights the quality of a wine, using the sense organs for sight, smell, taste and tactile sense. In the sensory evaluation of the wines analysed in this study, 21 evaluators participated, of which 10 were experienced tasters, members of the Romanian Association of Wine Tasters. Each person participating in the tasting noted each specific sensorial indicator with bonification points from 0 to 9, and a mean for each sensorial index of all results was calculated (Moroșanu *et al.*, 2018). A tasting sheet with all the organoleptic parameters was created and given to the tasters to complete. Visual evaluation was done by analysing the colour of the wine in contact with the glass when held at an angle of 45° in natural light, so that the tasters could determine whether the wine has a green-white, yellow-white, straw-yellow or amber colour. Visual bonification points were given only for the intensity of the wine's colour. The other attributes, such as clarity and brightness, were considered as having the maximum bonification points, because all the wines were clarified and filtered before the sensory analysis.

All sensory profile data are reported as means ± standard deviation. The form used for evaluation of olfactive and gustatory descriptors can be seen in supplementary file 1.

Statistical Analysis

Statistical analysis of the data was performed using "Orange 3" statistical software, while the statistical test applied was principal component analysis (PCA). Statistical analysis of the sensorial evaluation revealed that the samples could be grouped according to grape variety but also taking into account the organic or conventional methods of cultivation.

RESULTS

Chemical Analyses

All chemical analyses of the analysed wine samples are shown in *Table 2*.

Sensorial Analysis

A sensorial analysis of the studied wines was performed, taking into account perceived colour (*Table 3*) but also olfactory (*Table 4, Table 5* and *Table 6*) and taste descriptors (*Table 7*).

Table 2 - Chemical composition of the experimental white wines

Sample	V1	V2	V3	V4	V5	V6	V7	V8
Alcohol concentration (% vol.)	12.50± 0.05	12.44± 0.01	13.80± 0.07	13.20± 0.04	12.72± 0.02	12.52± 0.07	13.50± 0.01	13.45± 0.05
Volatile acidity (g/L acetic acid)	0.32± 0.05	0.34± 0.03	0.38± 0.07	0.26± 0.02	0.25± 0.01	0.20± 0.05	0.31± 0.02	0.22± 0.01
Total acidity (g/L tartaric acid)	5.90± 0.02	5.10± 0.07	7.30± 0.02	5.08± 0.02	6.10± 0.02	5.40± 0.01	6.92± 0.01	5.85± 0.01
pH	3.26± 0.02	3.45± 0.05	3.36± 0.01	3.37± 0.05	3.28± 0.05	3.15± 0.03	3.42± 0.05	3.35± 0.03
Lactic acid (g/L)	0.10± 0.03	0.61± 0.01	0.15± 0.01	BDL*	0.25± 0.03	0.57± 0.05	0.32± 0.07	0.22± 0.06
Malic acid (g/L)	0.84± 0.02	1.00± 0.01	3.00± 0.07	1.1± 0.01	0.87± 0.05	0.79± 0.02	0.84± 0.05	0.61± 0.02
Residual sugars (g/L)	0.61± 0.02	0.55± 0.00	0.32± 0.01	0.330± 0.07	0.59± 0.02	0.48± 0.06	0.53± 0.06	0.52± 0.03
Free SO_2 (mg/L)	28.9± 0.07	24.2± 0.01	25.8± 0.01	27.40± 0.07	32.3± 0.05	29.8± 0.05	33.2± 0.02	29.8± 0.06
Total SO_2 (mg/L)	78.2± 0.05	76.1± 0.06	73.20± 0.07	83.3± 0.01	87.2± 0.00	81.5± 0.02	88.6± 0.03	85.9± 0.05

*BLD, below limit of detection (<0.01 mg/L)

Table 3 - Mean bonification points obtained after visual evaluation

Characteristic	V1	V2	V3	V4	V5	V6	V7	V8
Colour intensity	3.58± 0.11	3.77± 0.5	4.96± 0.12	3.84± 0.08	3.85± 0.7	3.92± 0.10	5.21± 0.13	4.23± 0.09

PCA plots obtained from sensorial analysis showed a discrimination of samples according to the grape variety (*Figures 1, 2, 3* and *4*).

DISCUSSION

Differentiation between wines obtained from grapes grown with a conventional cultivation method and those using organic methods have been analysed using many methods, taking into account colour, phenolics and aroma, among other qualities (Bunea *et al.*, 2012; Mulero *et al.*, 2009; Vrček *et al.*, 2011). Few studies, as far as the authors know, are directed towards a differentiation according to sensorial analysis, as well as the basic chemical composition of the wine samples.

The maturity level of the grapes (*Table 2*) shows that the grapes had not reached full maturity. Although 2021 was a normal year from a climatic point of view, the grapes reached full maturity in mid-September, but for technical reasons, they were harvested two weeks earlier for this experiment, at the end of August. The Italian Riesling and Chardonnay varieties had the highest acidity, and this was also due to the typicality of the variety. The Muscat

Ottonel variety acquires a higher acidity in the Murfatlar vineyard than in other regions of the country, and this may also be due to the calcareous soils on which it is grown. The grapes were harvested so that the potential alcoholic strength of the wines would not exceed 14% vol., especially because wines with an equilibrated alcoholic strength are preferred by consumers.

The results of the chemical analysis underline important aspects (*Table 2*). Ethanol concentration ranged from 12.44±0.01%-13.80±0.07% volume for all wines and was within the range of quality wines, according to Vine and Wine Law no. 164/2015, which states that all samples should be above 10 % volumes. The pH for organic and conventional wines varied between 3.26±0.02-3.45 ±0.05 and 3.15±0.03-3.42±0.05, respectively.

The differences between the alcohol values were due to the used raw matter, with a higher content of sugars, specific to each grape variety, but also to the yeast strains used during the alcoholic fermentation (*Table 1*).

Considering that all of the grapes were harvested simultaneously in carrying out this experiment, the differences may stem from varietal characteristics, but could also depend on the agrotechnological characteristics of the vineyards (e.g. the way the rows are placed or exposure to sunlight).

Analysing the reductive sugar content, all of the samples had fermented to dryness, with a sugar content of less than 1 g/L. This trend is more and more visible in fresh, young wines. In terms of total acidity, the variants obtained from Chardonnay grapes have the highest values, but the V3 sample, an organic wine, registered 7.30±0.02 g/L tartaric acid, unlike its conventional counterpart, the V7 sample, for which the value is lower (6.92±0.01 g/L tartaric acid). This difference is important, as acidity can influence the freshness of the samples, particularly when the raw matter is obtained in the warm, southern part of Romania.

Malolactic fermentation was not performed for any sample; this can be seen from the low values, below the detection limit of the device for lactic acid, although for the V3 version this fermentation would have been recommended because it would have reduced the harshness of the acidity. For wines obtained from Chardonnay grapes, malolactic fermentation is recommended because it provides softness, and the wine responds well to this type of fermentation, as has been found by many experimental studies (Tassoni, 2013). The V3 sample had the highest malic acid content (3±0.07 g/L value), which would corroborate later with the green apple aromas. A minimal amount of sulphur dioxide was added to provide protection over time to the wine; this is not allowed for biodynamic wine, but it is permitted in organic wines, even if in smaller quantities than in conventional wine. The values for free sulphur dioxide range between 28.9±0.07 mg/L in the V1 sample and 24.2±0.01 mg/L in the V2 sample for the organic wines, and between 29.8±0.05 mg/L for the V6 sample and 33.2±0.02 mg /L for the V7 sample for conventional wines. The wines obtained in a conventional manner also have higher values for total sulphur (*Table 2*). Comparing the results with legislation, all of the samples taken in the study comply with the rules stipulated in the Law of Vine and Wine number 164/2015 for their wine category.

Following the visual evaluation, from the average bonification points presented in *Table 3*, it was noticed that most of the analysed samples have a colour intensity that can be described as yellow-green, except for samples V3 and V7, represented by the Chardonnay wine, which are characterised by yellow hues, less green tones, which is a colour specific to the grape variety. In terms of clarity and shine, all of the wine samples obtained maximum points, because of the procedure applied before bottling (filtration and fining). After performing the visual analysis, the wines were evaluated from an olfactory point of view, depending on different descriptors. The average bonification points obtained by quantifying the olfactory evaluation of fruity and herbaceous notes can be found in *Table 4*, and the average bonification points of floral and mineral notes are presented in *Table 5*.

Table 4 - Mean bonification points for sensorial profile of fruity and herbaceous descriptors

Sensorial descriptor	V1	V2	V3	V4	V5	V6	V7	V8
Green apple	2.67± 0.50	3.67± 0.43	3.76± 0.23	2.48± 0.42	2.85± 0.12	3.43± 0.60	3.65± 0.37	2.98± 0.42
Baked apple	2.38± 0.60	2.67± 0.47	2.48± 0.12	2.62± 0.37	2.33± 0.42	2.59± 0.43	3.74± 0.47	3.15± 0.36
Lemon/lime	2.19± 0.25	2.67± 0.40	2.57± 0.36	2.62± 0.23	2.38± 0.42	2.19± 0.36	2.48± 0.12	2.86± 0.20
Peach	1.48± 0.36	1.76± 0.37	2.43± 0.47	2.90± 0.42	1.57± 0.37	1.67± 0.50	2.65± 0.36	2.85± 0.60
Apricot	1.57± 0.43	1.71± 0.25	2.33± 0.42	2.29± 0.36	1.63± 0.40	1.84± 0.43	2.45± 0.45	2.34± 0.37
Pear	1.90± 0.43	2.86± 0.47	2.00± 0.36	2.19± 0.47	2.00± 0.21	2.97± 0.50	2.13± 0.36	2.00± 0.36
Pineapple	2.10± 0.23	1.81± 0.37	2.95± 0.50	1.95± 0.47	1.81± 0.40	2.19± 0.36	2.90± 0.43	2.34± 0.45
Quince	2.48± 0.36	1.48± 0.42	1.52± 0.50	1.90± 0.60	2.38± 0.40	1.85± 0.43	2.00± 0.37	1.76± 0.36
Grape (Muscat)	2.19± 0.47	1.71± 0.42	2.14± 0.21	2.81± 0.40	1.90± 0.50	2.00± 0.43	1.71± 0.50	2.97± 0.42
Freshly mown hay	1.76± 0.40	2.87± 0.25	2.13± 0.36	1.67± 0.43	1.97± 0.42	2.90± 0.78	2.25± 0.50	1.97± 0.36
Asparagus	1.14± 0.43	2.87± 0.50	1.95± 0.69	2.33± 0.60	1.00± 0.36	2.67± 0.50	1.43± 0.37	1.76± 0.43
Fennel	0.86± 0.37	1.48± 0.40	1.24± 0.18	1.90± 0.50	0.78± 0.40	1.12± 0.50	0.94± 0.23	1.18± 0.60
Green bell pepper	2.19± 0.43	1.29± 0.40	1.29± 0.60	1.05± 0.40	1.85± 0.37	0.98± 0.43	1.10± 0.50	0.87± 0.40
Tea leaves	2.43± 0.32	1.67± 0.40	1.86± 0.23	2.48± 0.37	2.20± 0.50	1.26± 0.43	1.98± 0.50	2.10± 0.69
Basil	1.38± 0.32	2.33± 0.37	1.57± 0.18	2.14± 0.43	1.52± 0.42	2.10± 0.50	1.10± 0.40	1.85± 0.46

Table 5 - Mean bonification points for sensorial profile of floral and mineral descriptors

Sensorial descriptor	V1	V2	V3	V4	V5	V6	V7	V8
Elder tree flower	2.48± 0.32	2.71± 0.25	2.95± 0.23	3.48± 0.37	2.71± 0.23	3.10± 0.32	3.45± 0.26	3.87± 0.23
Acacia	1.57± 0.26	1.76± 0.21	2.81± 0.25	3.29± 0.25	1.54± 0.32	2.10± 0.35	2.95± 0.21	3.46± 0.18
Vine flowers	1.90± 0.23	2.33± 0.32	2.95± 0.18	2.62± 0.40	2.10± 0.21	1.90± 0.32	2.27± 0.25	2.64± 0.25
Wild flowers	2.71± 0.32	3.00± 0.21	2.71± 0.43	2.76± 0.23	2.94± 0.25	3.27± 0.18	3.23± 0.37	2.56± 0.32
Dried flowers	2.14± 0.21	2.19± 0.23	1.57± 0.18	1.48± 0.32	2.25± 0.26	1.97± 0.50	1.67± 0.23	2.45± 0.18
Clay	1.95± 0.18	1.62± 0.35	1.52± 0.21	1.95± 0.25	1.75± 0.26	1.54± 0.43	1.47± 0.32	1.25± 0.25
Earthy	1.33± 0.18	1.57± 0.32	1.33± 0.25	1.81± 0.26	1.25± 0.18	1.37± 0.37	1.10± 0.21	1.76± 0.23
Chalk	1.48± 0.32	1.10± 0.23	1.29± 0.18	1.62± 0.78	1.34± 0.23	1.00± 0.32	1.10± 0.26	1.33± 0.21
Iodine	1.15± 0.21	1.52± 0.25	1.43± 0.32	1.33± 0.60	1.10± 0.42	1.35± 0.23	1.29± 0.78	1.00± 0.21

Analysing the sensorial analysis values, it was noticed that the wines were not characterised by extreme bonification points, leading to the deduction that the samples were elegant and equilibrated.

Some common characteristics were underlined, with similar bonification points, such as green apple, ripe apple and lemon/lime (*Table 4*). The green apple note may be more pronounced due to a higher content of malic acid. The citrus note usually defines a high acidity and is given by 3-mercaptohexanol (3MH) (Tominaga *et al.,* 2000), and the apricot or peach note indicates a certain over-ripeness of the grapes used to produce these wines.

In the case of organic samples V1, V2, V3, V4, a lower intensity in the fruity descriptors was registered than that characteristic of the samples of conventional wines - V5, V6, V7 and V8 - but overall, there were no significant differences. Although the herbaceous descriptors were registered in all samples, as can be seen in *Table 4*, higher bonification points were registered for asparagus and green bell pepper in the organic samples. The vegetal characteristics present in wines can have both a positive and a negative aspect, depending on the intensity of these aromas. In *Figure 1*, the differences between fruity and herbaceous notes were highlighted, comparing the organic wines samples with conventional wines samples obtained from the same variety. A PCA analysis of the wines from a sensorial point of view, when taking into consideration the vegetal and fruity descriptors (*Figure 1*) of the analysed samples, shows good discrimination according to the grape varieties used, as was found by others as well (Nicolescu *et al.*, 2021), but not according to the grape cultivation method.

Table 6 - Mean bonification points for sensorial profile of defects

Sensorial descriptor	V1	V2	V3	V4	V5	V6	V7	V8
Oxidized	1.62± 0.37	1.76± 0.18	2.52± 0.22	1.24± 0.37	1.10± 0.21	1.25± 0.42	1.75± 0.14	0.92± 0.51
Reductive	2.52± 0.14	1.95± 0.32	2.33± 0.14	2.14± 0.34	1.37± 0.20	1.10± 0.23	1.33± 0.53	1.48± 0.51

Table 7 - Mean bonification points from sensorial gustatory evaluation

Sensorial descriptor	V1	V2	V3	V4	V5	V6	V7	V8
Sweet	2.38± 0.10	1.14± 0.38	1.48± 0.50	2.10± 0.45	2.20± 0.42	1.95± 0.32	1.25± 0.14	1.54± 0.37
Acid	4.24± 0.18	4.33± 0.40	5.10± 0.18	4.33± 0.42	4.33± 0.37	3.95± 0.60	4.85± 0.26	4.10± 0.40
Bitter	2.24± 0.26	2.38± 0.37	2.57± 0.21	0.38± 0.40	1.75± 0.14	1.95± 0.36	2.15± 0.18	1.65± 0.37
Salty	1.90± 0.27	1.95± 0.38	2.14± 0.28	2.14± 0.26	2.10± 0.14	1.85± 0.18	1.75± 0.37	1.97± 0.14
Persistence of the aftertaste	3.10± 0.44	3.90± 0.26	4.24± 0.18	4.33± 0.27	3.95± 0.36	4.10± 0.27	4.56± 0.25	4.25± 0.46
Structure (taste balance)	3.33± 0.21	3.95± 0.38	3.86± 0.25	3.76± 0.14	3.56± 0.36	4.15± 0.30	3.95± 0.42	3.85± 0.21

Bonification points for olfactory evaluation of floral and mineral notes are registered in *Table 5*. Elder tree flower and acacia flower were evaluated with higher intensity in the Muscat Ottonel variety, V4 and V8, with a higher mean for the conventional wine (V8). Evaluation of mineral notes is presented in *Table 5*: earthy aromas have bonification points between 1.10±0.21 (V7) and 1.81±0.26 (V4); for chalk, the bonification points ranged between 1.00±0.32 (V6) and 1.62±0.78 (V4); for iodine the bonification points ranged between 1.00±0.21 (V8) and 1.52±0.25 (V2). In *Figure 2*, the differences of the herbaceous and mineral notes are highlighted, comparing the organic wines samples with conventional wines samples obtained from the same variety. Statistical analysis (i.e. PCA tests), as can be seen in *Figure 2*, which shows that in the case of mineral descriptors, discrimination occurred according to grape variety, but not according to the organic or conventional grape cultivation method. A lesser discrimination according to the cultivation method of the raw material for wines was also found in other articles (Tobolková *et al.*, 2014).

The presence of defects was analysed and the results are shown in Table, using oxidized and reductive smells as parameters. All of the wines taken intro study obtained bonification points below 2.52 for oxidization and reductive smell, suggesting that the wines were healthy and with none or low intensity in unpleasant odours.

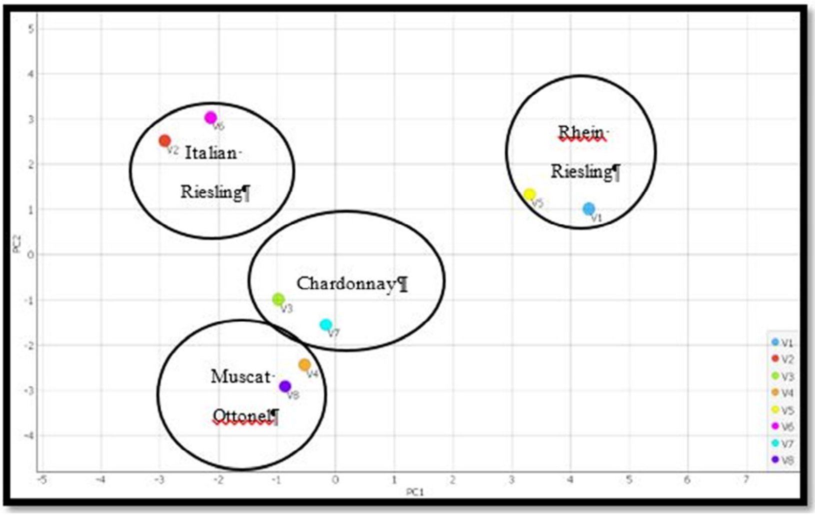

Figure 1 - PCA discriminant plot of vegetal and fruity descriptors

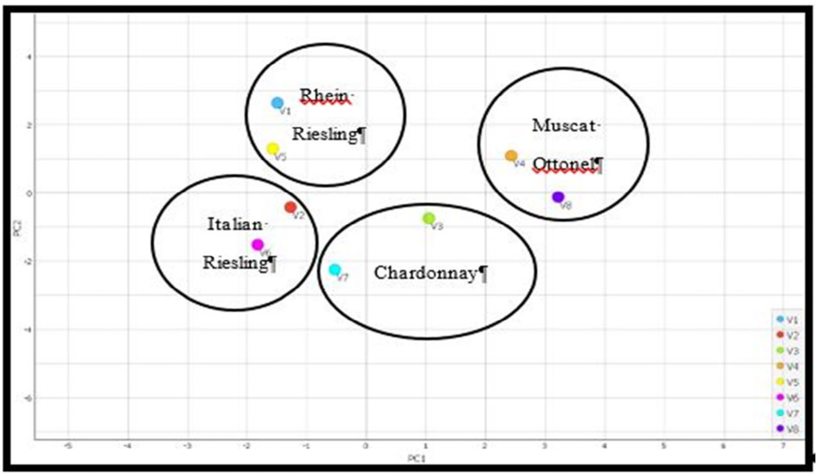

Figure 2 - PCA discriminant plot of mineral descriptors

The evaluators mentioned that these unwanted odours, if present, disappeared after the wines were aerated for a few minutes. Statistical analysis (i.e. PCA tests), as can be seen in *Figure 3*, revealed that in the case of wine faults, discrimination occurred both according to grape variety and according to the grape cultivation method. The highest bonification points were obtained for the sour/acid taste among taste characteristics (*Table 7*), which is due to the acidity of the wines, but it bears remembering that this taste is specific to young wines. In terms of taste persistence, represented by the amount of time it remained perceptible after the wine was removed from the mouth, for organic wines the highest bonification points were obtained by the V4 sample with a mean of 4.33±0.27.

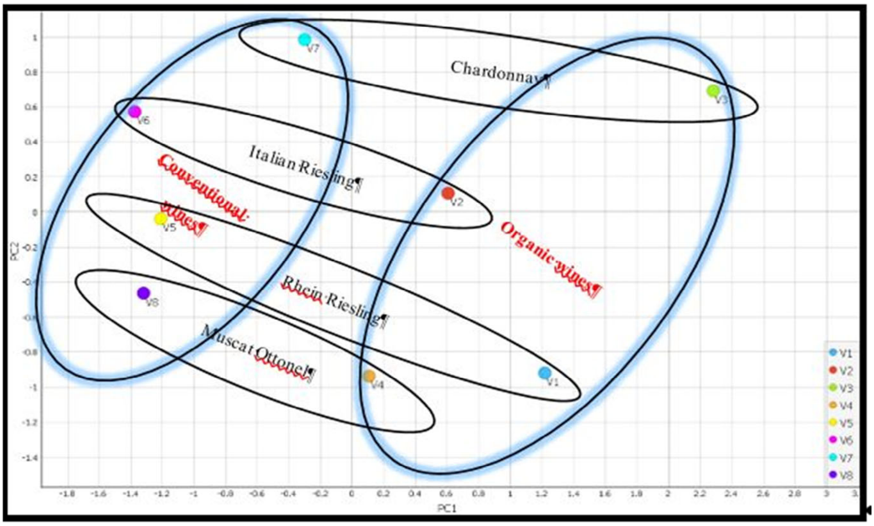

Figure 3 - PCA discriminating plot of wines according to faults

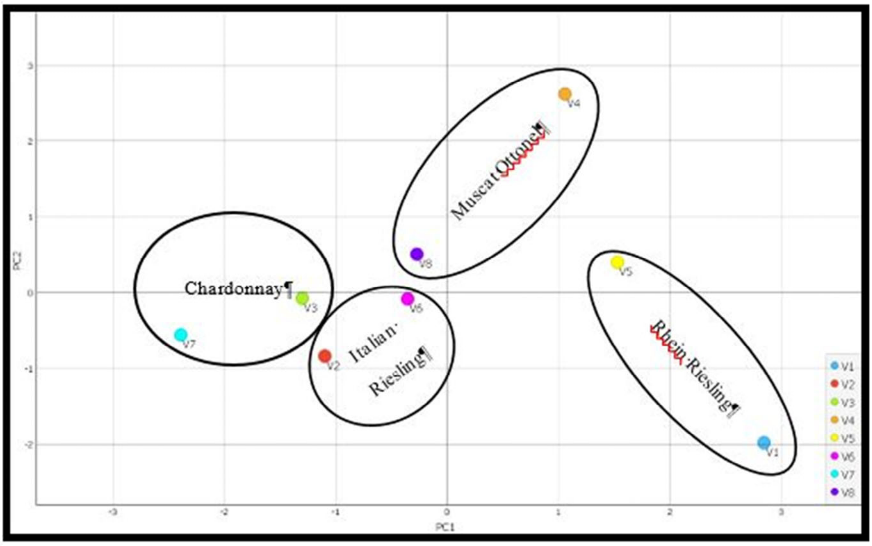

Figure 4 - PCA discriminant plot of wines according to gustative descriptors

Very close to this value, with an average of 4.24±0.18, was the V3 sample, and the lowest scoring was the Rhein Riesling wine, with a value of 3.10±0.44. For the conventional wines, the lowest mean value was obtained by the V5 sample (Rhein Riesling 3.95±0.36) and the highest by the Chardonnay (V7), with 4.56±0.25 bonification points. The taste balance perceived in the oral cavity was appreciated with similar bonification points for all of the analysed wine samples, between 3.33±0.21 for V1 - Rhein Riesling and 4.15±0.36 for V6 - Italian Riesling (*Table* 7). Statistical analysis (i.e. PCA tests), as shown in *Figure 4*, revealed that in the case of wine taste evaluation, the discrimination was obvious in the case of the grape variety used, less so for the method of grape cultivation (Vrček, 2011).

At the moment, there is still debate about whether ecological, organic and biodynamic wines are the same, better or worse than conventional wines. Although some oenologists say that ecological practices make wines better, some consumers remain sceptical (Delmas *et al.*, 2016); an increase in the prices of organic wines was also clearly noticed (Delmas *et al.*, 2010). The wine experts should, however, know if ecological practices and organic wines are superior to conventional ones. The fact that a smaller amount of sulphur dioxide is allowed in organic wines than in conventional wines may suggest that they are of lower quality, because sulphur dioxide, through its antioxidant and antiseptic properties, offers protection to wines (Waterhouse, 2016), but the results of this study show that there were no significant differences between these two types of wines.

CONCLUSIONS

The analysed chemical properties of conventional and organic wines showed small differences, that were not important statistically, as has been shown in previous research. Although several categories of aromas were discovered in the analysed wines, the bonification points they received were below 5 out of 9, most being between 0 and 3 points. This may be because the grapes from which the samples were obtained were not harvested at their specific maturity or because the permissible organic practices are not as effective in obtaining wines with more intense aromas. However, the organic wines have a more elegant, more equilibrated structure and sensorial profile.

Taking into account the data presented, further research should analyse whether the cultivation method of grapes (conventional or organic) can affect the identity and thus the typicality of wine. Furthermore, the quality of the final product is clearly influenced by the technology involved. In the current study, statistical analysis underlined the fact that the method of grape cultivation did not have an impact on the sensorial and chemical properties of the wines, but the grape variety did. In the future, these findings should be analysed and correlated with viticultural practices, knowing that the quality of the harvest influences the quality of the wine as well as oenological practices. Consumer choice is a matter of preferences, as the producer, the region or environmental concepts is of the utmost importance to their beliefs.

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REFERENCES

Bunea, C.I.; Pop, N.; Babeş, A.C.; Matea, C.; Dulf, F.V.; Bunea, A. Carotenoids, total polyphenols and antioxidant activity of grapes (*Vitis vinifera*) cultivated in organic and conventional systems. *Chemistry Central Journal*. **2012**, 6, 66. https://doi.org/10.1186/1752-153x-6-66.

Castellini, A.; Mauracher, C.; Troiano, S. An overview of the biodynamic wine sector. *International Journal of Wine Research*. **2017**, 9, 1-11. https://doi.org/10.2147/ijwr.s69126.

Cotea, V.D.; Barbu, N.; Grigorescu, C.C.; Cotea, V.V. The vineyards and wines of Romania (*in Romanian)*, Publishing House of the Romanian Academy, Bucharest, **2003**.

Delmas, M.A.; Grant, L.E. Eco-Labeling Strategies and Price-Premium. *Business & Society*. **2010**, 53, 6-44. https://doi.org/10.1177/0007650310362254

Delmas, M.A.; Lessem, N. Eco-Premium or Eco-Penalty? Eco-Labels and Quality in the Organic Wine Market. *Business & Society*. **2016**, 56(2), 318–356. https://doi.org/10.1177/0007650315576119.

Delmas, M.A.; Gergaud, O.; Lim, J. Does Organic Wine Taste Better? An Analysis of Experts' Ratings. *Journal of Wine Economics*. **2016**, 11, 329-354. https://doi.org/10.1017/jwe.2016.14.

Martin, K.R.; Rasmussen, K.K. Comparison of Sensory Qualities of Geographically Paired Organic and Conventional Red Wines from the Southwestern US with Differing Total Polyphenol Concentrations: A Randomized Pilot Study. *Food and Nutrition Sciences*. **2011**, 2, 1150-1159. https://doi.org/10.4236/fns.2011.210154.

McKenzie, H. Muscat Wine: Why This Multifaceted Grape Stands the Test of Time. **2021**, https://usualwines.com/blogs/knowledge-base/muscat-wine (accessed on 03 November 2022).

Moroșanu, A.; Luchian, C.E.; Niculaua, M.; Colibaba, C.L.; Tarțian, A.C.; Cotea, V.V. Assessment of Major Volatile and Phenolic Compounds from 'Fetească Regală' Wine Samples after Prefermentative Treatments using GC-MS Analysis and HPLC Analysis. *Notulae Botanicae Horti Agrobotanici Cluj-Napoca*. **2018**, 46, 247-259. https://doi.org/10.15835/nbha46110889

Mulero, J.; Pardo, F.; Zafrilla, P. Effect of principal polyphenolic components in relation to antioxidant activity in conventional and organic red wines during storage. *European Food Research and Technology*. **2009**, 229, 807-812. https://doi.org/10.1007/s00217-009-1117-x.

Nicolescu, M.C.; Bumbac, M.; Radulescu, C.; Buruleanu, C.L.; Olteanu, L.R.; Gorghiu, M.L.; Teodorescu, G.; Holban, G.C. Romanian Organic and Conventional Red Grapes Vineyards as Potential Sources of High Value-Added Products, in a Circular Economy Approach. In Grapes and Wine. Grapes and Wine, Edited by Antonio Morata, Iris Loira and Carmen González, 2022. https://doi.org/10.5772/intechopen.98972.

Oprea, A.; Indreaş, A. *Viticulture (in Romanian), First Edition*, Ceres Publishing House, Bucharest, 2000.

Puckette, M. The Taster's Guide to Riesling Wine. 2018, https://winefolly.com/deep-dive/the-tasters-guide-to-riesling-wine/ (accessed on 03 November 2022).

Steiner, R. *Spiritual Foundation for the Renewal of Agriculture*, Bio-Dynamic Farming and Gardening Association, Inc USA,1993, 101.

Tassoni, A.; Tango, N.; Ferri, M. Comparison of biogenic amine and polyphenol profiles of grape berries and wines obtained following conventional, organic and biodynamic agricultural and oenological practices. *Food Chemistry*. **2013**, 139, 405-413. https://doi.org/10.1016/j.foodchem.2013.01.041.

Tobolková, B.; Polovka, M.; Belajová, E.; Koreňovská, M.; Suhaj, M. Possibilities of organic and conventional wines differentiation on the basis of multivariate analysis of their characteristics (EPR, UV–Vis, HPLC and AAS study). *European Food Research and Technology*. **2014**, 239, 441-451. https://doi.org/10.1007/s00217-014-2237-5.

Tominaga, T.; Baltenweck-Guyot, R.; Gachons, C.P.D.; Dubourdieu, D. Contribution of Volatile Thiols to the Aromas of White Wines Made From Several *Vitis vinifera* Grape Varieties. *American Journal of Enology and Viticulture*. **2000**, 51, 178-181. https://doi.org/10.5344/ajev.2000.51.2.178.

Vrček, I.V.; Bojić, M.; Žuntar, I.; Mendaš, G.; Medić-Šarić, M. Phenol content, antioxidant activity and metal composition of Croatian wines deriving from organically and conventionally grown grapes. *Food Chemistry*. **2011**, 124, 354-361. https://doi.org/10.1016/j.foodchem.2010.05.118.

Waldin, M. *Biodynamic Wine. First Edition*, Infinite Ideas Limited. Oxford. United Kingdom. 2016, pages XII-XIV.

Waterhouse, A.L. University of California, Davis, Waterhouse Lab: Sulfites. 2016, https://waterhouse.ucdavis.edu/whats-in-wine/sulfites (accessed on 03 November 2022).

Biodynamic Federation - Demeter International. *Production. Processing and Labelling. International Standard for the use and certification of Demeter*, Biodynamic and related trademarks (as of: Oct 2021)

EU Council Regulation EC No 834/2007 and EC Reg No 203/2012

European Union Regulation (EEC) No. 2092/91, on organic production of agricultural products and indications referring thereto on agricultural products and foodstuffs, OJ L 198, 22.7.1991, p. 1. On line at: https://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CONSLEG:1991R2092:20060506:EN:PDF.

Regulation of the Vine and Wine Law number 164/2015

International Organisation of Vine and Wine. www.oiv.int (accessed on 03 November 2022).

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