

ABSTRACT

Worldwide, the organic wine market is growing (Abraben et al., 2017), therefore the development of technologies for wine production that respect the terroir and character of the wines to protect human health are increasingly necessary.

Comparisons between vineyards and/or oenological techniques according to the type of agriculture (conventional, biodynamic and organic) in which a product is grown/obtained are quite difficult to do because there are many variable empirical factors and research needs to be carried out for longer periods of time in order to extract clear, objective, quantifiable and reproducible results.

Research results are contradictory or in some cases inconclusive, and most of the time no significant differences are mentioned between them.

Mäderet al., 2002 demonstrated that plots cultivated in an ecological and biodynamic system ultimately had greater biodiversity and increased soil fertility. Another study conducted between 2010-2012 and published in 2015 claims that the biodynamic culture system does not affect fruit quality (Döring et al., 2015). Regarding wine, the existing data so far do not support the fact that wine obtained from biodynamic practices would be much more sensory appreciated than other wines. Also, no notable differences were found regarding the physical-chemical parameters of the wines (Reeve et al., 2005). Another study carried out on the Merlot variety, in the period 2001-2004, indicated that only in 2003 and 2004 of the 4 studied harvests were sensory differences obtained between the ecological and biodynamic wines studied (Ross et al., 2009).

Ecological viticulture, respectively ecological wine, started to be well known both at the European level and in Romania. In addition to this ecological approach, biodynamic viticulture began to gain the attention of consumers (Vastola, 2008) as well as winegrowers. Currently this type of agriculture is found under several names depending on the country where it is practiced and the legislation of that country. Coming under the scope of organic agriculture and organic viticulture is obliged to obey the laws of the country of origin.

Even if at the level of the European Union the standards and legislation of organic agriculture has been regulated, unfortunately or fortunately this practice and name are also used in other non-EU member states, such as the USA for example, a country that has different legislation for this agricultural practice.

Because the present study was carried out in Romania, the legislation analyzed was mainly that of Romania with reference to the European Regulations and by comparison with the legislation of other countries outside the EU.

As far as the legislation of biodynamic wines is concerned, things are a little clearer, as Demeter International, the certification body for these wines, makes available to those interested a specification with standards that must be unanimously respected by anyone who wants to produce and market wine as biodynamic. This unifies the legislation of these wines, but also the production rules, eliminating possible confusions that may arise, because a wine before being certified biodynamic must be certified ecological.

Ecological practices were regulated in 2007 in the European Union (EC Regulation no. 834/2007) and updated in 2012 (EC Regulation no. 203/2012).

Regulation (CMO) 606/2009 presents a series of oenological practices and substances that can be used in the production technology of organic wines. Sulfur dioxide, ascorbic acid, genetically modified organisms (GMOs) are part of the substances presented in the regulation.

It is recommended that, as far as possible, organically certified products and substances of agricultural origin are used. Regulation (EU) 2018/848 comes with additions to the previous provisions in relation to certain technologies that are not accepted in obtaining organic wine, such as tartaric stabilization with the help of equipment with cation exchangers.

21 samples of red wines were obtained from black grape varieties: Syrah, Merlot and Fetească neagră. The vineyard plots from which the grapes were harvested come from the Murfatlar Vineyard.

The Murfatlar vineyard is located in the south-east of Romania, on the territory of Constanța county, it includes the areas bordering the cities of Cernavodă, Medgidia and Murfatlar. The altitude of the vineyard varies between 50 and 130 m. The rows in the plantations are oriented, most of the time, towards south and south -west. Smooth slopes and chamfered plateaus facilitate agrotechnical work.

It is a region conducive to the ripening of grapes, because the springs are early and the autumns are late. Summers are hot and dry, winters are moderate, typical to the excessively continental climate. The region is known to be among the driest in Romania, its aridity being accentuated during the summer by the strong winds coming from the Black Sea and the low rainfall of approximately 200-250 mm, out of the annual average of 450-500 mm.

The grapes were harvested when they reached full maturity. For logistical reasons each producer managed the harvesting of their own grapes. The same variety was harvested a maximum of 3 days apart from each other.

The technology for obtaining red wines, regardless of the type of wine obtained, up to a point, presupposes the observance of standard vinification steps common to all wines.

For the present study, 9 vineyard plots were selected from which to harvest grapes, for 3 consecutive years. Each variety and type of crop corresponds to a plot. For conventional wines, we chose a producer who declared that he does not use any principles specific to organic farming for vineyard management. For the organic wines, we chose an ecologically certified producer who agreed to grow 3 vineyard plots in a biodynamic system.

The differences between the three wine categories are due to the fact that for organic and conventional wines: the temperature was controlled throughout the process and selected varietal yeasts were used.

Immediately after harvesting, the grapes were processed according to the technology specific to the type of wine to be obtained.

The years in which the wines were produced are 2019, 2020 and 2021 with the mention that, for technical and cost reasons, no more biodynamic wines were produced in 2021. In 2020, only the biodynamic wine from the Merlot variety was no longer produced, because it was considered that the grapes did not meet the quality requirements for a biodynamic wine and the producer made the decision to vinify them according to the ecological wine

technology. This is not unusual because, according to Demeter International, only certain years are conducive to the production of biodynamic wines.

Following this study, the differences resulting from the analyses are not in favor of any type of wine, so in the end a clear line cannot be drawn between the three winemaking concepts (ecological, biodynamic, conventional). However, the differences resulting from the analyses performed offer the opportunity to develop more extensive future research.

The quantity of grapes per ha in relation to the cultivation technology directly influences the quality of the grapes. In this sense it is important to see in the future if a greater amount of biodynamic grapes per ha influences the quality of these wines compared to conventional and organic wines.

In the case of the present study, the quantities of grapes chosen to be obtained per hectare (of 4 tons in the case of plots cultivated following biodynamic principles, of 6 and 7 tons per hectare in the case of organic wines and 10 t/ha for plots cultivated in a conventional system) generated similar results following the analyses. Regarding the physico-chemical analyses of the wine, except for the values obtained for sulfur dioxide (much lower in the case of biodynamic wines compared to the other wines), the other parameters have close values.

Conventional wines have lower or equal alcohol concentration than their organic and biodynamic counterparts. All wines fermented to dryness, whether select were added to aid alcoholic fermentation. Volatile acidity falls below the limit of 1.2 g/L acetic acid. Free sulfur dioxide has values between 2 mg/L and 39 mg/L. The lowest values belong to biodynamic wines.

The content of phenolic compounds decreases from conventional to biodynamic wines. This has not been found in other studies and more analysis is needed to draw a generally valid conclusion. However, in the present case, the absence of sulfur dioxide during storage had unfavorable effects on the color stability of biodynamic wines.

The participation percentage of anthocyanins delphinidin-3-monoglycoside (Del-3-gl), peonidin-3-monoglycoside (Po-3-gl) and malvidin-3-monoglycoside (Mv-3-gl), varies directly proportional to the year in which the wine was produced. Instead the anthocyanin Cy-3-gl increases as the wine has been in the bottle longer. Conventional wines have a higher percentage of free anthocyanins than organic and biodynamic wines, but the difference between the 3 categories is not constant within the same anthocyanin or for all varieties.

Regarding chroma, tonality and brightness, it cannot be stated that conventional or biodynamic wines have higher or lower values compared to the other samples. The values of these parameters vary depending on the year and variety and less depending on the applied winemaking technology.

Regarding the sensory analysis of the wines, all samples were identified as corresponding to the variety from which they were obtained: Merlot, Feteasca neagră or Syrah.

Oxidative character is not necessarily a characteristic of biodynamic wines. It differs according to the year or variety, for example in 2021 the conventional Merlot variety obtained a higher score for this parameter compared to the organic Merlot variety or in 2020 it had the

same average for the biodynamic and the conventional wine obtained from the Fetescă neagră variety .

Regarding the content in biogenic amines, it is consistent with the amounts of biogenic amines specified in other studies carried out on red wines.

The results of physico-chemical, spectrophotometric, HPLC and sensory analyses do not always vary consistently from one sample to another, from one year to another or from one type of wine to another.

The difference between the three types of wines (ecological, biodynamic and conventional) being ultimately made by the economic factor and the beliefs and value system of the producer and the consumer because this study proves that quality wines can be obtained without the addition of oenological products.