

Change of hue and intensity of color during the fermentation in case of must obtained from various varieties of red grapes from Minis-Maderat Winery

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Abstract The color and opacity of a red wine reveal clues regarding the type of wine. The color of a wine reveals its age, the variety of grapes, density of aroma and its acidity.

This work is presenting the differences of color existing between the varieties of red grapes during the fermentation process. The parameters that have been assessed within this study have included the chromatic parameters (intensity and hue of color) correlated with the pH changes and depending on the alcohol content of the fermenting must. Three red wines obtained by fermenting in rotary tanks grapes of three black varieties (Merlot, Burgund and Pinot Noir) cultivated in Minis-Maderat winery from Pancota, were studied. The wines have been obtained in the month of September 2013. During the fermentation process the intensity of color has decreased, while the hue of color has increased. The highest value of the color intensity has been reached by the Burgund red wine (23.418) and the lowest the wine obtained from the Pinot Noir variety (8.458). The highest value of the color hue has been reached by Pinot Noir wine (0.65) and the lowest by the red wine Merlot (0.54). The value of these parameters has changed during the fermenting process and is very different in relation to the grapes variety, the change of pH value and of the alcohol content. The results that have been obtained regarding the chromatic parameters of every wine in particular are important in anticipating the color of red wines at the end of the fermentation process when the finite product is obtained.

Key words

hue, intensity, fermenting must, red wine

The color of wine is conferred by the pigments of the grape beam after they begin to ripen. The color is intensifying during the ripeness process. The pigments are localized especially in the beam peel and less in the core.

The color of the wine is depending on the variety of grapes, on the winemaking technology and on the ageing.

The color is completing the visual examination of the intensity and vivacity of wine and also hue (<http://www.restaurantedelux.ro/terminologia-folosita-la-degustarea-vinurilor.html>).

The main color of the wine is the one identified in the center of the wine glass. (<http://blog.vinuridecolectie.ro/2013/08/cum-putem-identifica-vinurile-rosii-dupa-culoare/>).

In order to define the color of wine, several words can be used to indicate the perceived hue or nuance. Moreover for each color various degrees of intensity can be distinguished: dark, light, loaded etc. Usually the terminology used to distinguish the color of red wines is the following: purple red, crimson red

wine, garnet and red brown (<http://www.restaurantedelux.ro/terminologia-folowita-la-degustarea-vinurilor.html>;<http://vinotecaodobesti.ro/shop/Custom/DegustareaVinurilor.htm>).

The intensity of a wine is revealed by the color. If the color is concentrated and dense, it is certain that the wine shall contain richer tannins than a lighter color wine. The red wines are distinguished by their nuances of red.

The young red wines have a darker hue, sometimes even brown. After time passing (ageing), the red wines become clearer> the characteristic red color is transforming into garnet (<http://www.vinulportughez.ro/degustarea-vinului/>).

The color intensity and also the content of flavored materials and tannin are depending on the duration of maceration, temperature and on the alcohol content of the fermenting must. The dissolution of the coloring materials is never complete, in the optimum cases it can reach 80% of the quantity of colored materials contained in the peel.

At the beginning of the maceration a rapid increase of the coloring substances is occurring, therefore of color, until it reaches the maximum on the sixth day, in case of classical winemaking, afterwards the intensity of color begins to decrease. (<http://www.nicoresti.n.nu/vin>).

Material and Methods

The red wines made of Merlot, Burgund and Pinot Noir varieties have been produced in Pancota winery, located on the west side of the country, from grapes harvested in 2013.

The change of the chromatic parameters from the three varieties of black grapes has been assessed using Glories Method (1984).

VIS Color (Cuvette) module of the OenoFoss device is measuring the chromatic parameters of wine according to the international standards.

The intensity of color (Ic) has been expressed in absorption units and it has been generated by the sum of the extinctions' absolute values on 420, 520 and

620 nm obtained by high-efficiency spectrophotometric methods, establishing the levels of the chromatic characteristics specific to the antocyanic complex.

The hue of color (Tc) has been expressed by the ratio between A_{420} and A_{520} . The chromatic structure of wines has been expressed by the contribution of blue, green and red pigments (%) to the coloring of red wines. The difference of the described color is based upon the absorption of the visual light at the three specific wavelengths (A_{420} , A_{520} , A_{620}).

The sampled must has been filtered through a filter paper where a few grams of filtering flour have been placed in order to facilitate the release of CO_2 . Therefore, 5 ml of the filtered must have been taken using a dropper and have been put in the VIS Color module of OenoFoss.

The values of the chromatic parameters are automatically read by the device and saved in a dedicated application installed on the laptop connected to the Cuvette module of OenoFoss (Fig. 1).

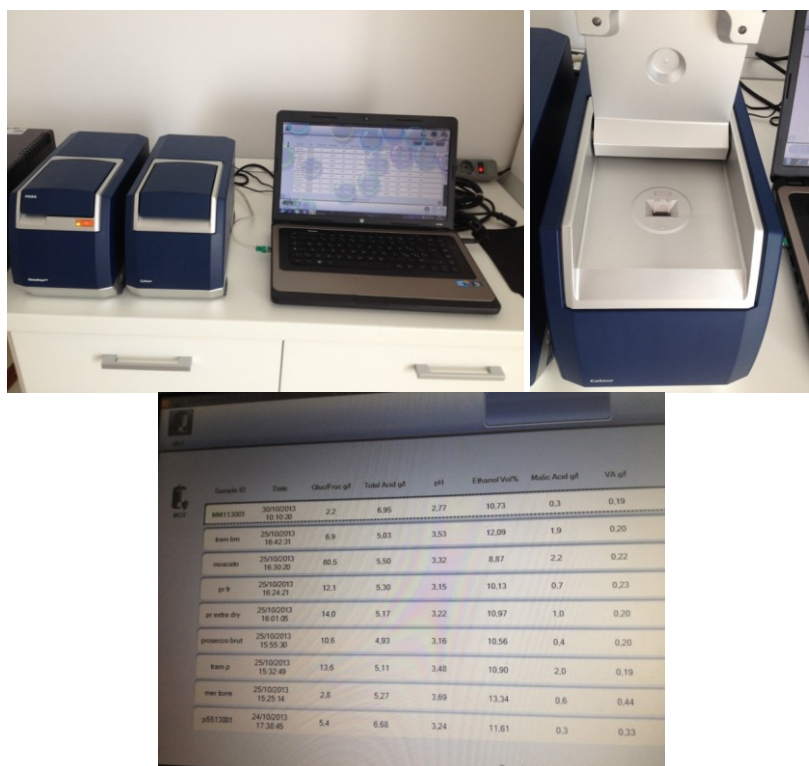


Fig. 1 OenoFoss device (a) of the Cuvette module (b), chromatic parameters (c)

The measuring of these parameters is high sensitive therefore the drum of the VIS Color module shall be cleaned with ethanol in order to remove all fingerprints and very well dried before introducing the sample.

Results and Discussions

In order to chromatically characterize the red wines, the intensity and hue of color has been assessed. The red color of Burgund, Merlot and Pinot Noir wines

has been expressed by the blue, green and red pigments.

The results presented in the table no 1 are revealing that the intensity of the Burgund wine is

decreasing during the fermentation process from 25.131 to 21.455. The same is happening regarding the hue of color that is also decreasing from 0.62 to 0.58.

Table 1

Evolution of chromatic parameters during the fermentation process of the Burgund wine

Date	Intensity	Hue	pH	Alcohol concentration
16.09.2013	25,131	0,62	2,71	11,48
17.09.2013	24,911	0,61	2,68	11,57
18.09.2013	25,079	0,61	2,69	12,11
19.09.2013	24,092	0,58	2,73	12,36
20.09.2013	24,135	0,59	2,73	12,79
22.09.2013	24,100	0,58	2,62	13,26
23.09.2013	23,746	0,58	2,73	13,45
24.09.2013	23,916	0,57	2,72	13,52
25.09.2013	24,286	0,58	2,77	13,65
26.09.2013	23,674	0,57	2,64	13,57
27.09.2013	23,888	0,57	2,72	13,68
28.09.2013	24,854	0,57	2,71	13,82
30.09.2013	23,409	0,57	2,77	13,83
01.10.2013	24,011	0,57	2,74	13,65
05.11.2013	23,067	0,56	3,02	13,75
08.11.2013	22,408	0,56	3,27	13,64
11.11.2013	21,579	0,56	3,27	13,72
14.11.2013	21,650	0,56	3,29	13,90
18.11.2013	21,326	0,57	3,30	13,80
26.11.2013	21,066	0,57	3,28	13,67
16.12.2013	21,455	0,58	3,30	13,81

Table 2

Evolution of chromatic parameters during the fermentation process of the Merlot wine

Date	Intensity	Hue	pH	Alcohol concentration
21.09.2013	5,700	0,63	3,2	0,19
22.09.2013	8,748	0,53	3,16	0,15
23.09.2013	8,559	0,51	3,18	0,8
24.09.2013	11,326	0,48	3,15	1,8
25.09.2013	7,509	0,50	3,16	2,33
26.09.2013	16,047	0,51	3,11	4,48
27.09.2013	16,577	0,51	3,23	5,88
28.09.2013	15,860	0,52	3,1	6,62
30.09.2013	16,382	0,51	3,11	9,81
01.10.2013	15,839	0,51	3,04	11,01
02.10.2013	16,308	0,51	3,03	12,10
07.10.2013	16,814	0,52	3,03	12,84
09.10.2013	17,312	0,53	3,06	12,47
05.11.2013	16,118	0,55	3,23	12,82
08.11.2013	15,637	0,56	3,39	12,86
11.11.2013	15,917	0,56	3,34	13,01
14.11.2013	15,769	0,56	3,39	12,97
18.11.2013	15,760	0,57	3,39	13,14
26.11.2013	15,377	0,58	3,37	12,90
05.12.2013	15,209	0,59	3,40	12,92
10.12.2013	14,283	0,60	3,43	12,99
13.12.2013	15,469	0,62	3,44	12,76
16.12.2013	14,557	0,60	3,40	12,94

The values of the color intensity are corresponding to the content of antocytans, and they range between 5.700 and 17.312 in case of Merlot wine (Table no 2). The color hue (between 0.48 and 0.62 at the Merlot wine) is expressed by the ratio between the yellow-orange and the red pigments. This is focused on the remarkable quality of the wine color, exercising a positive influence over the organoleptic aspect. The

finite product having no visual irritating nuance (example: purple, violet) is attractive and consumed with pleasure.

The Table no 3 is presenting the chromatic parameters of Pinot Noir wine. The hue of the color has values ranging from 0.56 to 0.74, and the intensity ranged between 3.502 and 11.457.

Table 3

Evolution of chromatic parameters during the fermentation process of the Pinot Noir wine

Date	Intensity	Hue	pH	Alcohol concentration
20.09.2013	3,502	0,74	3,46	0,54
21.09.2013	4,362	0,60	3,29	1,77
22.09.2013	5,228	0,59	3,11	7,38
23.09.2013	6,838	0,56	3,20	10,95
24.09.2013	9,422	0,63	3,28	11,18
25.09.2013	10,121	0,62	3,31	11,41
26.09.2013	9,593	0,61	3,17	11,43
27.09.2013	9,662	0,62	3,28	11,44
28.09.2013	10,097	0,61	3,23	11,40
30.09.2013	10,398	0,60	3,31	11,54
01.10.2013	9,935	0,60	3,27	11,43
11.10.2013	11,457	0,63	3,30	11,27
30.10.2013	9,498	0,67	3,41	11,57
05.11.2013	9,033	0,67	3,43	11,52
08.11.2013	8,293	0,69	3,46	11,63
11.11.2013	9,374	0,71	3,45	11,62
14.11.2013	8,995	0,69	3,44	11,64
18.11.2013	7,873	0,73	3,45	11,61
26.11.2013	7,765	0,73	3,39	11,67
16.12.2013	7,731	0,74	3,45	11,57

Figure no 2 is presenting the change of the chromatic characteristics depending on the pH and the alcohol concentration from the Burgung wine, for three months, during the fermentation period. The measuring

has revealed a decrease of the chromatic values in time, depending on the raise of the pH value (from 2.71 to 3.30) and of the alcoholic concentration (from 11.48 to 13.81).

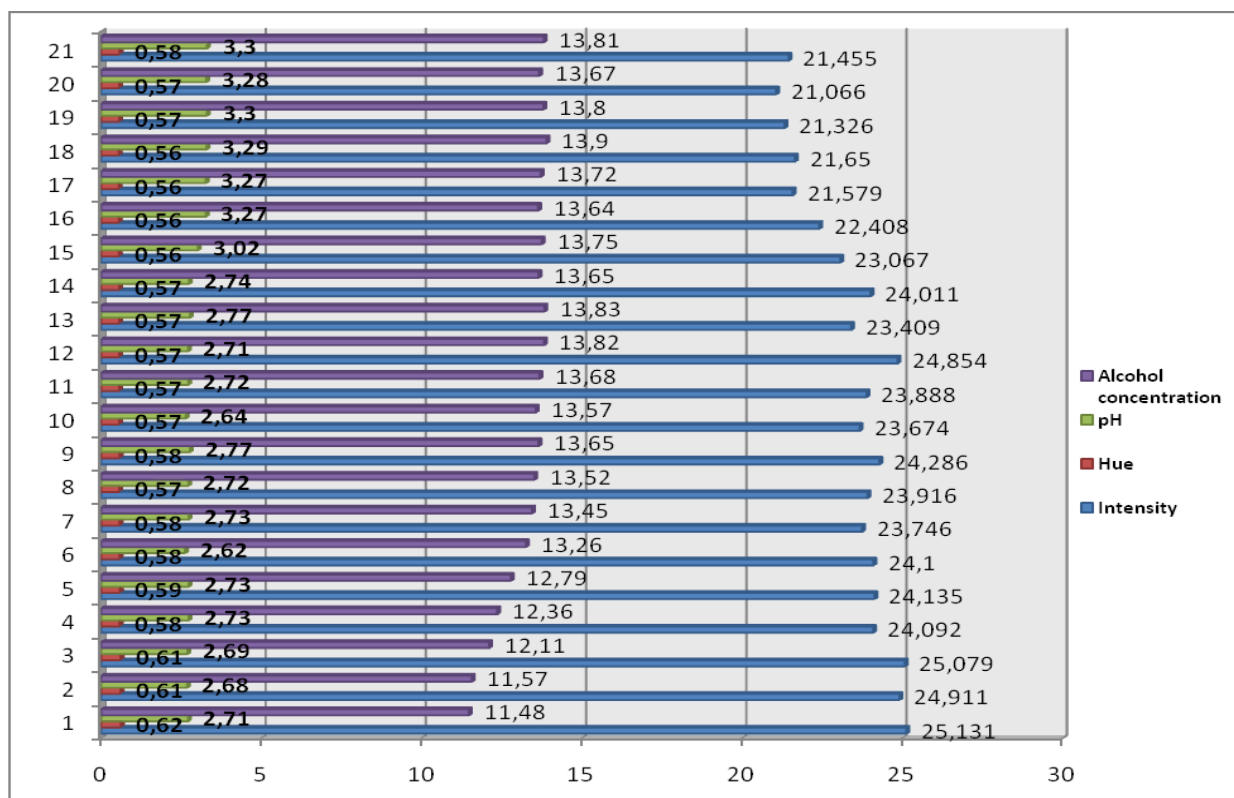


Fig. 2 The change of the color intensity and hue of the must during fermentation depending on the pH and alcohol content changes to the Burgung wine

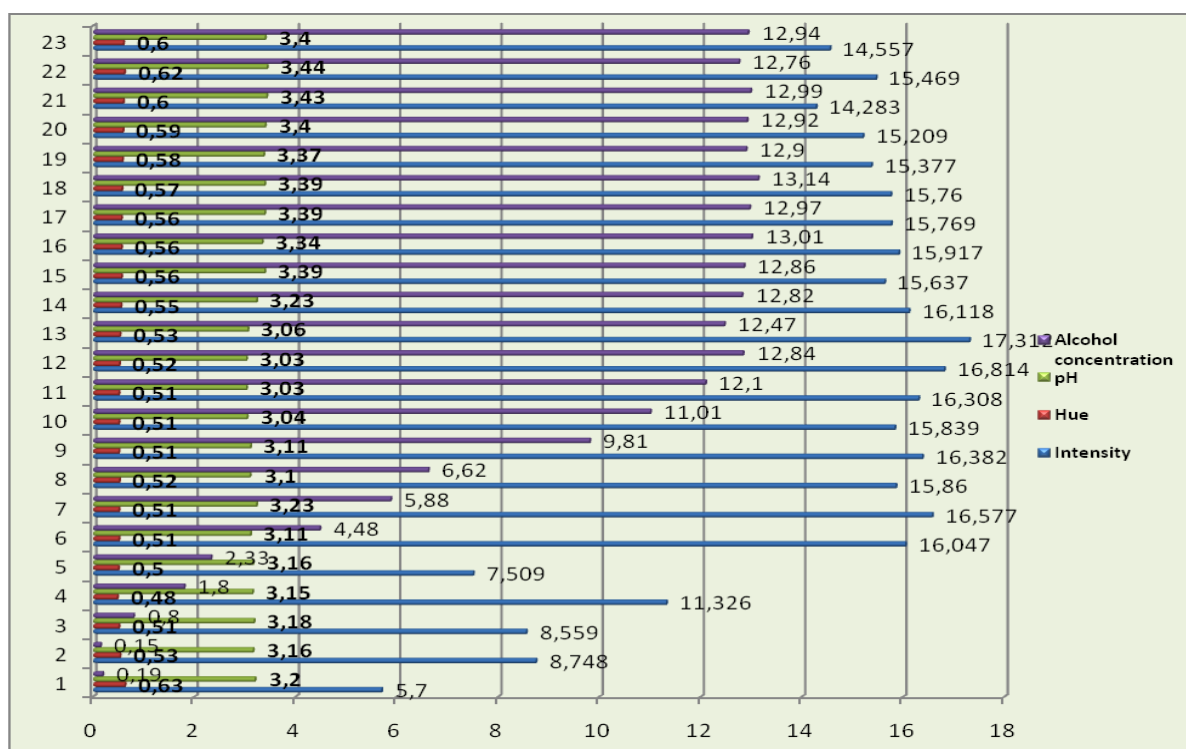


Fig. 3 The change of the color intensity and hue of the must during fermentation depending on the pH and alcohol content changes to the Merlot wine

After a 3-month monitoring, the hue of the Merlot wine has slightly decrease (from 0.63 to 0.60) following the intensification of its color (from 5.700 to 14.557) due to the modification of pH (from 3.2 to 3.4) and of the alcohol concentration (from 0.19 to 12.94) (Figure 3).

The Figure no 4 reveals that the hue of the Pinot Noir wine decreases and its intensity is raising

depending on the modifications of pH (from 3.11 to 3.46) and of the alcohol content (from 0.54 to 11.67). The smallest value of the color intensity has been measured at the Pinot Noir wine (8.458) and the highest at Burgund wine, i.e. 23.418.

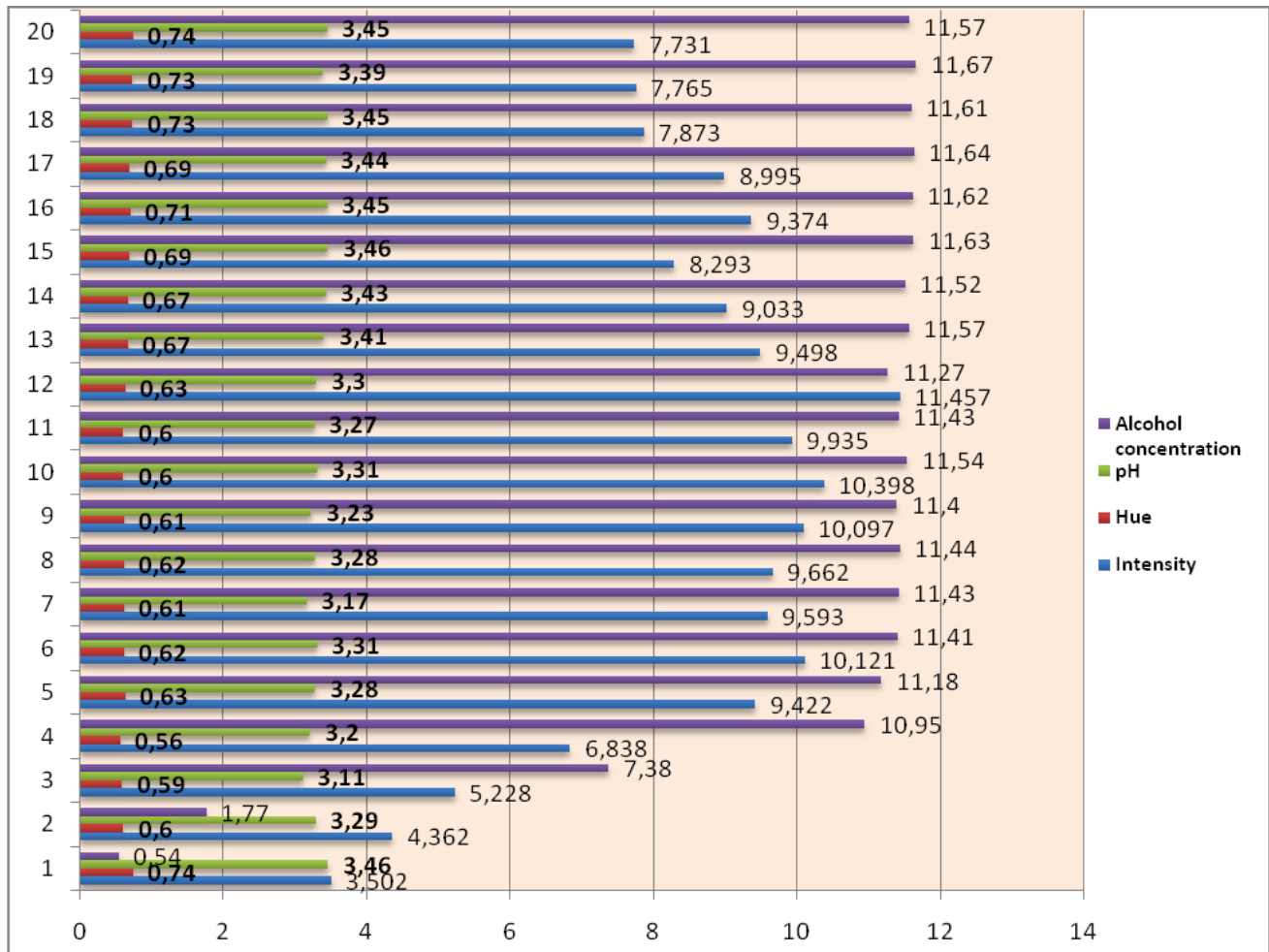


Fig. 4 The change of the color intensity and hue of the must during fermentation depending on the pH and alcohol content changes to the Pinot Noir wine

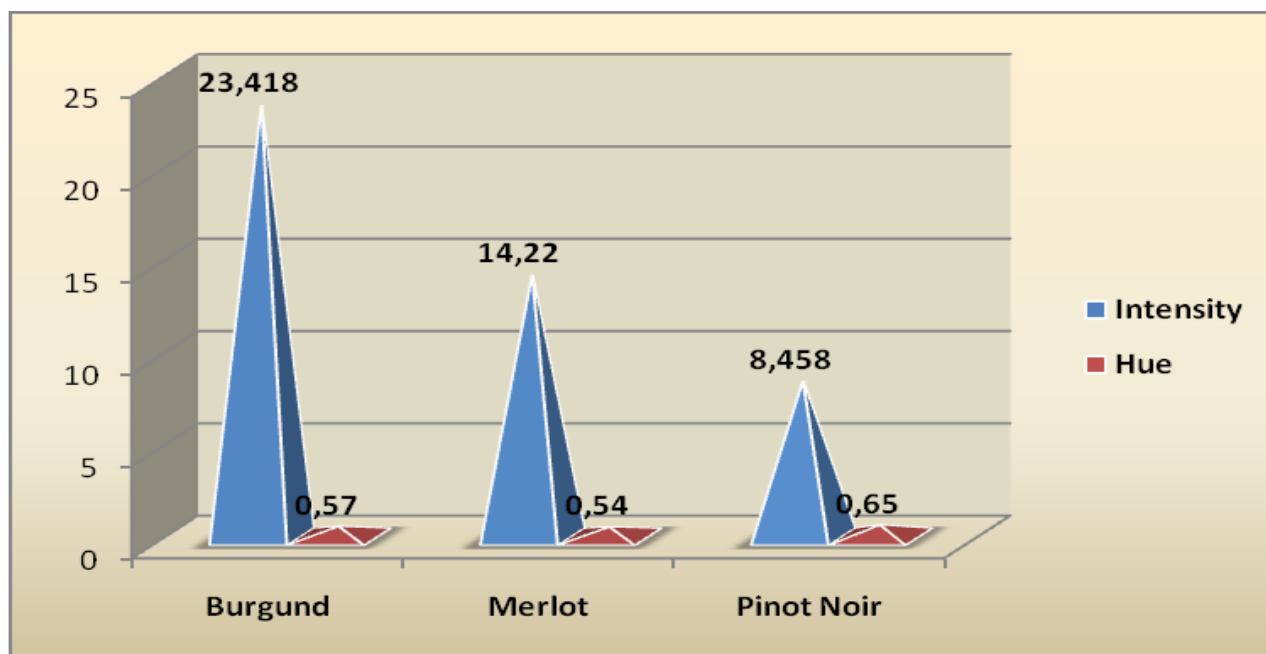


Fig. 5 Value of the chromatic parameters of the studied types of wines

The results presented in Figure no 5 are revealing that the most accentuated hue has been measured at the Pinot Noir wine (0.65) and the other two studied wines had similar values of this parameter: the Burgund wine 0.57 and the merlot wine 0.54, values that are less obvious in comparison with the here above type of wine.

Conclusions

The values of the alcohol concentration higher than 11.00% at all analyzed wines have emphasized their classification as high quality wines with Controlled Origin Name (DOC).

The two observations of color (intensity and hue) have been correlated with the pH and alcohol concentration values. The pH has registered raising values at all analyzed wines, leading to the change of the chromatic characteristics following the pH influence over the antocytans.

Therefore there is a correlation between the hue and the intensity of wine color. Moreover the intensive colored wines, due to the dressing with phenolic compounds, the hue is lower, and contrary, higher to less colored wines.

The value of the hue was similar to the analyzed wines, its evolution being descendent.

The data regarding the chromatic parameters (intensity and hue) measured for each studied wine, are facilitating an objective estimation of color in young red wines and implicitly over their quality during their evolution in time.

The Romanian red wines are able to face the international concurrency due to the very high potential

of polyphenols in the grapes used as raw material for processing the red wines from the vineyard, even if sometimes the winemaking technologies are not in line with the novelties from the international markets.

References

1. Bourzeix M., 1976, Les composés phénoliques du raisin et du vin, Bulletin O.I.V., vol. 49, nr. 550, Paris.
2. Cotea D. V., 1985, Tratat de Oenologie, vol. 1. Bucuresti, Edit. Ceres.
3. Heredia F. J., Troncoso Ana María, Guzmán-Chozas M., 1997, Multivariate characterization of aging status in red wines based on chromatic parameters, volume 60, Issue 1, pages 103–108.
4. Glories Y., 1984, La couleur des vins rouges, Connaissance Vigne Vin, 18(4), 253-271.
5. Odăgeriu G., Coșofreț S., Cotea V. V., Bîrliga N., Ciubucă A., 2000, Caracteristicile cromatice, C.I.E. Lab-76 ale vinurilor roșii din podgoria Bujoru. Lucrări științifice, seria Horticultură, Universitatea Agronomică Iași, vol. 1 (43), p. 269-276.
6. Pascu L., 2005, Red wine quality establishing on the basis of chromatic properties. Revista de Chimie, 56(7), 703-707.
7. Ribereau-Gayon J., Peynaud E., Sudraud P., Ribereau-Gayon P., 1972, Traité d'oenologie, Sciences et techniques du vin, tome 1. Analyse et contrôle des vins. Dunod-Paris, France
8. Rusu E., 2006, Oenologia Moldavă, Realitatea și perspectivele, Tipografia Academiei de Științe a Moldovei, Chișinău.
9. Țârdea C., 2007, Chimia și analiza vinurilor, Edit. "Ion Ionescu de la Brad", Iași.

10. Țârdea C, Sârbu G., Țârdea Angela, 2000, Tratat de vinificație, Ed. Ion Ionescu de la Brad, Iași.

11. Vișan Luminița, Dobrinioiu Ricuța, 2013, Studies on the chromatic characteristics of red wines and color evolution during maturation, Scientific Bulletin. Series F. Biotechnologies, Vol. XVII, pg. 132-136.

12. <http://blog.vinuridecolectie.ro/2013/08/cum-putem-identifica-vinurile-rosii-dupa-culoare/>

13. <http://www.nicoresti.n.nu/vin>

14. <http://www.restaurantedelux.ro/terminologia-folosita-la-degustarea-vinurilor.html>

15. <http://www.vinotecaodobesti.ro/shop/Custom/DegustareaVinurilor.htm>

16. <http://www.vinulportughez.ro/degustarea-vinului/>