THE QUALITATIVE OENOLOGICAL POTENTIAL OF THE WINE GRAPECULTIVARS FROM THE AMPELOGRAPHIC COLLECTION AT SCDVV DRĂGĂȘANI

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ABSTRACT

Research was carried out during 2020-2022 period at SCDVV Drăgăşani and at the Wine Analysis Laboratory within Sâmbureşti Domains. The cultivars analyzed and studied were 'Negru vârtos', 'Novac', 'Cârlogancă' and 'Bikaver 13', from the national germplasm collection of the Drăgăşani unit. The first three cultivars are considered autochthonous and even local, the fourth is a Hungarian cultivar. These cultivars are valuable, which lend themselves best to the eco-pedological conditions of the wine-growing area. The qualities of the wines obtained from these cultivars were valued, through physical-chemical analyzes and statistical calculations, using indices such as mean, variance (s^2), standard deviation (s) and the coefficient of variation (CV%), the aim being to obtain wines of the DOC type and GI and their promotion on the national and international wine market. Therefore, the wines from Drăgăşani continue their traditional performance even today, that of being present on the market with their famous and very good wines. Drăgăşani wines are known in the country and abroad, being appreciated among the best red and white wines.

INTRODUCTION

The Drăgășani vineyard stands out for its moderate, miraculous, natural relief, with an infinite range of shapes, slopes and exposures and with a scale happily dosed with altitudes.

Its location along the Olt River, which ensures a permanent movement of air, always having a good humidity even in July-August, the warmest months.

All these are natural conditions that decided that the most gifted and valuable Romanian and foreign cultivars should find in Drăgăşani the most favorable environment to fully express the extent of their quality skills.

At the international competitions, the most appreciated wines in the Romanian "sweet-aromatic" category were awarded the samples of "Tămăioasă de Drăgășani" and "Tămăioasă de Pietroasele" wines, obtaining the highest average score from the jury.

It should be noted that the Drăgăşani vineyard is perhaps unique, which through its winegrowers have made persistent efforts since the last century to affirm the quality of its wines abroad.

Thus, Drăgăşani wines could be appreciated and awarded at the universal exhibitions in Paris in 1867 and in 1889 and 1900, where they received medals as follows:

- The white wines from the harvests of 1879, 1883, 1890;
- The red wines of 1887 and 1896;
- The wines of 'Tămăioasă Românească' from the years 1890, 1891, 1896, and at the International Wine Competition in Bordeaux (1898) the presented white wines obtained the diploma of honor.

Also, from the exhibition in Milano (1908) and Gand (1912) they obtained gold medals and diplomas of honor (Teodorescu et al. 1987).

MATERIAL AND METHODS

Research was carried out during 2020-2022 period at Research and Development Station for Viticulture and Winemaking (SCDVV) Drăgăşani in the ampelographic collection and at the Wine Analysis Laboratory within Sâmbureşti Domains (S.C. Viti-Pomicola Sâmbureşti S.A.).

The cultivars analyzed were 'Negru vârtos', 'Novac', 'Cârlogancă' and 'Bikaver 13', from the national germplasm collection of the Drăgăşani unit.

The characterization of these cultivars was carried out in order to highlight their main agro-productive and technological characteristics.

The physical and chemical analyzes of the wine (performed in 3 repetitions) were as follows: alcohol concentration (vol%); total acidity (g/l); volatile acidity (g/l); free sulfur dioxide (mg/l); total sulfur dioxide (mg/l); non-reducing dry extract (g/l); reducing sugar (g/l); relative density at +20 ^{0}C.

Mean, variance (s^2), standard deviation (s) and coefficient of variation (CV%) were used for calculation in case of the wines analyzed. Statistical significance was determined using the *post-hoc* Multiple comparison test-Tukey Multiple Range Test Procedure ($p<0.05$).

RESULTS AND DISCUSSIONS

The physical and chemical analyzes of the four cultivars from the ampelographic collection of SCDVV Drăgăşani are presented in table 1. As a result, it was found that all the four cultivars studied meet the conditions necessary to obtain DOC (Romanian equivalent of *Appellation d'origine protégée*) and IG (Geographical indication) wines.

Thus, we have an alcoholic concentration in 'Negru vârtos' of 11.17 (% vol.), in 'Novac' of 15.72 (% vol.), in 'Cârlogancă' of 11.97 (% vol.), and in 'Bikaver 13' of 11.76 (% vol.). Volatile acidity is 0.307 (g/l acetic acid) in 'Negru vârtos', 0.345 (g/l acetic acid) in 'Novac', 0.344 (g/l acetic acid) in 'Cârlogancă' and 0.245 (g/l acetic acid) at 'Bikaver 13'.The total acidity shows the following values, 'Negru vârtos' 5.20 (g/l tartaric acid), 'Novac' 5.50 (g/l tartaric acid), 'Cârlogancă' 6.50 (g/l tartaric acid), and 'Bikaver 13' of 5.70 (g/l tartaric acid). The good physical and chemical parameters are achieved at free and total SO_2, at the total dry extract, sugar and at the relative density at +20^{0}C.

Table 1

Physical and chemical analyzes of the studied wines

Cultivar	Alcohol conc. (% vol.)	Volatile acidity (g/l acetic acid)	Acidity total (g/l tartaric acid)	SO$_2$ free (mg/l)	SO$_2$ total (mg/l)	Sugar (g/l)	Dry extract total (g/l)	Density (g/cm³)
'Bikaver 13'	11.76	0.245	5.70	12.8	24.0	1.486	29.4	0.994
'Novac'	15.72	0.345	5.50	24.0	40.0	0.085	31.0	0.990
'Negru vârtos'	11.17	0.307	5.20	22.4	40.0	0.095	17.2	0.990
'Crâmpoșie'	11.97	0.344	6.50	17.6	36,8	0.068	22.4	0.990

In addition to the fact that the three Romanian local cultivars studied have a certain viticultural value, the Hungarian variety 'Bikaver 13' finds the favorable environment from the oenological point of view in the wine-growing area of the Drăgăşani vineyard.

'Crâmpoșie' or 'Cârlogancă' is highlighted by the fact that in the morphological descriptors, the opening of the tip of the young shoot is completely open, the port of the shoot is semi-erect, the number of consecutive tendrils is 2 or less.In the young leaf, the color of the upper side of the limb (4th leaf) is tan-yellow. The adult leaf is large, pentagonal, entire or 3-lobed. The cross-section of the cord is elliptical and the color of the woody shoot is yellow-brown. The flower is normal hermaphrodite. The shape of the grape is cylindrical-conical and the shape of the grain is spherical. The length and weight of the seeds is average. The phenological characteristics are average, the color of the leaves in autumn being yellow. The agrobiological properties are strong, regarding the growth of shoots. It is resistant to diseases and pests. The technological characteristics are average, from the study it was shown that it accumulates 205 g/l of sugar at full maturity (Gorjan, 2013).

A valuable variety for red wines is 'Negru vârtos'. It shows the following characters: the opening of the shoot tip is fully open. The port of the young shoot is erect. The color of the upper face of the limb (4th leaf) is yellowish-green. The adult leaf is medium, pentagonal with 3-5 lobes, the color of the upper side of the limb being dark green.The woody shoot is yellowish-brown in color. The flower is functionally female hermaphrodite. The grape has a medium-large length, it is compact with a cylindrical-conical shape. The grain is small, spherical, blue-black in color.Autumn leaves are reddish-yellow in color. The length of the seeds is small and the weight is average. It shows a very strong shoot growth vigor. It has good resistance to drought, *Plasmopara*, *Oidium* and *Botrytis*. Both the production and the must content in the grapes are high, the acidity being average (Gorjan, 2013).

The 'Novac' cultivar is part of the Drăgăşani vineyard assortment and is intended for quality red wines. The vigor of the hub is high; the flowers are hermaphrodite, normal, the variety being self-fertile, the grapes are conical, uniaxial, large with an average weight of 250 g, with densely placed berries; the grain is medium, ovoid, with a bluish-black skin, with an intense medium-thick rind, adherent to the pulp, the pulp is white, juicy, frank. Under the conditions of Drăgăşani, the cultivar achieves a production of 5.8 kg/plant, respectively 24.0 t/ha. The average sugar content of grapes at full maturity is 214 g/l, and the acidity is 5.8 g/l expressed

in H_2SO_4. The full ripening of the grapes takes place between September 16-30 (5th epoch) (Varga, 2005).

The wine cultivar 'Bikaver 13' (syn. 'Turán') is a Hungarian variety obtained in 1964 from the crossing of 'Bikaver 8' and 'Gardonyi Geza' (https://www.vivc.de, 2022). The term "Bikaver" (meaning "Bull's blood" in Hungarian) is also used for a dry red wine blend based on 'Kékfrankos' ('Blaufränkisch'). Officially, the "Bikaver" blend must contain at least three or five of the following 13 grape cultivars: 'Bibor kadarka', 'Blauburger', 'Cabernet franc', 'Cabernet Sauvignon', 'Kadarka', 'Kékfrankos', 'Kékoportó', 'Menoire', 'Pinot noir', 'Syrah', 'Zweigelt' and 'Turán' (https://en.wikipedia.org/wiki/Egri_Bikaver, 2022).

In table 2 and figure 1 we present the average alcohol content of these wines and the statistical calculations, respectively statistical indices such as: variance (s^2), standard deviation (s) and coefficient of variation (CV%).We can observe significant differences in these cultivars from the point of view of alcohol concentration, with the exception of 'Crâmpoșie' and 'Bikaver 13'which are not statistically different. 'Novac' had higher alcohol concentration, typical of this cultivar, namely 15.72 (% vol.).

Table 2

Alcohol content of the wines analyzed in 2021

Cultivar	Mean	Variance (s^2)	Standard deviation(s)	Coefficient of variation (CV%)
'Bikaver 13'	11.76	0.059	0.24	2.06
'Novac'	15.72	0.059	0.24	1.54
'Negru vârtos'	11.17	0.011	0.11	0.94
'Crâmpoșie'	11.97	0.007	0.08	0.68
Mean	12.66	0.03	0.17	1.31

	Bikover	Novac	Negru vârtos	Crâmpoșie	Mean
Alcool (%)	11.76	15.72	11.17	11.97	12.66

The means followed by the same letter are not significantly different
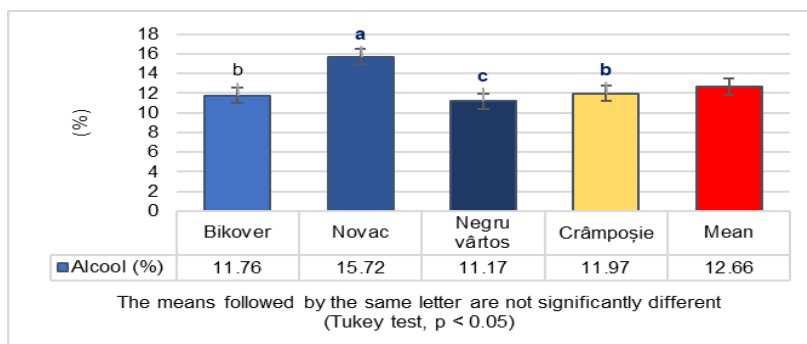(Tukey test, p < 0.05)

Figure 1. The mean alcohol content of wines analyzed in 2021

In the table 3 the volatile acidity is presented, all cultivars showed close values, except for 'Bikaver 13', which has a lower volatile acidity of 0.245 (g/l acetic acid). Significant differences between cultivars regarding volatile acidity were observed, with the exception of 'Crâmpoșie' and 'Novac' (figure 2).

Table 3

The levels of volatile acidity in the wines analyzed in 2021

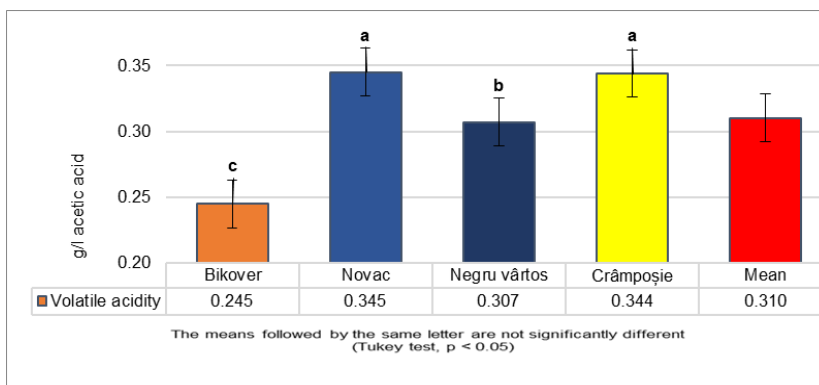| Cultivar	*Mean*	Variance (s^2)	Standard deviation(s)	Coefficient of variation (CV%)
'Bikaver 13'	*0.245*	0.00044	0.021	8.52
'Novac'	*0.345*	0.00033	0.018	5.24
'Negru vârtos'	*0.307*	0.00013	0.011	3.67
'Crâmpoșie'	*0.344*	0.00010	0.010	2.86
Mean	*0.310*	*0.00025*	*0.015*	*5.07*

Figure 2. Mean volatile acidity of wines analyzed in 2021

Regarding the total acidity, we can observe in table 4 a high value for 'Crâmpoșie', of 6.50 (g/l tartaric acid). 'Crâmpoșie', 'Bikaver 13' and 'Negru vârtos' differed significantly regarding total acidity, while between 'Bikaver 13' and 'Novac' the differences according to Tukey test were not significant, the same as for 'Negru vârtos' and 'Novac' (figure 3).

Table 4

Total acidity levels in the wines analyzed in 2021

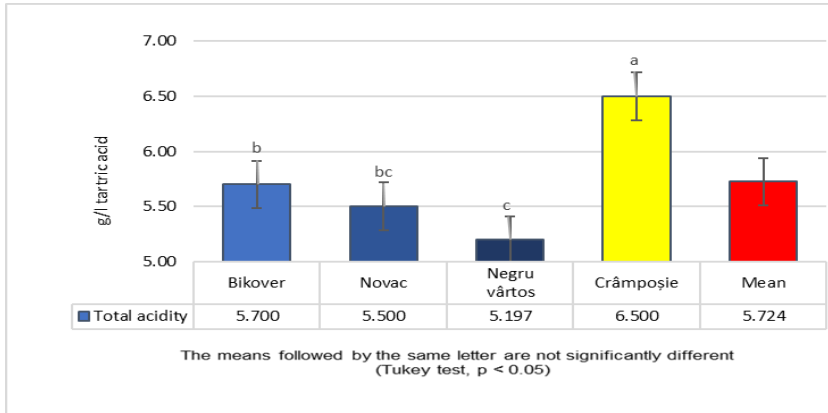| Cultivar	*Mean*	Variance (s^2)	Standard deviation(s)	Coefficient of variation (CV%)
'Bikaver 13'	*5.70*	0.104	0.32	5.66
'Novac'	*5.50*	0.054	0.23	4.24
'Negru vârtos'	*5.20*	0.016	0.13	2.42
'Crâmpoșie'	*6.50*	0.019	0.14	2.14
Mean	*5.72*	*0.048*	*0.21*	*3.61*

Figure 3. The mean total acidity of wines analyzed in 2021

Regarding the free sulfur content, significant differences were found for all cultivars, a fact due to the typicity of the analyzed wines (table 5 and figure 4).

Table 5

The content of free sulfur in the wines analyzed in 2021

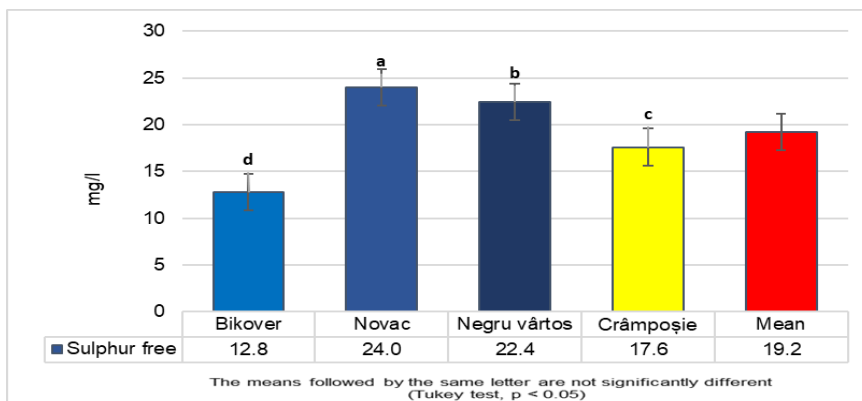| Cultivar	*Mean*	Variance (s^2)	Standard deviation(s)	Coefficient of variation (CV%)
'Bikaver 13'	*12.8*	0.024	0.16	1.21
'Novac'	*24.0*	0.092	0.30	1.26
'Negru vârtos'	*22.4*	0.137	0.37	1.65
'Crâmpoșie'	*17.6*	0.031	0.18	1.00
Mean	*19.2*	*0.071*	*0.25*	*1.28*

Figure 4. The mean content of free sulfur of wines analyzed in 2021

We can observe in these cultivars from the point of view of the average content of total sulfur significant differences, with the exception of 'Novac' and 'Negru vârtos', who do not differ (figure 5), Lower values in total sulfur content were recordedfor 'Bikaver 13' and 'Crâmpoșie' (table 6).

Table 6

The total sulfur content of the wines analyzed in 2021

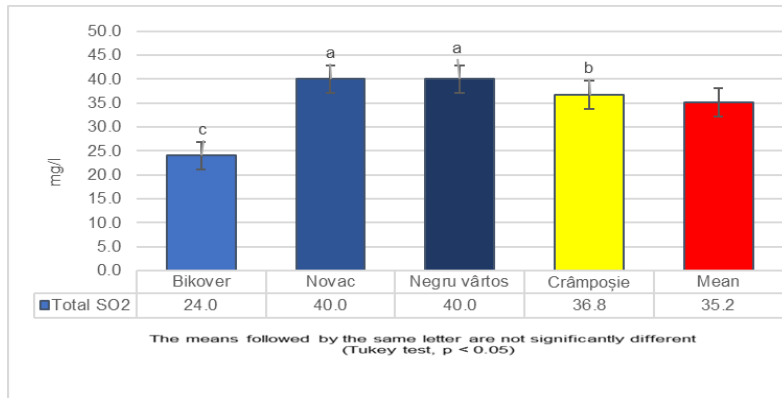| Cultivar	Mean	Variance (s^2)	Standard deviation(s)	Coefficient of variation (CV%)
'Bikaver 13'	24.0	0.117	0.34	1.43
'Novac'	40.0	0.125	0.35	0.88
'Negru vârtos'	40.0	0.044	0.21	0.52
'Crâmpoșie'	36.8	0.069	0.26	0.71
Mean	35.2	0.089	0.29	0.89

Figure 5. The mean total sulfur content of wines analyzed in 2021

The mean content of reducing sugar shows different values from the calculations of the standard deviation (s) and the coefficient of variation (CV%), the variety 'Bikaver 13' having a higher content of reducing sugar than the other cultivars (1.486 g/l) (table 7 and figure 6).

Table 7

The content of reducing sugar in the wines analyzed in 2021

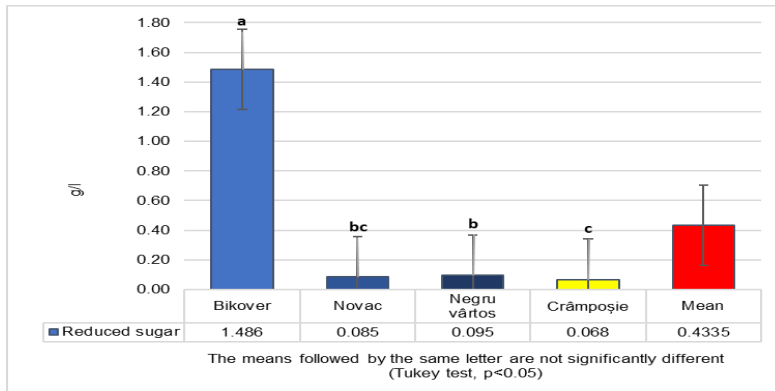| Cultivar	Mean	Variance (s^2)	Standard deviation(s)	Coefficient of variation (CV%)
'Bikaver 13'	1.486	0.00012	0.011	0.75
'Novac'	0.085	0.00008	0.009	10.26
'Negru vârtos'	0.095	0.00015	0.012	12.76
'Crâmpoșie'	0.068	0.00018	0.013	19.78
Mean	0.434	0.00013	0.011	10.89

Figure 6. The mean content of reducing sugar in the wines analyzed in 2021

We can also observe significant differences between cultivars from the point of view of the dry extract of these wines, which present different values (table 8 and figure 7).

Dry extract of the wines analyzed in 2021

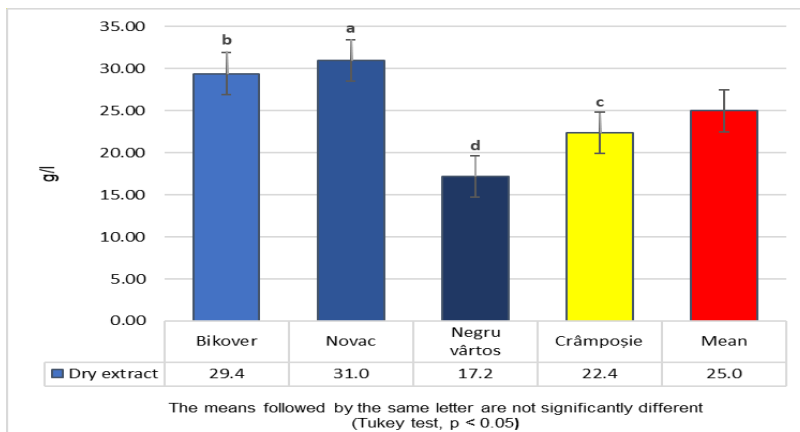| Cultivar	Mean	Variance (s^2)	Standard deviation(s)	Coefficient of variation (CV%)
'Bikaver 13'	29.4	0.318	0.56	1.92
'Novac'	31.0	0.859	0.93	2.99
'Negru vârtos'	17.2	0.047	0.22	1.27
'Crâmpoșie'	22.4	0.068	0.26	1.17
Mean	25.0	0.323	0.49	1.84

Figure 7. Mean dry extract of wines analyzed in 2021

Table 9

The relative density of the wines analyzed in 2021

Cultivar	*Mean*	Variance (s^2)	Standard deviation(s)	Coefficient of variation (CV%)
'Bikaver 13'	*0.994*	0.0089	0.094	9.47
'Novac'	*0.990*	0.0013	0.036	3.60
'Negru vârtos'	*0.990*	0.0088	0.094	9.49
'Crâmpoșie'	*0.990*	0.0038	0.061	6.19
Mean	*0.991*	*0.0057*	*0.071*	*7.19*

	Bikover	Novac	Negru vârtos	Crâmpoșie	Medie
■Relative density	0.994	0.990	0.990	0.990	0.991

The means followed by the same letter are not significantly different
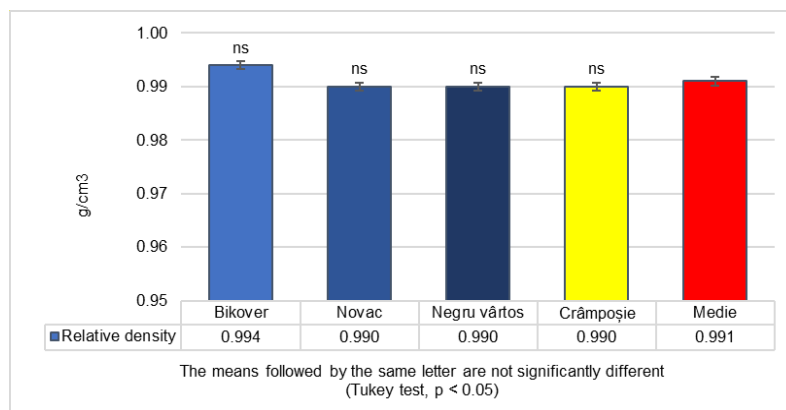(Tukey test, p < 0.05)

Figure 8. The mean relative density of wines analyzed in 2021

CONCLUSIONS

The studied cultivars are of a certain value and meet the conditions necessary to obtain DOC and IG wines.

Physical and chemical analyzes highlight the fact that it has a very good alcohol concentration and volatile and total acidity, typical in the production of fine wines of great nobility.

Their agro-productive and technological qualities prove to us that they lend themselves very well from an eco-pedological point of view to the Drăgăşani vineyard.

In addition to the three Romanian local cultivars studied, of a certain viticultural value, the Hungarian variety 'Bikaver 13' finds the favorable environment from the viticultural point of view in the Drăgăşani vineyard area.

These wines can successfully participate in all international wine competitions, provided that they are intensively promoted and marketed in the future.

They can revive the viticultural tradition that Romanian winegrowers enjoyed in the past, by obtaining quality white and red wines.

REFERENCES

Gorjan S.Ş. 2013. Evaluation of the agrobiological potential of some grapevine genetic resources *on farm* in the Drăgăşani vineyard. Doctoral thesis, University of Craiova.

Măcău I., Gorjan S.Ş, 2016. Drăgăşani Vineyard – Monographic and traditional aspects – Alma Publishing House, Craiova.

Teodorescu Şt., Popa A., Sandu Gh., 1987. The Oenoclimate of Romania, Scientific and Encyclopedic Publishing House, Bucharest.

Varga N., Ion M., Stoian M., 2005. Cultivars of fruit-bearing vines produced by Romanian viticultural research. Bucharest.

***https://en.wikipedia.org/wiki/Egri_Bikaver,accessedon 30.08/2022

***https://www.vivc.de/index.php?r=passport%2Fview&id=15834, accessed on 30.08/2022