

# CHARACTERIZATION OF THE HARVEST YEAR AND THE QUALITY OF RED WINES FROM VALEA CALUGAREASCA DEPENDING OF THE TECHNOLOGICAL AND PHENOLIC POTENTIAL OF THE VARIETIES

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## Abstract

The study was conducted during 2014–2018 period in order to define the quality level of the Cabernet Sauvignon and Feteasca neagra varieties, according to the characteristics of the harvest year. The grape harvest was recorded earlier with 12 days in case of Cabernet Sauvignon and with 14 days in case of Fetească neagră variety, compared to the multiannual average. During the years of study, harvesting of grapes from the Cabernet Sauvignon variety was made between September 17 and October 6, and that of the grapes from the Feteasca neagra variety during September 17-28. The dynamics of grape ripening was very fast in the harvest year 2014, fast in the years 2015 and 2016, slow in 2017 and 2018. In the 2014 harvest year for the Cabernet Sauvignon variety, the phenolic maturity of the grapes was assessed as good for all determined analytical parameters. Grapes from the Cabernet Sauvignon variety are well formed, with a percentage of normally developed berries, with the skin of the grapes in a high proportion, high in anthocyanins; small-medium grains, thick skin of the grapes. Cabernet Sauvignon wine was appreciated, compared to the average of 1990-1999, with a very good alcoholic concentration of 12.6% vol. alc. in 2016 and 12.8% vol alc. in the years 2017 and 2018. The wine from the Feteasca neagra variety was appreciated as being extractive, with a high alcohol concentration of over 13% vol. alc., with a medium acidity, intensely colored.

**Key words:** variety, phenolic maturity, technological potential, quality level

The quality of the grapes and the wine is largely influenced by the variety, which has its own physiognomy. Climate has an influence on both quality and productivity. Usually, the temperature influences the ripening period of the grapes in the vineyard. The evolution of the maturation process is greatly influenced by the variety, the vineyard, but especially by the specific conditions of the harvest year.

A component of the qualitative potential of the black grape harvest, phenolic maturity give information about the phenolic and anthocyanin richness of grapes, the extractability of anthocyanins and the share of astringent tannins (Glories, 1998). This is directly related to the wine climate.

The precocity of the vine represents the vine's response to its natural environment and is decisive for the quality of the phenolic potential of the grapes. It is evaluated by comparison with the average registration date of this phenophase.

Research on grape ripeness has indicated that it is closely correlated with ripening kinetics. Vivas *et al.*, (2003) defined a model for describing the dynamics of grape ripening. This is a straight

line, determined by the index of technological ripening of the grapes (sugar/acidity) and the sum of the degrees of temperature during the ripening period of the grapes. The value of the slope defines the maturation kinetics, which can be very slow, slow, fast and very fast.

In this context, the work aimed to quantify the quality of the phenolic potential of the grapes varieties characteristics for Dealu Mare-Valea Calugareasca vineyard area and to correlate it with the functioning components of the vine, such as the precocity and kinetics of grape ripening.

## MATERIAL AND METHOD

The study was conducted during 2014-2018 period, in the viticultural area Dealu Mare, Valea Calugareasca center, a wine producing area recognized mainly for the qualitative red wines. The varieties taken into study were Cabernet Sauvignon and Fetească neagră. The climate of the ripening period of red wine grapes was defined by comparing the values of the annual climatic parameters with the multiannual parameters of the period 1987-2017. The data from the climate database of IC-DVV Valea Călugărească were

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collected from the weather station belonging to Institute, having the following coordinates: 44°59' N lat; 26°13'E long; at the altitude of 210 m. Comparative analysis of the leverage for the chosen varieties, was performed compared to the multiannual average, and the registering differences were expressed in number of days (Carbonneau, A. Deloire *et al*, 2007). The harvesting of black grapes was done differently by variety. The precocity of varieties and the maturation kinetics of grapes were evaluated based on mathematical relation  $l_j = f(C_j)$  (Vivas N. *et al*, 2003), where  $l_j$  is the maturity corrected index and  $C_j$  the climatic index of the ripening period. The slope of the straight  $y = ax$  has defined the kinetics of maturation on the 4 levels: very slow ( $a < 0,8$ ), slow ( $0,8 < a < 1,1$ ), fast ( $1,1 < a < 1,4$ ) and very fast ( $a > 1,4$ ). The polyphenolic potential of the grapes harvest was assessed by specific parameters: total Polyphenol Index-IPT, Total anthocyanins-PA, Anthocyanins extractibility (EXA%) and contribute of grape seeds tannins-MS as determined by method Glories (1998), cited by (Anneraud C., Vinsonneau E., 2009). The technological properties of the grape harvest were evaluated for the two varieties for harvest years. The following technological indices (Blouin J. *et al*, 2000), have been defined: ISST-grape structure index IB-grape berrie index, ICZB-grape berrie composition index, IRD-yield index. Polyphenolic Potential of the Black Grapes for Winemaking was evaluated for the varieties studied, by harvest years. The analytical parameters that define the specific characteristics are the following: Polyphenol Index (IPT) using the method Folin Ciocalteu, Total anthocyanin potential (PA) and Anthocyanins extractibility (EXA) and seeds maturity (MS) using the method Glories (Christaki T. *et al*, 2002).

The qualitative level of the 2016, 2017 and 2018 harvest years on the specific composition of the wine from Cabernet Sauvignon and Feteasca neagra varieties was evaluated by comparison with the average of 1990-1999.

## RESULTS AND DISCUSSIONS

**Climate characterization during the maturation of grapes.** The climate of the ripening period (July-September) was good in terms of air temperatures (as mean values, minimum and maximum) and mediocre in the amount of precipitation recorded in 2018, compared to average the years 1987-2017 (*figure 1 and table 1*).

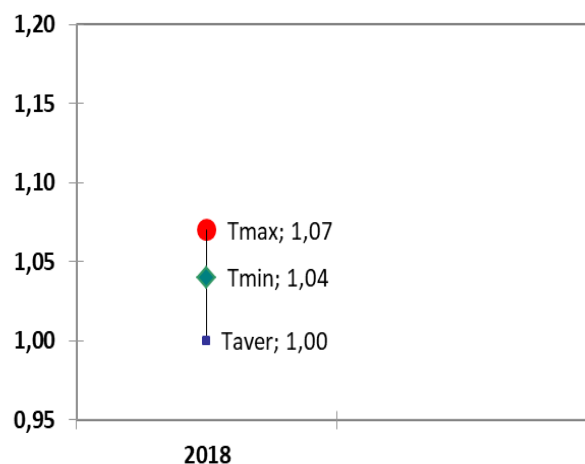


Figure 1 **Comparative analysis (year/multiannual average) of climatic parameters specific to maturation in the year of vintage 2018**

Table 1

**The evolution of the climatic parameters analyzed the ripening period of the grapes for wine**

Harvest year/ Period	Specifi- cation	Air temperature			Rainfall (mm)
		T aver. (°C)	T min. (°C)	T max. (°C)	
1987-2017	Min.	18.1	12.5	23.6	
	Max.	23.7	17.4	29.1	
	Aver.	21.7	15.6	27.3	
	Sum				195
2018	Min.	18.6	13.9	25.5	
	Max.	24.1	17.4	33.7	
	Med.	21.6	16.4	29.2	
	Sum				146
Evaluation 2018/1987-2017					
2018	Aver.	1.00	1.04	1.07	0.75
Comparative analysis of data		good	good	good	mediocre

The precocity was registered earlier with 12 days in case of Cabernet Sauvignon variety and 14 days

in case of Feteasca neagră, compared to the multiannual average (table 2).

Table 2

**Comparative analysis regarding the veraison to black wine grapes of Cabernet Sauvignon and Feteasca neagra varieties**

Harvest year	Annual date (number of days)		Differences number of days compared to the multiannual average	
	Cabernet Sauvignon	Fetească neagră	Cabernet Sauvignon	Fetească neagră
2014	213	208	-11	-14
2015	212	206	-12	-16
2016	208	203	-16	-19
2017	215	210	-9	-12
2018	214	212	-10	-10
Multiannual average	224	222		
Average			-12	-14

The maturation kinetics were specific to the variety and were correlated with the value of the regression coefficient and with the value of parameter «a» (determined from the slope of the straight  $y = ax$ ).

The regression coefficient for Fetească neagră, specific for 2017 and 2018 harvests was 0,990 and 0.991, respectively, the maturation kinetics being slow (table 3).

Table 3

**Harvest and variety specificity of the regression equation  $I_j = f(C_j)$  to the Fetească neagră variety**

Harvest year	Regression coefficient	Value of parameter „a”	Evaluation of grapes maturation kinetics
2014	0.992	1.502	very fast
2015	0.991	1.372	fast
2016	0.993	1.163	fast
2017	0.991	1.084	slow
2018	0.990	1.057	slow

The values of the analytical parameters that define the characteristics associated with the phenolic potential of red wine grapes were collected in a basis for the quantification on this potential presented in table 4.

The analysis of the data put into evidence (table 4) variations of parameters and their different classification, depending on the harvest year and variety.

In case of Cabernet Sauvignon, Total anthocyanin potential (PA), was appreciated as excellent in 2016, 2017 and 2018 year and for Fetească neagră it was just good.

The specific values of Anthocyanins extractibility (EXA%) were good for both varieties in the 2014 and 2018 harvest years.

The maturity of the seed was excellent in the 2016 harvest year both for Cabernet Sauvignon and Fetească neagră and very good in 2015, 2017 and 2018 years. The variation of the technological indices according to variety and harvest year is presented in table 5.

The data presented certify that the black grapes are well composed, with a normally developed berry content, the skin of the grapes is in a high proportion, with a high content of anthocyanins and specific flavors.

Grapes from the Cabernet Sauvignon variety contain more must and have a thinner skin than those from the Fetească neagră, they have smaller berry (the values of the IRD-yield index are very

small) and the skin of the grapes is thicker, specific to the variety of origin.

**The influence of the quality level of the harvest year on the composition of the wine.**

The wine from the Cabernet Sauvignon variety was appreciated, compared to the average of 1990-1999, with a very good alcoholic strength, of 12.6-

12.8% vol. Alcohol (*table 6*). The acidity of the wines was good (*table 6*), specific to the variety, the non-reducing extract good and the total polyphenol content high. The values of coloring intensity were very high for the potential of the variety, the nuance very good in 2016 and good in the 2017 and 2018.

Table 4

**Base for the phenolic potential quantification of black grape for winemaking**

Variety	Harvest year	Analyticals parameters			
		IPT (UA)	PA (mg/L)	EXA (%)	MS (UA)
Cabernet Sauvignon	2014	66	1099	56	54
	2015	45	882	48	72
	2016	39	1547	44	95
	2017	40	1575	53	62
	2018	72	1661	54	68
Fetească neagră	2014	56	839	50	53
	2015	34	947	59	74
	2016	39	1456	54	94
	2017	39	1266	47	66
	2018	65	1383	52	72

Table 5

**The variation of technological indices according to variety and harvest year**

Variety	Harvest year	Analyticals parameters			
		ISST	IB	ICZB	IRD
Cabernet Sauvignon	2014	31.3	97.4	2.8	4.6
	2015	28.7	82.1	5.7	4.3
	2016	28.4	93.2	8.0	2.6
	2017	32.1	85.6	6.7	3.0
	2018	46.5	78.3	6.5	3.9
Fetească neagră	2014	43.6	72.8	9.9	3.7
	2015	41.1	60.6	4.8	3.1
	2016	31.5	91.1	6.9	2.2
	2017	35.1	87.2	8.1	2.2
	2018	55.6	67.9	7.8	3.0

The wine from the Fetească neagră variety was appreciated as extractive, with a high alcoholic strength of more than 13% vol. alcohol (*table 7*).

The wine had a medium acidity and was intensely colored.

Table 6

**The composition of the wine from the Cabernet Sauvignon variety,  
compared to the average of 1990-1999**

Particularity		Tad* (% vol)	AT (g/L sulf. ac.)	Enr** (g/L)	IC*** (mm)	Nuance
Average (1990-1999)	Very good	12.5-13.7	3.5-4.0	>30	1.0-1.3	>0.7
	Good	12.0-12.5	3.5-4.5	27.5-30	0.75-1.0	0.5-0.7
	Mediocre	11.5-12.0	3.5-4.5	25-27.5	0.50-0.75	
	Slow	<11.5	>3.5	<25	<0.5	<0.5
<b>Year 2016</b>		12.6	3.8	27.8	1.09	0.71
<b>Year 2017</b>		12.8	4.4	26.7	1.16	0.64
<b>Year 2018</b>		12.8	4.4	26.4	1.20	0.57

\*Tad- high alcoholic strength; \*\*Enr- nonreducing extract, \*\*\*IC- coloring intensity

Table 7

**The composition of the wine from the Fetească neagră variety,  
compared to the average of 1990-1999**

Particularity		Tad (% vol)	AT (g/L sulf. ac.)	Enr (g/L)	IC (mm)	Nuance
Average (1990-1999)	Very good	12.5-13.7	3.0-3.5	27-29	0.8-1.3	>0.7
	Good	12.0-12.5	3.5-4.0	25-27	0.6-0.8	0.5-0.7
	Mediocre	11.5-12.0	3.4-4.0	22.2-25.0	0.4-0.6	
	Slow	<11.5	3.5-4.5	<22.2	<0.4	<0.5
<b>Year 2016</b>		13.0	3.78	18.85	0.70	0.87
<b>Year 2017</b>		13.5	3.89	27.33	0.82	0.95
<b>Year 2018</b>		13.6	3.75	27.33	1.03	0.62

## CONCLUSION

The rainfall regime in year 2018 registered a deficit of 49 mm compared to the average of 1987-2017.

The precocity was registered earlier with 12 days in case of Cabernet Sauvignon and with 14 days in case of Feteasca neagra, compared to the multiannual average.

Grapes maturation kinetics was very fast in the 2014 harvest year, fast in 2015 and 2016 and slow in 2017 and 2018.

Phenolic maturity at the Cabernet Sauvignon variety in the 2014 was appreciated as good for all determined analytical parameters, in 2015 very good for grape seed maturity, in 2016 particularly good for the total anthocyanin potential and grape seed maturity, and in 2017 and 2018 excellent, regarding of total anthocyanin potential.

Phenolic maturity at the Fetească neagră variety of the grapes in the 2014 and 2015 was appreciated as being very good for the maturity of the grape seeds.

The maturity of the grape seeds in 2016 was exceptional and the anthocyanin potential was very good.

The years 2017 and 2018 are distinguished by a very good anthocyanin potential and a very good maturity of the grapes seeds.

The grapes are well composed, with a percentage of normally developed grape berries.

The wines have a high alcohol concentration, a good acidity specific to the variety, intensely colored.

The wines reveal the specificity of the variety and are balanced in taste, on the strength of the harmony between the chemical parameters of composition.

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The study has the value of fundamental research, the data obtained may constitute reference elements for new experiments or for establishing efficient processing conditions in the wine industry, to achieve the quality and stability of finished products (wines), in accordance with modern quality standards.

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