STUDY OF THE CLIMATIC INFLUENCE ON THE COMPOSITIONAL CHARACTERISTICS OF WINES OBTAINED IN THE COPOU HILL VINEYARD

STUDIUL INFLUENȚEI CONDIȚIILOR CLIMATICE ASUPRA CARACTERISTICIILOR COMPOZIȚIONALE ALE UNOR VINURI OBȚINUTE ÎN PODGORIA COPOU

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Abstract: *Climate changes is a real impact factor for any form of agriculture and subsequently for grapes, but also for the quality of wines. The present study has as its main axis of research: observation of the influence of climatic conditions on the quality of wine mainly analysed. In order to accomplish this, we will study the wines from Copou vineyard obtained from the following varieties: Pinot gri, Fetească albă and Băbească gri, provided that they have undergone the same process of vinification in white. The study is based on the existing differences at physico-chemical level and chromatic characteristics of the analyzed wines in order to make correlations between the mainly wines features and weather conditions during the reference period 2012-2013.*
Key words: *white whines, climatic changes, spectrofotometry, compositional characteristics*

Rezumat: *Schimbările climatice reprezintă un factor de real impact pentru orice formă de agricultură și prin urmare și pentru struguri, dar și pentru calitatea vinurilor. Studiul de față are ca principală axă de cercetare: observarea influenței condițiilor climatice asupra calității compoziționale a vinurilor analizate. În vederea îndeplinirii acestui deziderat, se vor studia vinuri obținute în podgoria Copou din soiurile: Fetească albă, Pinot gri și Băbească gri, cu mențiunea că au fost supuse aceluiași procedeu de vinificare în alb. Studiul se bazează pe evidențierea diferențelor existente la nivelul fizico-chimic și al caracteristiciilor cromatice pentru vinurile analizate încercând realizarea unor corelații între caracteristiciile compoziționale și variația condițiilor climatice în perioada de referință 2012-2013.*
Cuvinte cheie : *vinuri albe, schimbări climatice, spectrofotometrie, caracteristici compoziționale*

INTRODUCTION

Climate is an omnipresent factor in the success of all farming systems, with a major influence in determining crop for a given region, is a measure of quality control of plant products and management of economic sustainability (Jones, 2008; Irmia et al., 2013).

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This study aims to follow the variability of quality wines produced from varieties: white Maiden (Fetească albă), Băbească gray and Pinot gray under the influence of different climatic indices in the reference period 2012-2013.

MATERIAL AND METHOD

The wines analyzed were obtained from white Maiden, Băbească gray and Pinot gray, applying a general technology of white wine. It should be noted that in conducting this research was chosen the reference years 2012 and 2013, wine years different in terms of climatic cues.

In a first stage, the wines were subjected to common physic-chemical analyzes, respective: acidity, density, pH, alcohol concentration, etc. The analytical methods used to determine these parameters were in accordance with the European standards and those imposed by the OIV (OIV, 2011).

In the second stage the wines were studied in terms of phenolic component and it was imposed to do some photometric analyzes with Shimadzu UV-1800 spectrophotometer. The reading of D280 index polyphenols was achieved at an 280 nm absorbance and for the Folin-Ciocalteu index it was used the method described by Watherhouse in 2002, so in this way the phenolic compounds are expressed by using a gallic acid standard curve with the following concentrations: 50, 100, 250, 500 mg / L (Watherhouse, 2002).

For an objective evaluation of the characteristic color of the wines the recommended method used was the one described by " Eclairage International Comission", namely: Cie Lab 76 (Cotea et al., 2009). The recording of transmittance spectra was performed using a UV-VIS spectrophotometer Carl Zeiss SPECORD coupled with an IBM-PC computer. In this way was made the digitization and the automatic recording of transmittance spectrum in a file stored on the computer. Digitized spectral data was processed with the program "WINECOLOR" to obtain the chromatic parameters L, a, b, c, and H^o.

RESULTS AND DISCUSSION

This article is a comparative study of the wines produced in 2012-2013, different years in terms of climate just to emphasize the importance of climatic conditions on the final product: the wine.

As a result of the physic-chemical analyzes that were performed and will be presented later, the wines analyzed were classified as quality wines. It can be seen in table 1 that in all samples, the parameter alcohol concentration exceeds 11% vol. alc., and between wines made from the same varieties the differences are minimal, except Pinot gray 2012 that shown an alcohol concentration of 14,77% and Pinot gray 2013 with an 12.66% alcohol.

Total acidity expressed in g / L $C_4H_6O_6$ presented differentiated values, so white Maiden 2012 reached a value of less than 4.94 g / L, and white Maiden 2013 had an acidity of 6.73 g / L. Pinot gray 2012 had a higher value of the acidity of 5.31 g / L to 2013 gray Pinot, whose value was 4.04 g / L and Băbească gray 2012 experienced a lower acidity of 5.27 g / L compared with Băbească gray 2013 that had an acidity of 6.62

In what concerns pH values, it were typical values varying between a minimum of 3.12 for sample white Maiden 2013 and a maximum of 3.53 for sample Pinot gray 2013.

Table 1

Physic-chemical analysis of wines

Wines considered	SO_2 mg/L		Vol. acidity (g/L $C_2H_4O_2$)	Total acidity (g/L $C_4H_6O_6$)	Relative density	Alch. conc. (% vol.)	Reductive subst. (g/L)	T.D.E. (g/L)	N.E. (g/L)	pH
	Free	Total								
White Maiden–2012	42.42	84.54	0.57	4.94	1.0049	11.78	36.30	53	16.7	3.46
White Maiden - 2013	5.57	36.23	0.27	6.73	1.0021	12.01	26.65	46.2	19.55	3.12
Pinot gray - 2012	15.79	78.65	0.49	5.31	0.9925	14.77	10.75	29.7	18.95	3.31
Pinot gray -2013	10.21	71.53	0.34	4.04	0.9995	12.66	20.77	41.6	20.83	3.53
Băbească gray-2012	10.21	54.50	0.38	5.27	0.990	11.98	3.54	15.2	11.66	3.36
Băbească gray-2013	41.49	101.57	0.40	6.62	0.9965	11.58	11.21	30.7	19.49	3.46

Reducing substances have recorded significant changes in the reference period 2012-2013 in the samples obtained from the same species. The 2012 white Maiden sample obtained a higher value of 36.30 g/ L reducing substances to sample white Maiden 2013 where reducing substances were 26.65 g/ L. However for Băbească gray and Pinot gray samples the pattern variation of this parameter was different. The Pinot gray 2012 registered a lower value of only 10.75 g/ L and Pinot gray 2013 an upper value of 20.77 g/ L reducing substances. Also Băbească gray 2012 showed a low value of 3.54 g/ L reducing substances and Băbească gray 2013 a higher value of 11.21 g/ L.

By making the correlation with climatic indices presented in table 2 it can be seen that the heat balance that favors the accumulation of sugars in the grapes and rainfall had a major influence on the physic-chemical characteristic of the samples analyzed. Thus, in 2012 when there was a heat balance higher and lower levels of precipitation, the sample showed elevated white Maiden sugars and a reduced total acidity, while in 2013 when there were lower values of heat balance and higher precipitation white Maiden samples shown a lower content of sugars and a higher acidity.

For the samples Băbească gray and Pinot gray the influence of climatic index caused a different evolution of the parameter reducing substances, namely:

the samples Băbească gray and Pinot gray 2012 showed lower levels of sugars from samples obtained in 2013.

Table 2

The climatic values of the reference years 2012-2013

Climate elements studied	Average years 1991-2010	Year 2012	Year 2013
Global heat balance, ◦C	3209.1	3652.8	3253.9
Active heat balance, ◦C	3096.8	3596.3	3147.1
Useful heat balance, ◦C	1425.9	1856.3	1467.1
The average annual temperature, ◦C	10.0	10.4	10.3
The average temperature during the growing, ◦C	17.5	19.9	17.8
Absolute minimum air temperature, ◦C	-27.2/28.12.1996	-26.7/12.02.12	-14.3/09.01.13
The absolute minimum temperature at the soil surface, ◦C	-35.0/26.01.2010	-33.0/08.02.12	-20.5/29.01.13
Maximum temperature, ◦C	42.3/20.07.2007	40.1/07.08.12	33,7/30.07.13
∑ actual annual insolation (hours)	2066.7	2169.5	2166.1
∑ actual insolation for vegetation period (hours)	1470.5	1499.1	1426.1
∑ annual rainfall (mm)	600.8	539.9	656.1
∑ rainfall during the growing season (mm)	409.1	287.2	501,1
Number of days with maximum temperatures >30◦C	24.1	55	14
During the growing season (no days)	173	175	167
Hydrothermal coefficient, CH	1.3	0.8	1.6
Real heliothermal Index, IHr	2.1	2.8	2.1
Bioclimatic index vineyard, Ibcv	7.1	10.7	5.4
Ability index oenoclimatic IAOe	4415.1	5058.2	4322.1
Annual index of aridity Martonne $I_{ar\text{-}DM}$	30.3	26.5	36.05

By evaluating TDE and NE can be inferred that these parameters have evolved in line with the reducing substances determined.

Volatile acidity expressed in g / L $C_2H_4O_2$ of analyzed wines shown the upper class quality and it is a proof of using raw materials with a high degree of health, of a right level of SO_2 and a good management of the technological process of winemaking.

Using spectrophotometry it was observed the variation of two parameters, namely: the total polyphenol index (IPT) and Folin Ciocalteu index (IFC) (fig. 1). In 2012 when there were higher values of heat balance, the number of days with maximum temperatures and higher values of the index bioclimatic vineyard the polyphenols content was higher for white Maiden 2012 sample compared to

sample white Maiden 2013 and for the samples Băbească gray 2012, Pinot gray 2012 this parameter was below the level recorded in 2013.

Chromatic parameters were calculated using the CIE Lab 76. The chromaticity revealed the predominance of green shades for Băbească gray and white Maiden wines and for gray Pinot gray samples quantitatively prevailed reds to green ones. In addition, it can be inferred that the samples with a small amount of chromaticity are brighter than the samples that have this chromatic parameter higher.

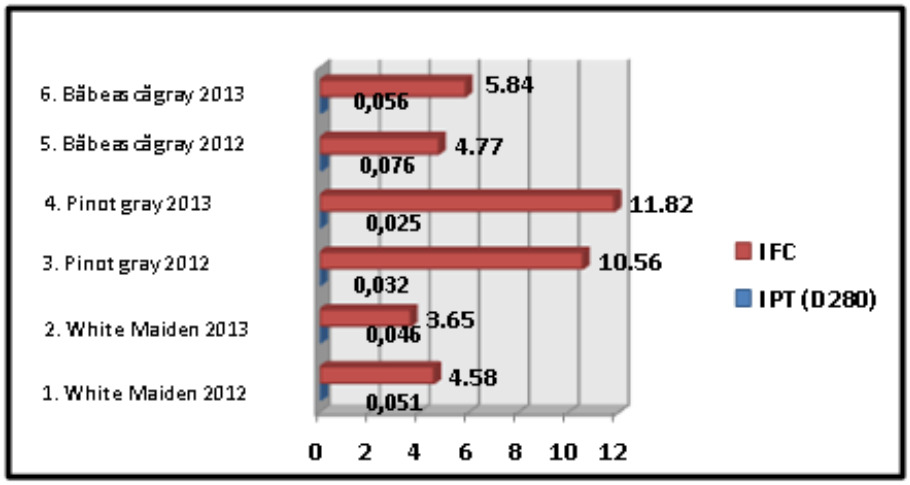

Fig. 1 - Polyphenol content and Folin- Ciocalteu index for the analyzed samples

Table 3

IPT values, IFC and chromaticity parameters obtained for the analyzed samples

Wines	IPT (D280)	IFC	CieLab-76					
			L clarity	Chromaticity	Croma (C)	Tone (H)	Bright-ness	Glass
White Maiden–2012	0.051	4.58	99.38	- a green= -0.312 +b yellow=2.508	2.527	-82.915	0.049	4.010
White Maiden-2013	0.046	3.65	99.28	- a green= -0.258 +b yellow=2.749	2.761	-84.626	0.056	3.882
Pinot gray-2012	0.032	10.56	87.56	+ a red= 13.47 +byellow=13.45	19.042	44.955	0.558	1.201
Pinot gray-2013	0.025	11.82	89.43	+ a red= 7.147 +b yellow=9.457	11.855	52.919	0.449	1.318
Băbească gray-2012	0.076	4.77	98.53	- a green= -0.356 +b yellow=5.544	5.556	-86.325	0.109	3.660
Băbească gray-2013	0.056	5.84	99.21	-a green= -0.516 +b yellow=3.073	3.116	-80.454	0.063	4.460

Analyzing the tone parameter (H) shown in table 3 is understandable that wines Băbească gray and white Maiden with higher values are visually perceived with yellow-green shadows and the Pinot gray wines where this parameter was between 44,955 and 52,919 it was perceived the presence of reds shadows.

CONCLUSIONS

Following the compositional evolution of wine samples analyzed and compared with the variation in climatic factors it can be deduced that these factors exert their influence in a different way on grape varieties and thus on the final product: wine.

So for the wines made from white Maiden variety the year 2012 was a better one in terms of quality than 2013, but for the wines made from Pinot gray and Băbească gray varieties, 2013 it was a differential one because there were obtained wines with a higher quality.

In order to obtain a characteristic production and for the improvement of quality wines is necessary to create future strategies for adapting to climate change factors, to apply a senior management and to improve wine grape varieties.

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