INFLUENCE OF MATURATION ON TECHNOLOGICAL PARAMETERS OF WHITE WINE CHARDONNAY AND PINOT GRIS

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Abstract: *The aim of the study was to determine, for two white wine varieties Chardonnay and Pinot Gris, the influence that wine maturation has on its chemical properties. For the experimental study we used two varieties of sweet wine from the same vineyard and the same year, with different periods of maturation. Harvesting took place when the grapes reached technological maturity, at a sugar content of 210-225g/l.*
We intended to highlight the improvement of wine quality during the aging period on the basis of the physico-chemical analysis made at the beginning and, after 24 months, at the end of the aging period. We analyzed the influence of aging on the chemical composition of wine, measuring its alcohol concentration, total acidity, volatile acidity, fixed acidity, pH (acidity real/ion), free and total SO_2 content, total dry extract and non-reducing extract.

The maturation had a significant effect on volatile acidity, fix acidity, pH, SO_2 free, SO_2 total, sugars, conductivity, total dry extract and non-reducing extract, while alcoholic concentration, total acidity and density were not significantly affected.

Keywords: *wine maturation, physico-chemical parameters, correlation matrix.*

1. Introduction

Wine maturation is the process that develops quality attributes of wine: clarity, colour, stability. During this phase, the process takes place under the action of oxygen, which combines fast enough with oxidizable constituents such as polyphenols, sulfur compounds, sulfur amhidrida. [1].

The transformations taking place are running at a relatively high redox potential, with limited participation of oxygen and consist in: the dissolution of some constituents of wood barrel, oxidation, condensation and partial precipitation of phenolic compounds and colloids, modifying the content of alcohols, aldehydes, acetals and esters, partial evaporation of volatile components, partial hydrolysis of (poliozide) and (heterozide) and finally, the process of insolubilisation accompanied by sedimentation of unstable components.

Wines produced by fermentation and maturation in oak barrels have different flavour characteristics to those which have undergone barrel maturation only after fermentation in stainless steel. One reason for this phenomenon is that actively growing yeasts are capable of transforming volatile flavour components, extracted from oak wood, into other volatile metabolites. [2]

Oxidation reaction rate increases with temperature under the action of oxidase enzymes, so aging is influenced by storage temperature. [3]

J. Maric and M. First-Baca, 2003 studied the evolution of chemical and sensory characteristics of bottled Chardonnay white wine matured at 12ºC and 75% humidity. Wine reaches its best quality at 12 months after bottling, longer periods, 24 respectively 36 months, can lead to a significant loss of quality due to reductive processes. [4]
Chardonnay is the most popular variety of white grapes used for wine production today, well known around the world; unlike other white wine varieties of Vitis vinifera L. Chardonnay's prominent aroma comes mainly from its maturation in oak barrels.

2. Materials and methods

The grapes were harvested in Panciu vineyard, Vrancea County.
The analysed wines (samples 1 ÷ 2, according to data from Table 1) were obtained using white wines specific technology.
After fermentation, clarification and fining, the wine was kept in wooden pots.

The vineyard from which the wine varieties come has plantations located as follows: 70% on the slope, 20% on set, and 10% on the plain. The great heliothermic resources have a positive influence on the quality of the wine.
Each wine received an identification code, namely:
C 01 - Chardonnay white wine at the beginning of maturation;
C 02 - Chardonnay white wine matured after 24 months;
Pg 01 - Pinot gris wine at the beginning of maturation;
Pg 02 - Pinot gris wine matured after 24 months;
The physical-chemical analyses (alcohol, total acidity, total dry extract, non-reducing extract, pH, SO_2 free, SO_2 total, density and conductivity) were made according to the methods indicated by in force State and international standards (***1988; *** 2005).

Statistical analysis
A multifactor analysis of variance (ANOVA) (using Statgraphics Plus version 5.1.) was carried out to study the influence of the type of wine and the maturation time. Two factors were taken into consideration: the type of wine and maturation time. The double interactions between these factors were also considered. The method used for multiple comparisons was the LSD test (least significant difference) with a significance level $\alpha = 0.05$.
The variables were weighted with the inverse of the standard deviation of all objects in order to compensate for the different scales of the variables. To achieve the correlation and the significance between the physico-chemical parameters the Pearson coefficient has been computed.

3. Results and discussion

During wine aging, alcoholic concentration can decrease but also increase due to the partial hydrolysis of esters.

Further analyses noted that the alcohol concentration of Chardonnay wine increased during maturation from 12.0 to 12.22º alc because of the fermentation of sugar residues, while the total acidity decreased from 6.3 to 6.135 g/l tartaric acid giving the wine physico-chemical stability, colour brilliance and a less astringent and softer taste.
In Table 1. shows physicochemical parameters analysed in sample before and after maturation of wines (Chardonnay and Pinot Gris); ANOVA F-ratio for each of two factors (maturation time and wine type) and their respective interaction

Table 1.
Physicochemical parameters analysed in sample before and after maturation of wines (Chardonnay and Pinot Gris); ANOVA F-ratio for each of two factors (maturation time and wine type) and their respective interaction

Physico-chemical parameters	Wine type		F-value	Maturation time [months]		F-value	W xM interaction
	Chardonnay	Pinot Gris		0	24		
Alcoholic concentration, [% v/v]	12.08a	11.91b	31.81**	11.92b	12.07a	24.77**	5.39ns
Total acidity [g/l sulphuric acid]	6.20b	6.58a	566.4***	6.51a	6.28b	209.3***	17.64*
Volatile acidity [g/l sulphuric acid]	0.60b	0.87a	19758***	0.62b	0.84a	13005.9***	175.85***
Fixed acidity [g/l sulphuric acid]	5.60b	5.72a	68.10***	5.88a	5.44b	987.8***	8.91*
pH	3.26a	3.23b	9.40*	3.18b	3.31a	274.15***	0.38ns
SO_2 free , mg/l	27.90a	25.74b	1027***	28.44a	25.19b	2335.8***	47.38**
SO_2 total, mg/l	140.74a	130.72b	860.7***	145.87a	125.86b	3532.7***	6.03ns
Sugars g/l	12.97a	11.97b	961.9***	15.46a	9.47b	34629***	0.0ns
Density g/cm^3	0.9914a	0.9949a	1.91ns	0.9926a	0.9937a	0.21ns	0.07ns
Conductivity w/mxgr	46.53a	46.58a	0.18ns	46.18b	46.93a	41.10**	8.95*
Total dry extract,g/l	32.57a	31.87b	73.82**	35.86a	28.58b	8028.3***	0.0ns
Non-reducing extract,g/l	19.60b	19.90a	36.51**	20.40a	19.10b	685.5***	0.0ns

The density of wine depends on the content of extractive substances and alcohol, but also on temperature.

Fixed acidity decreases due to the precipitation of salts of tartaric, malic and citric acid metabolism during malolactic fermentation, whence the combination of fatty alcohols.

Compared with the total acidity, volatile acidity of wines increased during storage, as well as the pH of wine, which fits in values up to 3.5 prevents attack microorganisms, tartaric precipitation and disposal oxidase. Such pH, and preservation of free and total SO_2 maximum limits prevents unpleasant taste and smell of sulfur in wine.

The higher the F-ratio (quotient between variability due to the considered effect and the residual variance), the greater the effect that a factor has on a variable. According to this, alchol, total acidity and density were most affected by the type of wine.

The factor "maturation" has an influence on volatile acidity, fix acidity, pH, SO_2 free, SO_2 total, sugars, conductivity, total dry extract and non-reducing extract.

Table 2 shows the correlation matrix obtained for each pair of variables. The

number in brackets is the P-value which tests the statistical significance of the estimated correlations at the 95.0% confidence level. The highest passively correlation was observed between sugars and SO_2 total, SO_2 total and SO_2 free, total dry extract and sugars, total dry extract and SO_2 total, total dry extract and fix acidity, non-reducing extract and total dry extract**.** The highest negative correlation was observed between the pH and the fix acidity, conductivity and sugars, non-reducing extract and pH, total dry extract and conductivity, SO_2 total and volatile acidity

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Table 2.
Correlation matrix (Pearson correlation coeffiecints) between physicochemical parameters

Parameter	Alchol	Total acidity	Volatile acidity	Fix acidity	pH	SO_2 free	SO_2 total	Sugars	Density	Conductivity	Total dry extract	Non-reducing
Alchol	1											
Total acidity	-0.886* (0.114) **	1										
Volatile acidity	-0.136 (0.864)	0.343 (0.657)	1									
Fix acidity	0.741 (0.259)	0.722 (0.278)	-0.403 (0.597)	1								
pH	-0.165 (0.835)	-0.664 (0.336)	0.474 (0.526)	-0.996 (0.004)	1							
SO_2 free	-0.260 (0.740)	-0.056 (0.944)	-0.954 (0.046)	0.648 (0.352)	-0.709 (0.291)	1						
SO_2 total	-0.506 (0.494)	0.081 (0.919)	-0.908 (0.092)	0.748 (0.252)	-0.799 (0.201)	0.989 (0.011)	1					
Sugars	-0.506 (0.494)	0.368 (0.632)	-0.747 (0.253)	0.908 (0.092)	-0.939 (0.061)	0.907 (0.093)	0.957 (0.043)	1				
Density	-0.524 (0.476)	0.603 (0.397)	0.906 (0.094)	-0.080 (0.920)	0.142 (0.858)	-0.749 (0.251)	-0.686 (0.314)	-0.461 (0.539)	1			
Conductivity	0.653 (0.357)	-0.351 (0.649)	0.646 (0.354)	-0.817 (0.183)	0.862 (0.138)	-0.831 (0.169)	-0.853 (0.147)	-0.902 (0.098)	0.264 (0.736)	1		
Total dry extract	-0.561 (0.439)	0.431 (0.569)	-0.699 (0.301)	0.935 (0.065)	-0.961 (0.039)	0.876 (0.124)	0.934 (0.066)	0.998 (0.002)	-0.399 (0.601)	-0.906 (0.094)	1	
Non-reducing extract	-0.777 (0.223)	0.690 (0.310)	-0.438 (0.562)	0.995 (0.005)	-0.998 (0.002)	0.683 (0.317)	0.774 (0.226)	0.924 (0.076)	-0.093 (0.907)	-0.868 (0.132)	0.948 (0.052)	1

*Pearson correlation, **P-value at 95.0%

4. Conclusions

Wine maturation took place from the first decanting and lasted until the wine has acquired characteristics (bottling). It was influenced by: oak barrels, climate change, oxidation, storage temperature, SO2 content, etc.

White wines made from Pinot Gris and Chardonnay varieties showed a slight increase in concentration during the maturation alcoholic fermentation due to the sugar residue, offering high alcoholic wine and a slightly sweet taste.

Although there was a slight increase during maturation, because the pH value of the wine did not exceed 3.5, wines from Pinot Gris and Chardonnay varieties are prone to attack microorganisms, precipitation of tartaric or quashing oxidase. The unpleasant taste and smell of sulfur and microorganisms attack for both types of wines are prevented by framing free and total SO2 values in the maximum limits for the entire period of storage of the wine. Non reducing extract values have decreased slightly during the ripening period due to condensation and deposit of phenolic compounds, and partial coagulation of protein substances.

The highest passively correlation was observed between sugars and SO_2 total, SO_2 total and SO_2 free, total dry extract and sugars, total dry extract and SO_2 total, total dry extract and fix acidity, non-reducing extract and total dry extract.

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