THE INFLUENCE OF AGEING ON LEES ON THE QUALITY OF WHITE WINES FROM THE MURFATLAR VINEYARD

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ABSTRACT

Ageing of wines on lees allows the release of different compounds such as mannoproteins and polysaccharides into wines during yeast autolysis. Yeasts can release polysaccharides, mainly mannoproteins, from the cell wall, not only during autolysis but also during alcoholic fermentation of the must. The polysaccharides released and more particularly the mannoproteins are wall constituents of yeast. We followed the effect of ageing on lees in 3 white wines from the Mulrfatlar vineyard, vintage 2020. We adopted 3 different maturation periods on yeasts: 10, 20 and 30 days. The results show that this technique offers great prospects for improving the quality of white wines.

INTRODUCTION

Wine aging on lees is a traditional oenological technique, which consists in placing wines on their fine lees (essentially dead yeast cells) and some grape solids (Salmon J-M. et. al., 2000). In enology, «grands crus» white wines are traditionally aged by the «sur lies» method, which consists of keeping the aging wine in contact with the lees (yeasts and organic residues). The lees can come either from the first or second fermentation and can be used for both white and red wines. This practice is still in the experimental stage (Bonnefond Caroline et. al., 2002). Wine lees are defined as the sediment formed at the bottom of the tank or barrel after wine alcoholic fermentation. They have a heterogeneous composition and currently constitute 6% of the byproducts generated by each ton of wine grapes. However, it is the most under-researched of all the byproducts of the winemaking process (Sancho-Galán P. et. al., 2020).

The composition of wine lees depends on environmental conditions, regions of origin and their agronomic characteristics, the grape variety, and the time of aging in the wood barrels (Pérez-Bibbins, B. et. al., 2015). After the winemaking process, the lees can be characterized as organic waste or byproducts, with a low pH value, low electrical conductivity values, and a high content of phosphorus, potassium, and organic matter, as well as a low content of micronutrients and heavy metals (Bustamante, M.A. et. a., 2008). Numerous wine lees recovery and valorization strategies have been proposed, with a particularly steep increase in published research in recent years. This attention is strictly linked to the concepts of circular economy and environmental sustainability that are attracting the interest of the scientific community (De Iseppi A. et. al., 2020).

Lees are characterized by an interesting oenological potential due to their complex composition and properties. Mannoproteins, lipids, volatile compounds and enzymes of lees are involved in the improvement of wine quality. The aromatic composition of wine is deeply modified during the aging on lees. In general, the contact with lees produces less astringent wine, with a slightly less intensity of color. Lees play a role in the removal of undesirable compounds of wine such as volatile phenols and residues of treatments (Pérez-Serradilla and Luque de Castro, 2008). Aging of wine on lees enhances the sensorial characteristics of wine. Only a small part of the lees produced in winemaking are used in traditional aging. Most are collected and then distilled or processed to obtain low quality wine. For these reasons, lees are currently an undervalued by-product of winemaking. A new technique was tested on an industrial scale to provide wine from lees of different origin. After racking, the lees were collected in an innovative steel system and processed by cycles of mixing in controlled condition of temperature and micro-oxygenation (Fia Giovanna, 2016).

MATERIAL AND METHOD

We studied 3 white varieties grown in Murfatlar, a famous Romanian vineyard, located in the Dobrogea region, in the South-East of the country. The 3 varieties are: Columna (a new Romanian variety, obtained right at Murfatlar), Sauvignon (one of the most appreciated varieties for quality white wines worldwide) and Fetească regală (a very popular and widespread Romanian variety). All varieties were harvested by hand on the same date and the grapes were subjected to microvinification at the Murfatlar Viticulture-Vinification Research Development Station under the same fermentation conditions and with the same doses of sulfur dioxide. For each variety, after the alcoholic fermentation we performed the ranking operation and three other variants were left on yeasts for different lengths of time: 10, 20 and 30 days, before being subjected to the ranking operation. The chemical analyzes were performed one month after the end of the alcoholic fermentation, in the Oenology laboratory of the Research Station, in accordance with the official methods of analysis of the International Organization of Vine and Wine (OIV).

RESULTS AND DISCUSSIONS

Alcohol concentration is the most important parameter of wine composition because ethyl alcohol is the main chemical constituent of wine and its concentration allows the classification of wine into categories and quality levels. The values of the alcoholic concentration for the wines from the 3 varieties show that for all the aging variants on yeasts, the Sauvignon variety had the highest concentrations, with 1-2% more vol. Than the Romanian varieties. This is not a surprise, because it is a variety of high quality. While in the Romanian varieties the control variant had a slightly lower alcoholic concentration compared to the delayed pritoc variants, in the Sauvignon variety the variants with wine storage on yeasts for 10 and 20 days had a lower alcoholic concentration compared to the control variant, with pritoc immediately after alcoholic fermentation. The variant with storage on yeasts for 30 days had, indeed, a higher alcohol concentration by 0.26% vol. (Table 1).

The second important parameter of composition in wine is the total acidity. In all varieties, keeping the wine on yeast after alcoholic fermentation led to higher values of total acidity. If the differences are small for the Columna and Sauvignon varieties, for the Fetească regală variety they are higher, with 0.08 to 0.41 g/L tartaric acid.

The volatile acidity shows a parallel evolution with the total acidity, increasing all varieties after keeping the wine in contact with the yeasts. At Fetească regală the highest values and the highest increases of volatile acidity were registered.

Keeping the wine in contact with the yeasts for 10 to 30 days led to a decrease in density relative to 200C in all 3 varieties, the biggest differences being the Sauvignon variety, followed by the Fetească regală variety and at least the Columna variety.

The influence of wine storage on yeast on the content of reducing sugars was not uniform in all varieties. Thus, for the Sauvignon and Fetească regală varieties, the decrease of the content from the control variant to those with wine storage on yeast was significant. On the other hand, for the Columna variety there was a decrease of only 0.2 g/L for the 30-day variant, for the others it was a very slight increase, of 0.1 g/L. Of the 12 variants of this study, only two (the control and the variant with 20 days of contact between wine and yeasts of the Sauvignon variety) the content of reducing sugars was higher than 4 g/L.

In all varieties, keeping the wine on yeast led to visible decreases in pH, compared to the control variant, even if in the Columna variety the pH in the variant with 30 days of contact was lower than in the variant with 10 days, at the Sauvignon variety values were constant at different contact times and for the Fetească regală variety the pH was higher in the 30-day variant compared to the 10-day contact duration variant.

There were important differences between varieties and variants in terms of tartaric acid and malic acid content. In the control version, without contact between wine and yeast, the highest tartaric acid content was for the Columna variety (3.52 g/L), followed by the Fetească regală variety (2.51 g/L) and the Sauvignon variety (1.85 g/L). In the variants with wine storage on yeast, the tartaric acid content was slightly higher at 30 days of contact with the Columna variety (3.59 g/L), it was higher in the 10-day variant and lower in the other variants in Sauvignon and Fetească regală varieties.

The malic acid content was significantly lower than the tartaric acid content in the Romanian varieties and slightly lower in the Sauvignon variety. For the Columna variety, the lowest content was for the martot variant and the highest was for the 20-day variant, given that the other contact variants also had a higher content. In the Sauvignon variety, the control variant had the highest content and the variant with 10 days of keeping the wine on yeast had the lowest content. For the Fetească regală variety, the highest content was for the 10-day contact version and the lowest content was for the 20-day contact variant.

CONCLUSIONS

Keeping the wine on yeast after alcoholic fermentation is an interesting possibility for improving the quality of white wines due to their enrichment in a lot of constituents extracted from the yeast storage. In this study, keeping the wine on yeast led to significant changes in the main composition parameters. The results obtained are partial because the wines were very young at the time of the analyzes and their follow-up will have to be continued because the effects of the diffusion of the different constituents from yeasts in wine will be felt in the following weeks and months of evolution.

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Table 1

Chemical composition of white wines

Variety	Chemical composition	Duration of stabulation			
		Control	*On lees* 10 days	*On lees* 20 days	*On lees* 30 days
Columna	Alcohol concentration (% vol.)	11,02	11,22	11,02	11,09
	Total acidity (g/L in tartaric acid)	6,20	6,21	6,18	6,35
	Volatile acidity (g/L in acetic acid)	0,51	0,58	0,56	0,59
	Relative density at +20 ºC	0,9941	0,9935	0,9938	0,9937
	Reducing sugars (g/L)	1,0	1,1	1,1	0,8
	pH	3,19	3,13	3,13	3,10
	Tartaric acid (g/L)	3,52	3,53	3,52	3,59
	Malic acid (g/L)	1,62	1,64	1,72	1,67
Sauvignon	Alcohol concentration (% vol.)	12,89	12,72	12,60	13,15
	Total acidity (g/L in tartaric acid)	4,62	4,76	4,81	4,63
	Volatile acidity (g/L in acetic acid)	0,61	0,65	0,68	0,59
	Relative density at +20 ºC	0,9933	0,9912	0,9935	0,9909
	Reducing sugars (g/L)	6,7	1,2	6,4	2,6
	pH	3,53	3,45	3,44	3,45
	Tartaric acid (g/L)	1,85	2,01	1,64	1,70
	Malic acid (g/L)	1,77	1,31	1,67	1,57
Fetească regală	Alcohol concentration (% vol.)	11,60	11,59	11,62	11,73
	Total acidity (g/L in tartaric acid)	4,79	5,20	4,87	5,07
	Volatile acidity (g/L in acetic acid)	0,77	0,77	0,76	0,95
	Relative density at +20 ºC	0,9945	0,9923	0,9920	0,9932
	Reducing sugars (g/L)	3,7	1,0	1,1	1,2
	pH	3,51	3,38	3,39	3,48
	Tartaric acid (g/L)	2,51	2,61	2,33	2,06
	Malic acid (g/L)	0,85	0,87	0,62	0,72