

Does barrel size influence white wine aging quality?

>>> White wine is increasingly aged in oak barrels to enhance its stability, aromatic complexity and organoleptic properties. Thus, this research aimed to highlight chemical and sensory differences in Sauvignon Blanc wines linked to barrel size. Oenological parameters, color, total phenolics and fruity aroma were not generally impacted by barrel size. Meanwhile, the smaller the barrel, the higher the extraction of oak woody volatiles. From an organoleptic point of view, Sauvignon Blanc varietal aromas and typicity seemed to be better preserved by 500 L barrels. <<<

To obtain a high quality aged wine, barrel choice is of great importance. Transfer of wood compounds into wine and micro-oxygenation that take place during barrel aging have a significant effect on phenolic composition and organoleptic perception of the final product. Both processes lead to a greater aroma and flavor complexity, and depend on several factors such as wood species and origin, aging time, barrel size, toasting and manufacture¹. As Emile Peynaud stated 'Young wine develops more rapidly in small volume'. The smaller the barrel, the greater the surface area to wine volume ratio and the higher the oxygenation flow per wine volume unit. Thus, even if aging time, barrel toasting, species and origin of wood are the same, the aging process and the oak character of wine will differ depending on barrel size. No studies have addressed this issue for white wines, even if aging them in oak barrels is becoming a common practice in some winegrowing regions.

■ Materials and methods

White wine (90 % Sauvignon Blanc, 5 % Sémillon and 5 % Muscadelle) considered in the present research was vinified in 2018 vintage in Château La Freynelle (Entredeux-Mers appellation). Alcoholic fermentation started in stainless steel tanks and, at a density of 1040 g/L, wine was transferred to barrels. All wooden containers used were made up of French oak from two species (95 % *Quercus petraea* and 5 % *Quercus robur*) by Nadalié cooperage (Ludon-Médoc, France). Barrels of two different sizes (225 L and 500 L) and two different toasting (Épicé and Fruité) were considered (three different units per modality size-toasting).

In order to highlight potential chemical and organoleptic differences linked to barrel size, phenolic composition, fruity and woody aroma profiles and sensory properties were determined. For this purpose, wine was sampled at the end of both alcoholic and malolactic fermentation, and after 2.5- and 5-months ageing.

■ Impact on chemical composition

Regardless of barrel size and toasting, conventional oenological parameters of wines such as pH (3.5 ± 0.0),

alcoholic strength (12.9 ± 0.1 %vol.), titratable and volatile acidity (2.9 ± 0.1 and 0.3 ± 0.0 g/L, respectively) remained constant beyond the malolactic fermentation. As observed in Figure 1, wine color was as well not impacted by barrel size. In addition, no signs of oxidation nor browning were observed during aging for any of the wines analyzed. In the case of Fruité toasting, no significant differences were found between both barrel sizes regarding total phenolic content of wines throughout the whole experimentation. Meanwhile, the Épicé 225 L barrel (231 ± 3 mg GA/L wine) led to a slightly higher total phenolic content than the largest barrel size (214 ± 1 mg GA/L wine) of the same toasting: the ratio of surface area to wine volume is greater in the smallest barrel (0.9 m²/hL wine for 225 L barrel and 0.7 m²/hL wine for 500 L barrel). The different behaviors observed for Épicé and Fruité barrels may be justified by the barrel toasting influence on phenolics extractability from oak wood.

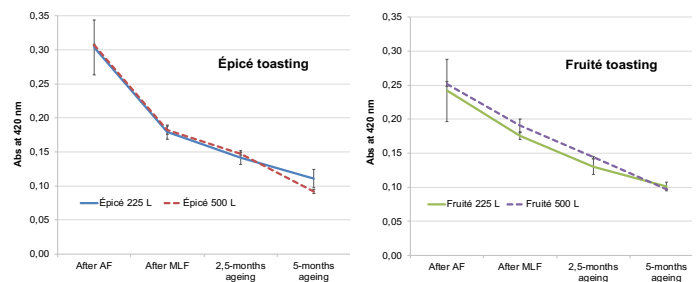


Figure 1. Evolution of wine color according to barrel size for both Épicé and Fruité toasting.

Esters, synthesized during alcoholic fermentation and modulated during malolactic fermentation, are known to play an important role in the fruity nature of wines². Throughout the whole experimentation, similar contents of these volatile compounds were found in wines from both barrel sizes. Thus, fruity character of wines was not impacted by barrel size.

In contrast, a quite different woody aroma profile was obtained depending on the barrel volume (Figure 2). Specifically, a greater extraction of whiskeylactones, considered as main responsible for coconut, woody and oak-like olfactory notes, was observed for wines aged in 225 L barrels. In the case of Épicé toasting, *trans*-whiskeylactone concentration was around 19-fold greater in wine from 225 L barrel than in wine from 500 L barrel. The same behavior was shown for Fruité toasting in a lesser extent (a content from 3 to 4-fold higher in the smallest barrel).

With regard to the *cis*-whiskeylactone, only wines from 225 L barrels presented concentrations above its perception threshold (54 µg/L wine). Wines from 500 L barrels exhibited values between 3- and 7-fold times lower. Consequently, a direct impact on woody perception of the final wine might be observed.

Even if less noticeable, the same behavior as whiskeylactones was displayed by vanillin, the main contributor to vanilla smell in wines.

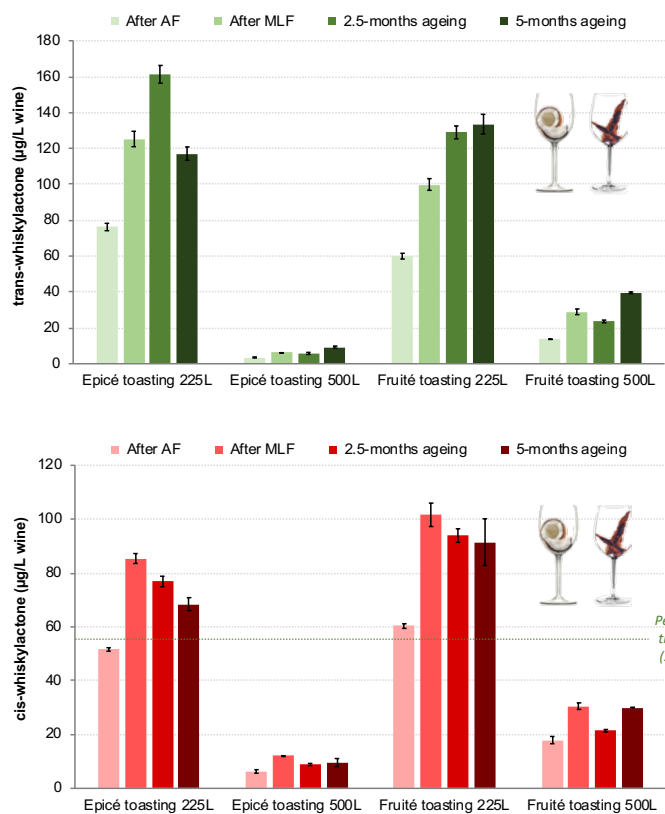


Figure 2. Evolution of main woody aroma compounds of white wines according to barrel size for both Épicé and Fruité toasting.

■ Impact on organoleptic quality

Sensory analyses were performed by a panel of 24 expert judges from the Institute of Vine and Wine Sciences of the University of Bordeaux. Olfactory and gustative panel training was first conducted to familiarize the subjects with Sauvignon Blanc character, aroma recognition and wine taste. Sauvignon Blanc character for this research according to the main odorant attributes of thiol compounds present in this grape variety: cat's pee, exotic fruits (grapefruit, passion fruit or lychee), and oxidation notes (cooked potato, curry or walnut).

Judges were able to distinguish wines according to barrel size. Differences detected between wines from 225 L and 500 L barrels were significantly related to cat's pee notes (higher intensity for wines from 500 L barrels) and, in the case of Épicé toasting, also to palate volume (greater for wine of 225 L barrel) (Figure 3). Furthermore, even if the differences were not statistically significant, judges generally perceived wines from 225 L barrels as woodier and attributed to wines from 500 L barrels a higher Sauvignon Blanc typicality. According to the judges' evaluation, oak character was pleasantly present in all wines, but better integrated into the aromatic bouquet of wines aged in 500 L barrels.

As observed according to the judges, the larger the size of the barrel, the greater the capacity to keep the typicality and the varietal aromas of Sauvignon Blanc. There are two processes participating in the phenomenon of wine aging in barrels: the interaction with wood and the oxygen entering the wine through the barrel. As both factors occurred in a lesser extent per unit of wine volume in the 500 L barrels than in 225 L barrels, white wines seem to keep longer their varietal essence as the barrel size increases.

■ Conclusions

In general, barrel size did not seem to impact significantly both phenolic and fruity aroma composition of the

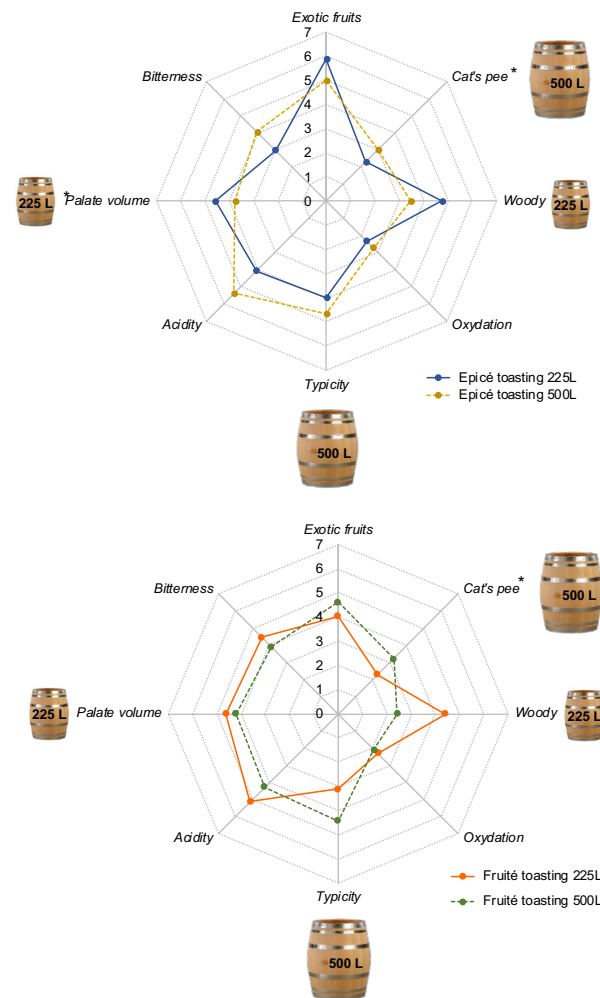


Figure 3. Sensory evaluation of white wines according to barrel size for both Épicé and Fruité toasting. * indicates statistical significant differences between both barrel sizes at 5 % level.

studied white wines. Meanwhile, it was observed that the extraction of woody aromas certainly depends on the surface area to wine volume ratio: the smaller the barrel, the higher the surface of wine-wood interaction per unit of wine volume, and the greater the transfer of whiskeylactones and vanillin from wood to wine. Regarding the sensory analyses, 500 L barrels seemed to better preserve Sauvignon Blanc varietal aromas (cat's pee, aromatic marker for Sauvignon Blanc typicality). Woody compounds, volatile or not, are transferred into the wine as it ages. Too much of these compounds might damage wine harmony, but just the right amount of wood may significantly improve its quality. The goal is to choose the best surface/volume ratio as well as the best contact time between oak and wine in order to enhance fruity aromas, add structure and build the desired oak character of the final wine. ■

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1 Pilet, A., de Sousa, R.B., Ricardo-da-Silva, J.M., Catarino, S. (2019). Barrel-to-barrel variation of phenolic and mineral composition of red wine. 41st World Congress of Vine and Wine, *BIO Web of Conferences* 12, 02011.

2 González-Centeno, M.R., Chira, K., Teissedre, P.-L. (2017). Comparison between malolactic fermentation container and barrel toasting effects on phenolic, volatile, and sensory profiles of red wines. *Journal of Agricultural and Food Chemistry*, 65, 3320–3329.