Influence of berry maturity, maceration time and wine maturation on the polyphenols and sensory characteristics of Pinot noir and Cabernet Sauvignon

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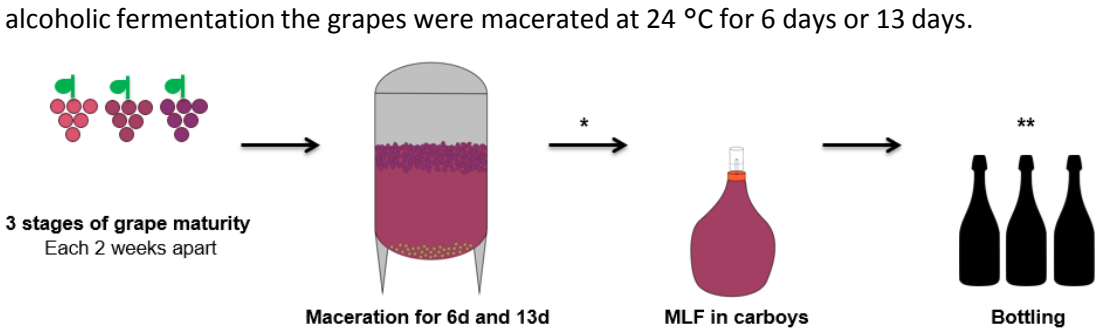
Introduction

The effects of berry maturity and maceration time on the polyphenols and sensory characteristics of Cabernet Sauvignon have been studied previously [1]. With an increase in berry maturity the color intensity and the concentrations of anthocyanins and proanthocyanidins increased. By extending maceration time a decrease in color intensity and anthocyanin concentration could be observed as well as an increase in proanthocyanidins [1].

The comparative investigation of the influence of berry maturity, maceration time and wine maturation was chosen to assess the importance of the term “phenolic maturity” and its impact on polyphenols and sensory characteristics in the context of well-known effects observed during winemaking. Pinot noir and Cabernet Sauvignon were used due to the huge differences in the climatic growing conditions, in phenolic profiles in grapes and wines and their high international relevance.

Experimental design and analytical methods

Pinot noir and Cabernet Sauvignon grapes of the vintage 2018 were harvested at three different stages of grape maturity (approx. 20.5 Brix, 22.6 Brix and 24.3 Brix). During/after alcoholic fermentation the grapes were macerated at 24 °C for 6 days or 13 days.



* Chemical analysis pre-MLF
** Chemical and sensory analysis post-bottling

Figure 1: Experimental design

Vinification was conducted in 100 L fermenters. All wines were fermented <1 g/L residual sugar and MLF was done after alcoholic fermentation. The phenolic composition was analyzed using HPLC-DAD/FD, LC-QToF-MS and different spectrophotometric assays. The descriptive sensory analysis has been conducted using 19 trained judges. Wines were analyzed immediately after pressing and three months after bottling to investigate the influence of wine maturation (Fig. 1).

Results and discussion

The PCA of the sensory data of Pinot noir showed a higher variance (47 %) between the wines due to berry maturity than due to maceration time (33 %) (Fig. 2).

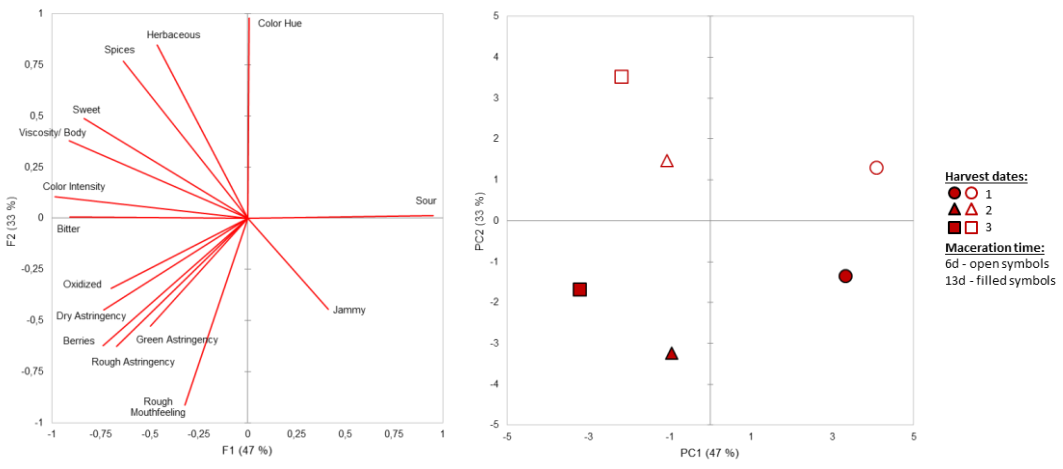


Figure 2: PCA of the sensory data of Pinot noir (n=3 panel replicates)

Wines of a higher berry maturity were described as more full bodied with a higher color intensity and low in acidity. An extended maceration time resulted in wines with a rougher mouthfeeling and higher astringency. Short macerated wines were described as more herbaceous. The sensory perception of wines made out of berries at different stages berry maturity could not be influenced towards another stage by extending maceration time.

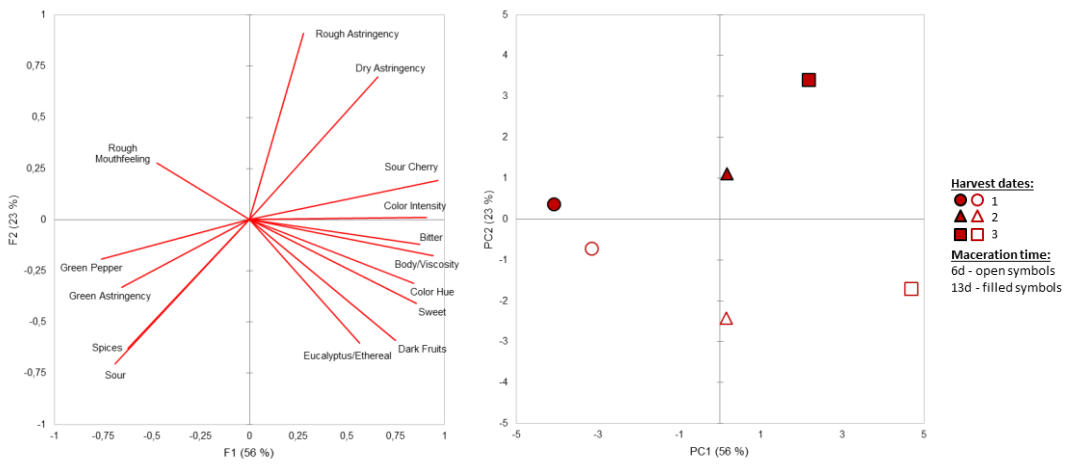


Figure 3: PCA of the sensory data of Cabernet Sauvignon (n=2 panel replicates)

The PCA of the sensory data of Cabernet Sauvignon showed similar results as Pinot noir with a higher variance (56 %) between the wines due to berry maturity than due to maceration time (23 %) (Fig. 3). It can also be observed that the variance due to maceration time of the wines of the same berry maturity increases with an increased berry maturity.

The PCA of the chemical data of Pinot noir showed the highest variance (47 %) between the wines due to wine maturation and the second highest due to maceration time (29 %) (Fig. 4). Berry maturity was responsible for 11 % of the variance (data not shown).

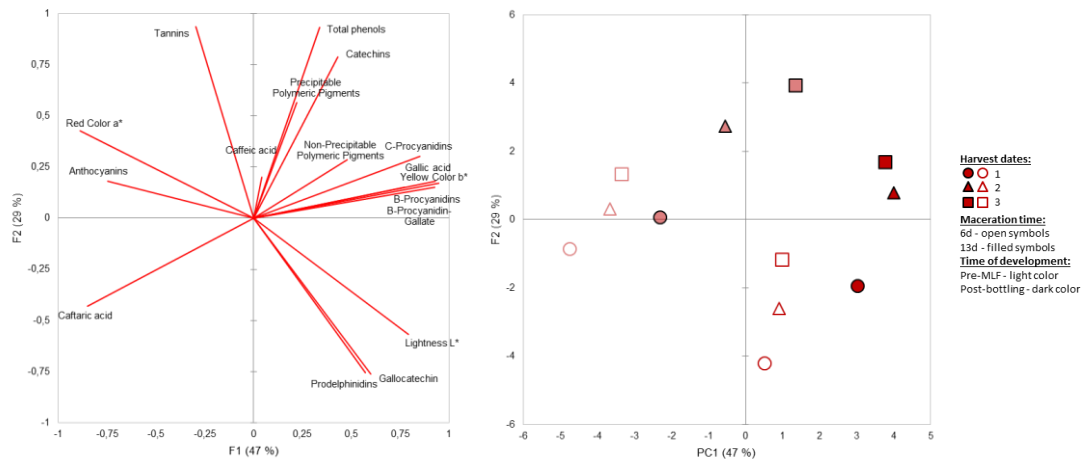


Figure 4: PCA of the chemical data of Pinot noir from pre-MLF and post-bottling (n=2 experimental replicates)

The PCA of the chemical data of Cabernet Sauvignon also showed the highest variance (37 %) between the wines due to wine maturation and the second highest due to maceration time (33 %) (Fig. 5). Berry maturity was responsible for 17 % of the variance (data not shown).

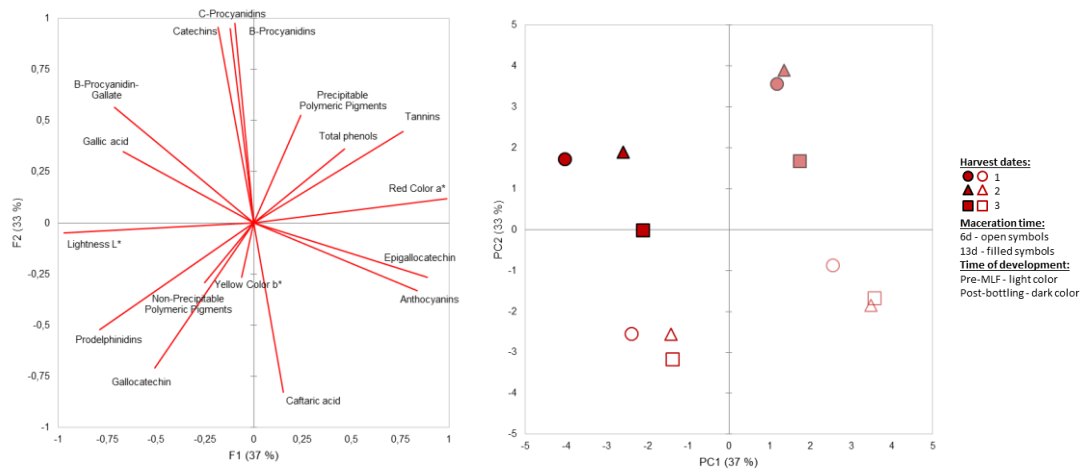


Figure 5: PCA of the chemical data of Cabernet Sauvignon from pre-MLF and post-bottling (n=2 experimental replicates)

The parameters C-Procyanidins and lightness showed a positive correlation with an increase in wine maturation, while anthocyanins correlated negatively.

The PCA of the chemical data of both grape varieties showed an increase in seed polyphenols such as gallic acid, monomeric catechins, B- and C-Procyanidins and B-Procyanidin-gallates, by extending maceration time as described previously [2, 3, 4].

Color intensity, anthocyanins as well as polymeric pigments could be identified as parameters that correlate positively with an increase in berry maturity [1]. However, these parameters are insufficient to explain the strong influence of berry maturity observed during sensory analysis.

Conclusion

The analytical methods are well suited to identify and explain the differences of the wines due to maceration time and wine maturation.

The strong influence of berry maturity on sensory perception cannot be explained solely by the phenolic composition of the wines. Further research is needed to identify other parameters that contribute to berry maturity and their interactions with polyphenols to improve the understanding of the term “phenolic maturity”.

This study shows that the oenological tool of extended maceration cannot compensate insufficient berry maturity in regard to sensory perception.

References

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