EFFECT OF DIFFERENT LEVELS OF OXYGENATION ON PHENOLIC AND VOLATILE COMPOUNDS OF NEBBIOLO WINE DURING BOTTLE STORAGE

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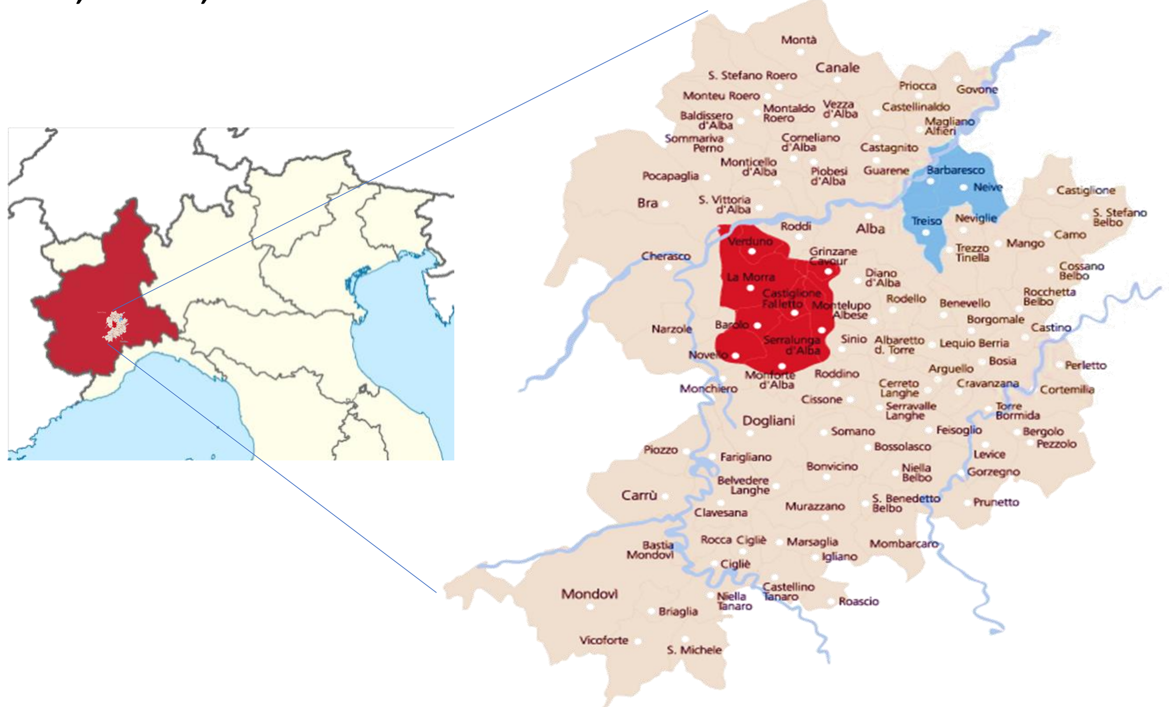
Four Nebbiolo-based wines, two from the Barolo area and two from the Barbaresco area, with a content of about 25 mg/L of free sulfur dioxide were subjected to subsequent oxygenation cycles (Petrozziello et al., 2018). For each cycle, a portion of wine was separated and bottled without undergoing further oxygenations as represented below. Oxygen was applied by air stirring in sequential cycles each one involving the consumption of about 7 mg/L of oxygen (saturation level); each oxygenation was performed only after the complete oxygen consumption by each sample. The wines were therefore oxygenated up to a maximum total supply of 28 mg/L of oxygen. Wines were then stored in the absence of oxygen, and their compositional traits were carried out after 60 days (T60) and 300 days (T300)



Experimental plan

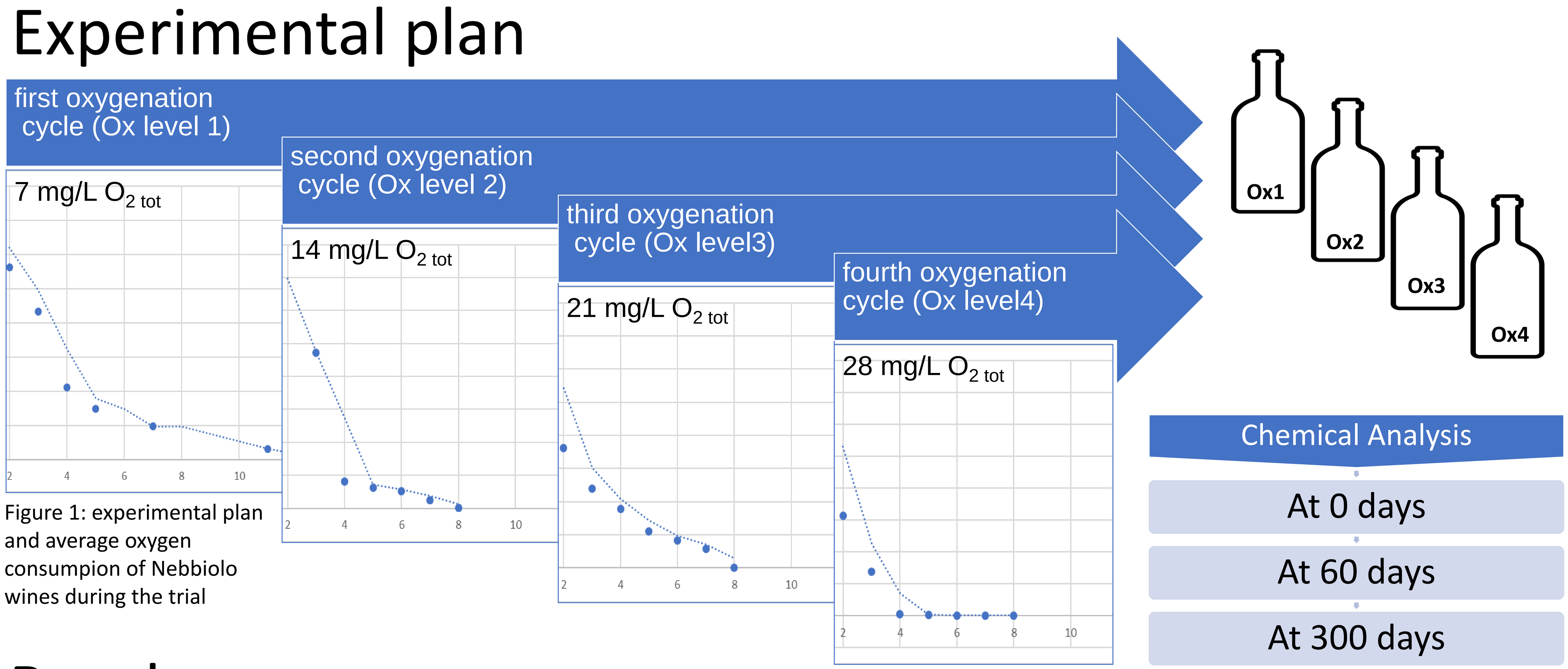


Figure 1: experimental plan and average oxygen consumpion of Nebbiolo wines during the trial

Results

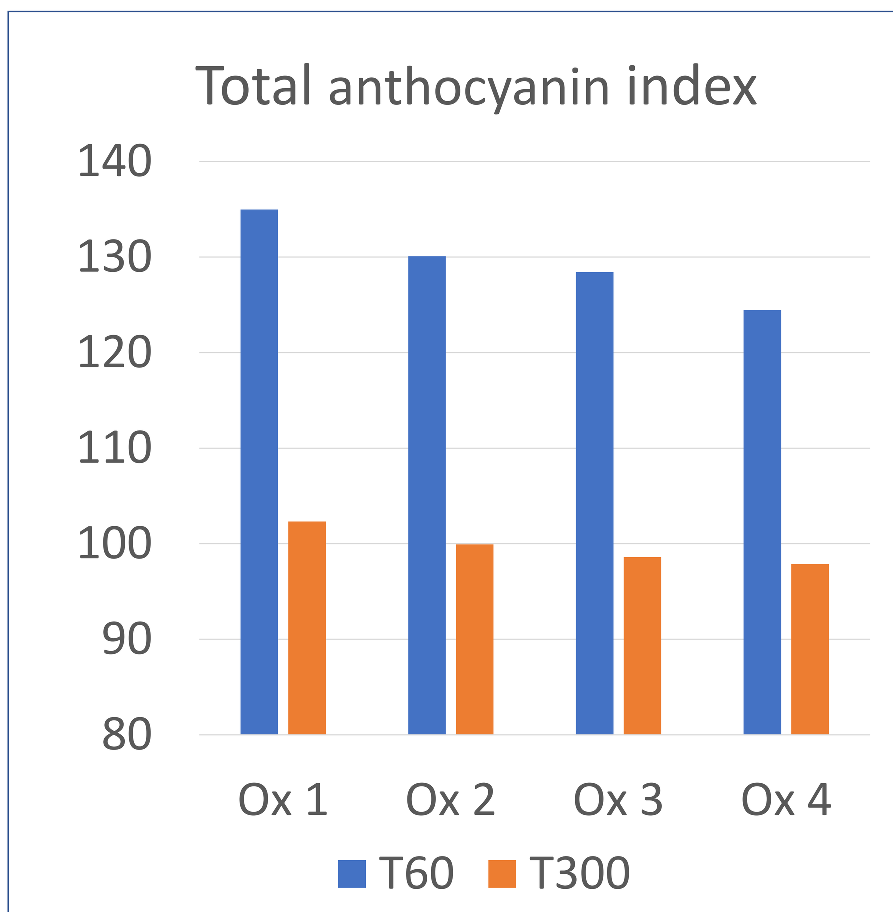


Figure 2: Total anthocyanin index expressed as mg malvidin-3-glucoside chloride/L at 60 and 300 days after bottling for each oxygenation level.

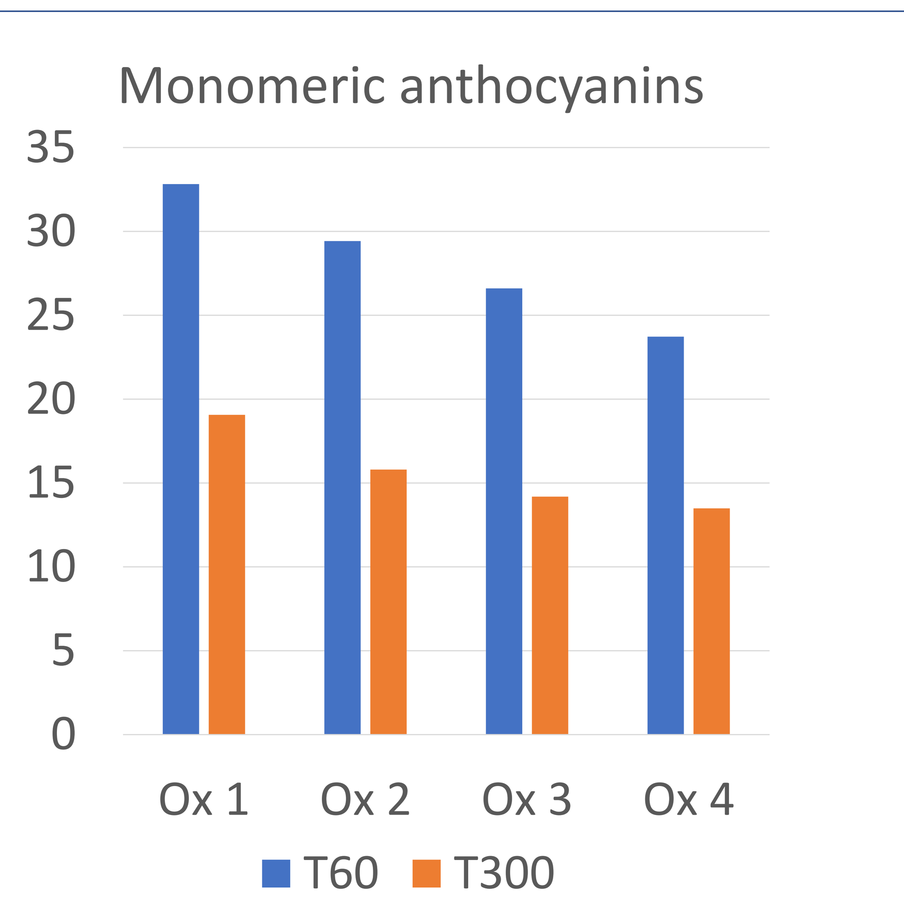


Figure 3: Monomeric anthocyanins index expressed as mg malvidin-3-glucoside chloride/L at 60 and 300 days after bottling for each oxygenation level.

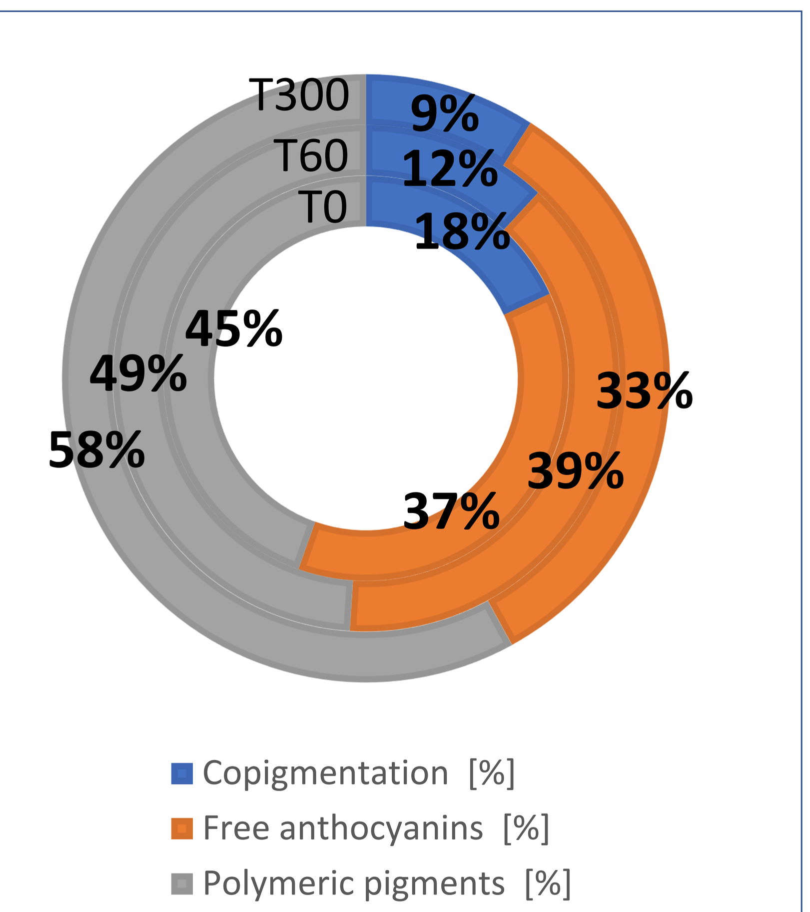


Figure 4: The copigmentation colour indexes (copigmented anthocyanins, free anthocyanins and polymeric pigments fractions expressed as percentage) for T0, T60, T300

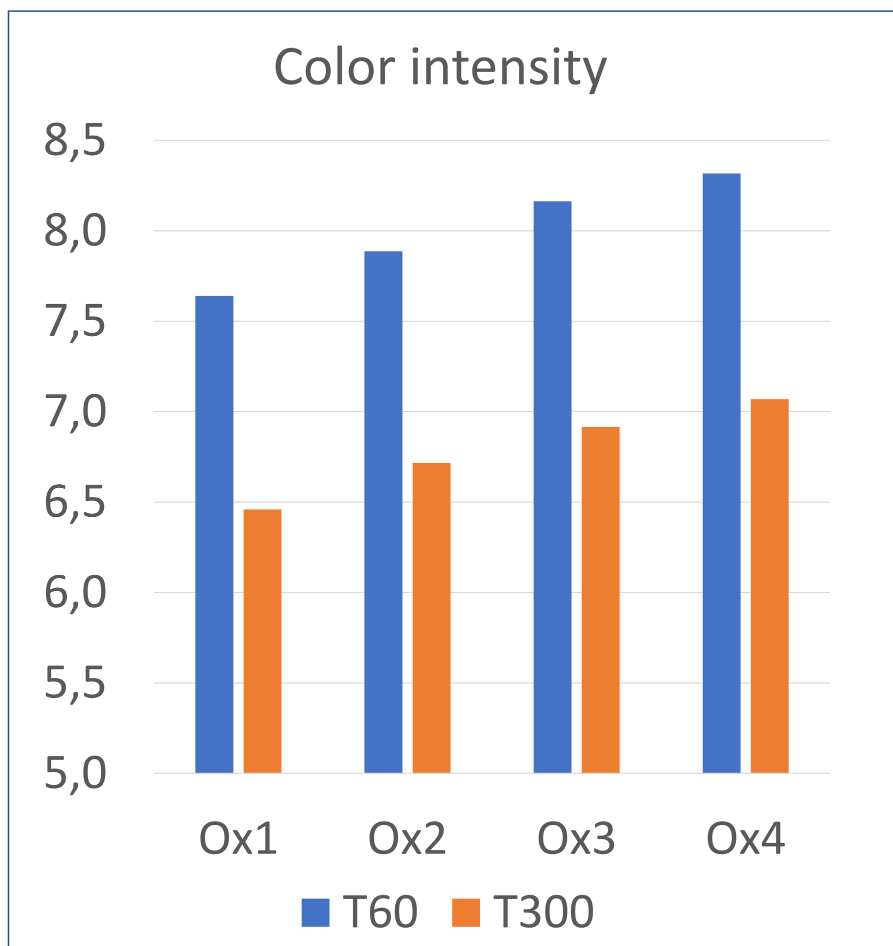


Figure 5: Average Color intensity of Nebbiolo wines during the trial. Color intensity is expressed as sum of absorbance (A.U. - O.P. 10 mm) at 420, 520, and 620 nm. 60 and 300 days after bottling for each oxygenation level are represented.

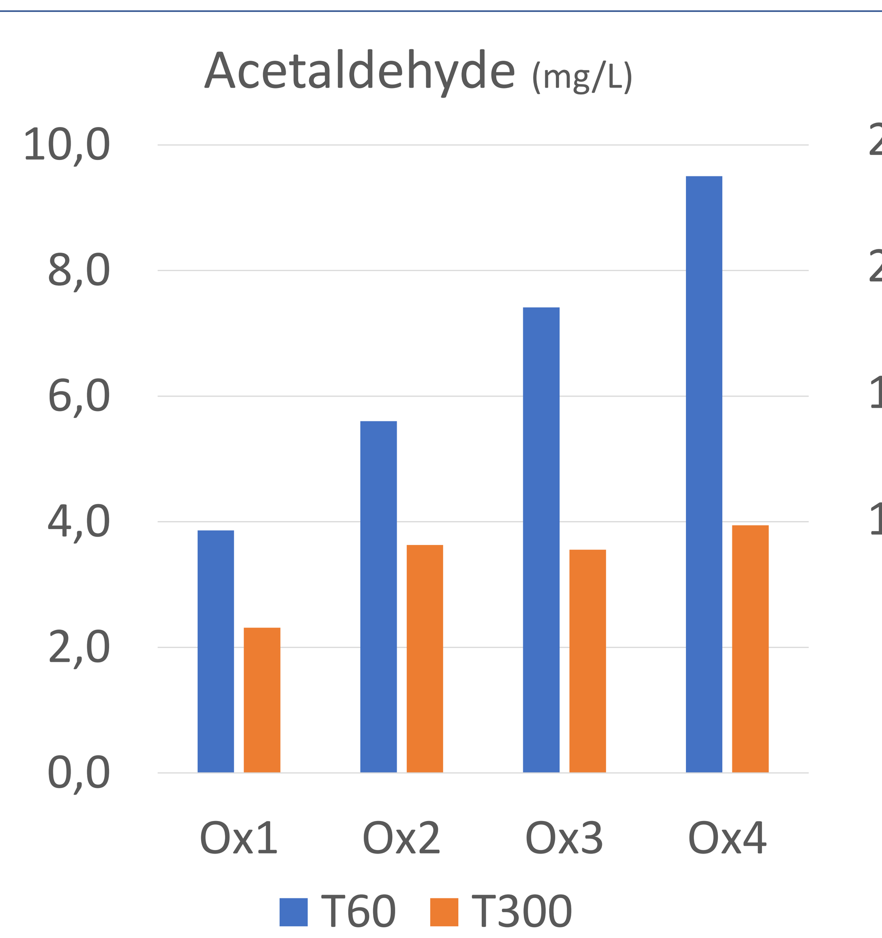


Figure 6: Acetaldehyde content in experimental wines. Acetaldehyde is expressed as mg/L at 60 and 300 days after bottling for each oxygenation level.

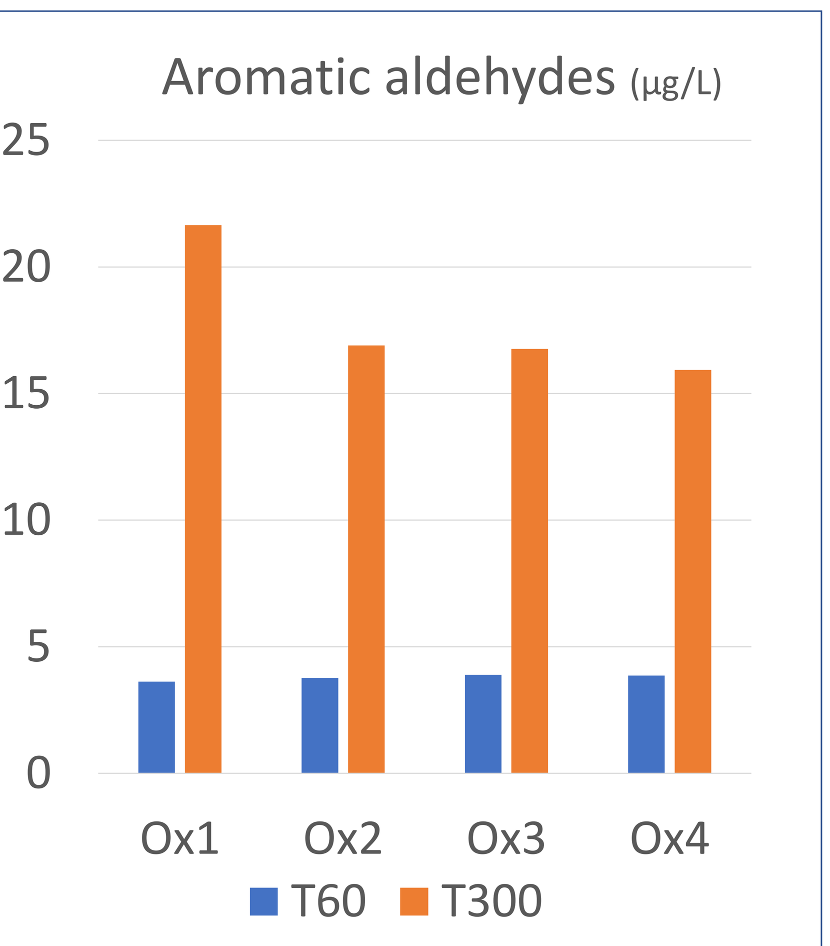


Figure 7: Sum of minor aldehydes (Hexenal, *t*-2-octenal, *t*-2-nonenal, phenylacetaldehyde, and methional) in experimental wines. Aldehydes are expressed as µg/L at 60 and 300 days after bottling for each oxygenation level.

Methods

The **dissolved oxygen** content was assessed by a luminescence-based measurement using a portable analyzer. **Wine color as intensity and hue** as well as CIEL*a*b* parameters (OIV, 2016) have been measured by spectrophotometry. The copigmentation colour indexes were determined according to the method proposed by Boulton (1996). total anthocyanin content was determined by measuring the maximum absorbance at 536-540 nm after dilution with hydrochloric ethanol, while anthocyanins in their monomeric form were determined as described by Di Stefano et al., 1989. **Volatile aldehydes:** Hexenal, *t*-2-octenal, *t*-2-nonenal, phenylacetaldehyde, and methional, were derivatised by (PFBHA) and determined by GC-MS. **Major aldehydes by HPLC a**cetaldehyde, was analysed by HPLC after derivatization with DNPH (Petrozziello et al., 2018).

Conclusions

The measurements of dissolved oxygen carried out during oxygenation steps have shown that the rapidity of oxygen consumption tends, in average, to increase as the oxygenation cycles proceed: complete consumption of dissolved oxygen took 10 days during the first cycle while 8 and only 4 days are needed during subsequently oxygenation steps.

As regards wines during storage, a decrease in color intensity, total and free anthocyanins was observed, while an increase in polymeric pigments and some minor aldehydes was also evidenced. After 300 days from the treatments the differences in color parameters among samples with different doses of oxygen were detectable but modest. These results were in contrast with a clear increase of free acetaldehyde content at increasing doses of oxygen measured after 60 days of storage. The effect of oxygen on color and production of pigments not bleachable by SO_2 during ageing probably varies with wines composition: Nebbiolo wines resulted resilient in this aspect, probably because of their low content in anthocyanins and a high content in tannins.

Bibliography

Boulton, R. B. (1996). A method for the assessment of copigmentation in red wines. in 47th annual meeting of the American Society for Enology and Viticulture, Reno, NV. June 1996.
Di Stefano, R., Cravero, M. C., and Gentilini, N. (1989). Metodi per lo studio dei polifenoli dei vini. *Enotecnico* 25, 83–89.
Petrozziello, M., Torchio, F., Piano, F., Giacosa, S., Ugliano, M., Bosso, A., & Rolle, L. (2018). Impact of Increasing Levels of Oxygen Consumption on the Evolution of Color, Phenolic, and Volatile Compounds of Nebbiolo Wines. *Frontiers in Chemistry*, *6*, 137. doi:10.3389/fchem.2018.00137