

Phenolic profiles of red straw wines: Impact of grape variety and ripeness on postharvest dehydration

Marta Baviera¹, Micaela Boido², Jessica Samaniego Solis³, Ivano De Noni¹, Antonio Tirelli¹, Simone Giacosa², Davide Slaghenaufl³, Daniela Fracassetti^{1,*}

¹Department of Food, Environmental and Nutritional Sciences, Università degli Studi di Milano, Italy

²Department of Agricultural, Forest and Food Sciences, Università degli Studi di Torino, Italy

³Department of Biotechnology, Università degli Studi di Verona, Italy

INTRODUCTION

- ✓ Grape dehydration is the dynamic process of water loss from the berries occurring under more or less controlled environmental conditions, leading to weight loss and the concentration of sugars and secondary metabolites.
- ✓ The process is influenced by temperature, relative humidity (RH), ventilation, and duration, which determine water and weight loss (WL), and it varies according to grape variety and ripeness [1].
- ✓ Dehydration markedly affects grape and wine phenolic composition, leading to both concentration and degradation of compounds that influence red wine color, astringency and bitterness [2].
- ✓ Harvest timing and withering duration appear to play a significant role in shaping the chemical composition of the resulting wines [1].
- ✓ Therefore, further research is needed to deepen our understanding of how the interaction between harvest time and grape withering influences wine phenolic composition.

AIMS

To evaluate the combined influence of ripeness level/dehydration duration and grape variety on the phenolic profile of grape and resulting straw wines.

MATERIALS AND METHODS

- ✓ 'Corvina', 'Moscato di Scanzo' and 'Nebbiolo' grapes were harvested at three ripeness levels: low (LR; 18° Bx), medium (MR; 21° Bx) and high (HR; 23° Bx) ripening.
- ✓ The grapes were subjected to controlled postharvest dehydration (14–15 ° C, 40–50% RH) until reaching 20% weight loss (Figure 1).
- ✓ Total anthocyanins (ACNs) and flavonoids (TFs) were assessed in grape samples.
- ✓ Microvinification trials were performed with skin maceration, monitoring the inoculated fermentation by weight decrease.
- ✓ The resulting wines were characterized in terms of ACNs, TFs, proanthocyanidin (PACs) profile, PACs mean degree of polymerization (mDP) and PACs galloylation (%G).

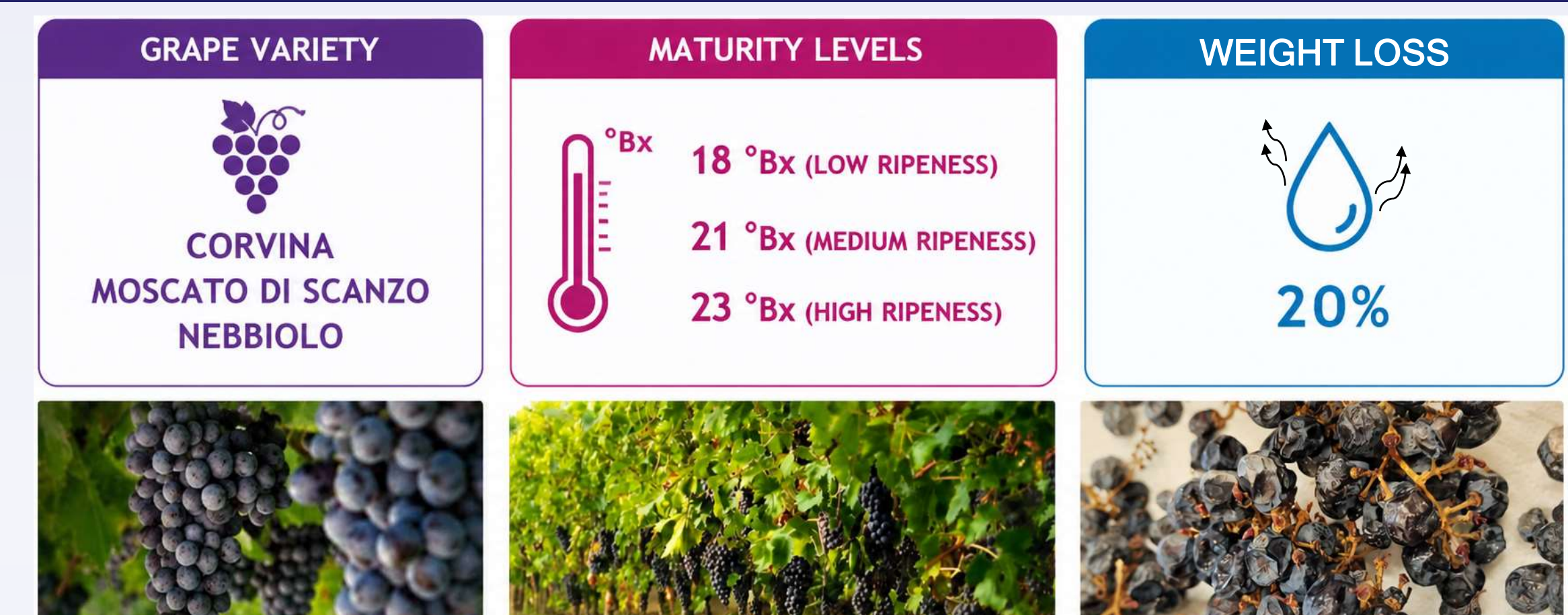


Figure 1: Experimental plan

RESULTS

- ✓ Grape ACNs and TFs showed a cultivar-dependent effect and in the distinct patterns of phenolic concentration and loss at different ripening levels (data not shown).
- ✓ Fermentations were completed within 12–21 days. The highest fermentation rate was observed in Moscato di Scanzo must from grapes harvested at 18° Brix (24.9 g sugar/day). Musts from 23° Brix grapes had slower kinetics in Moscato di Scanzo (13.5 g sugar/day) and Nebbiolo (16.7 g sugar/day). No maturity effect was observed for Corvina must (19.5 g sugar/day).
- ✓ The highest concentrations of ACNs were generally found in wines obtained from grapes harvested at 21° Bx (Figure 2).
- ✓ TFs showed a variety-dependent pattern with highest concentrations in wines from 23° Bx grape for Corvina, 21° Bx for Moscato di Scanzo and at 18° Bx for Nebbiolo (Figure 3).

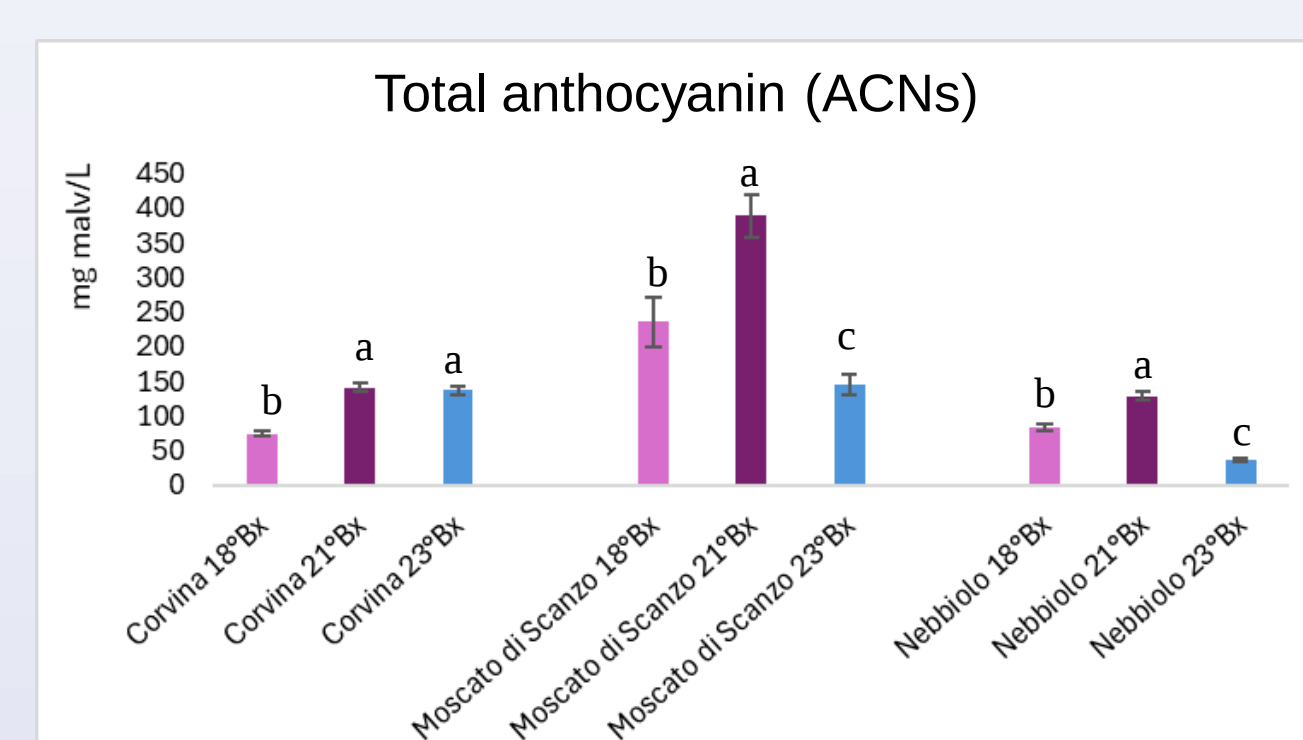


Figure 2: Total anthocyanin (ACNs; mg/L) in wine.

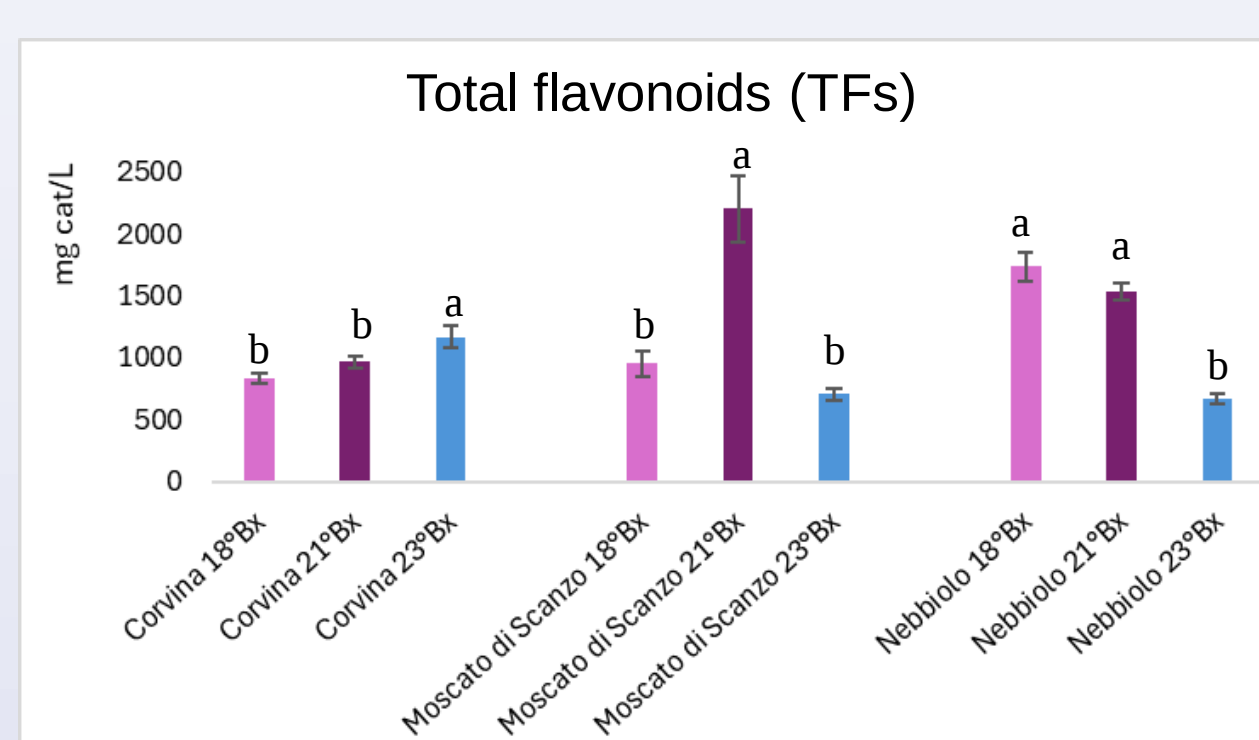


Figure 3: Total flavonoids (TFs; mg/L) in wine.

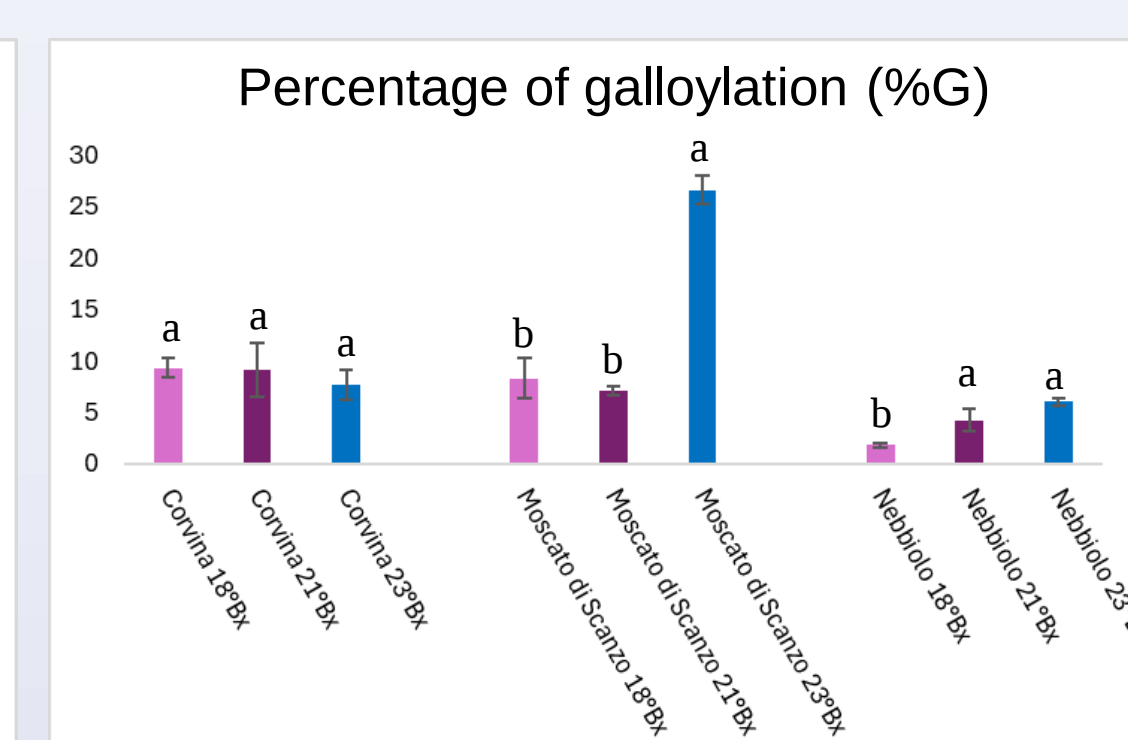


Figure 4: Percentage of galloylation (%G) of wine proanthocyanidins.

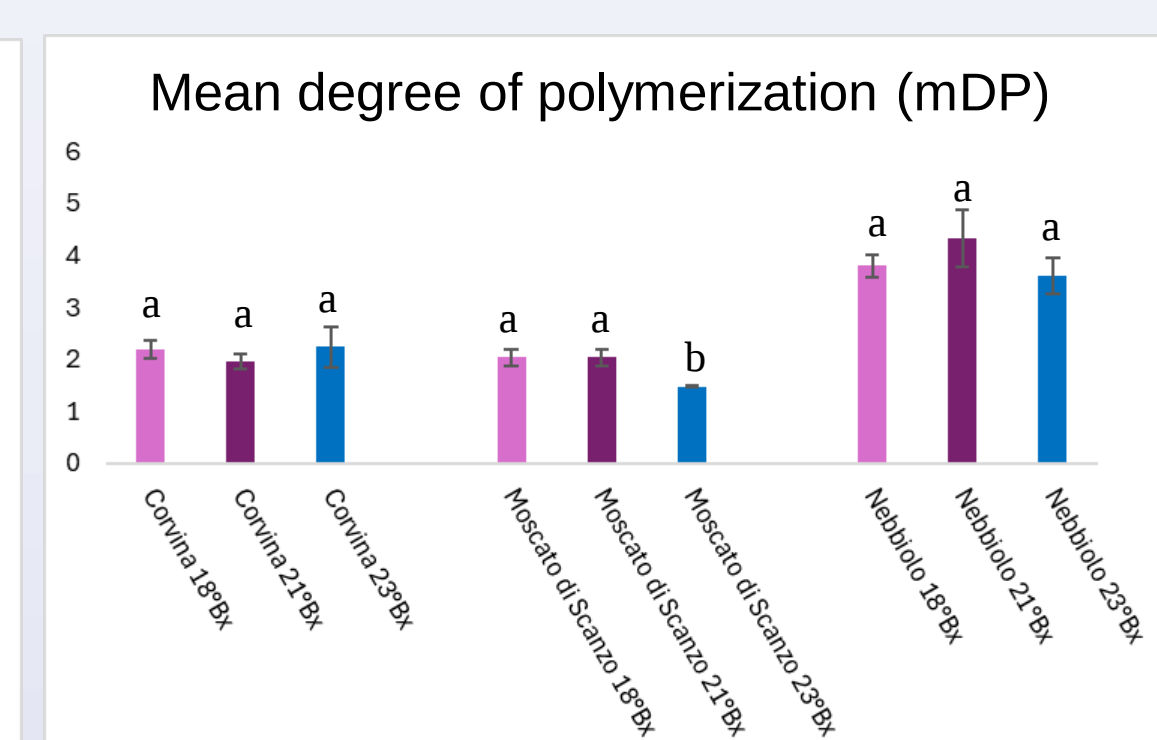


Figure 5: Mean degree of polymerization (mDP) of wine proanthocyanidins.

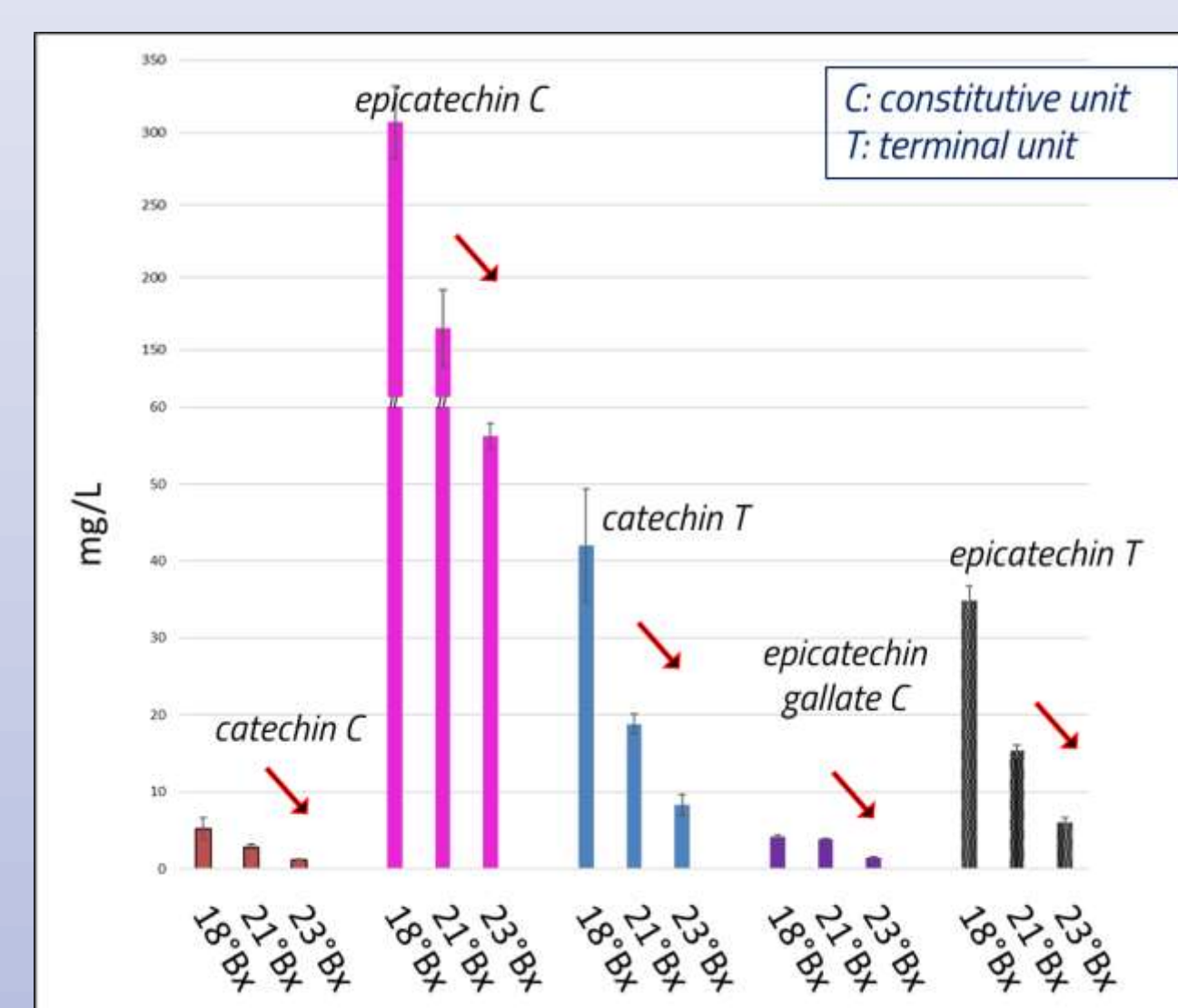


Figure 6: Proanthocyanidin constitutive (C) and terminal (T) units significantly affected by grape ripening level in Nebbiolo wines

- ✓ Proanthocyanidin (PACs) profile was also dependent to the grape variety: Nebbiolo wine showed highly polymerized but less galloylated PACs, whereas the opposite was observed for Moscato di Scanzo and Corvina wines (Figure 4; Figure 5).
- ✓ The percentage of galloylation (%G) increased in wines from musts obtained from grape collected at highest ripening levels for 'Moscato di Scanzo' and 'Nebbiolo' grapes (Figure 4).
- ✓ In contrast, the harvest at different ripening levels did not affect the mean degree of polymerization (mDP) of wine PACs (Figure 5).
- ✓ Regarding the constitutive and terminal units of PACs, they generally remained stable in Corvina wines, while they dropped in wines from grapes harvested at 23° Bx for Moscato di Scanzo wines.
- ✓ Certain PAC units showed a significant progressive decline with increasing grape maturity in Nebbiolo wines (Figure 6).

CONCLUSIONS

- ✓ The investigated grape varieties exhibited distinct phenolic compound dynamics at different ripening levels and, overall, intermediate grape ripening was associated with the highest phenolic concentration in wines.
- ✓ The response of wine PACs to grape ripening was strongly cultivar-dependent, indicating that varietal traits play a greater role than ripening stage in shaping PAC composition and evolution.
- ✓ Nonetheless, the research suggests that harvesting at about 21° Bx may be optimal one for preserving phenolic compounds.
- ✓ This study contributes to a deeper understanding of varietal-specific responses to postharvest grape dehydration, leading to a better understanding of red grape varieties traditionally employed in this technique.

REFERENCES

- [1] Scalzini, G., et al. (2023) DOI 10.1002/jsfa.12680
- [2] Scalzini, G., et al. (2021) DOI:10.1016/j.tifs.2021.08.004

Red straw wines of Italy

STRAWINE



UNIVERSITÀ
DEGLI STUDI
DI MILANO



UNIVERSITÀ
di VERONA



UNIVERSITÀ
DI TORINO

ACKNOWLEDGMENT

This research is part of the STRAWINE project funded by the Ministry of University and Research (PRIN, project no. 20223K8EJP) by the European Union – NextGenerationEU.