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What is the best time to harvest grapes destined for withering? Ripeness and dehydration length affect phenolic composition of Nebbiolo grapes

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1.INTRODUCTION

Sfursat is a DOCG reinforced wine produced in Valtellina from **partially withered red grapes** of *Vitis vinifera (L.)* **cv. Nebbiolo**. The grape ripeness degree and the withering process strongly influence the physicochemical characteristics of grapes [1, 2, 3]. In particular, grape skin and seeds contain several classes of phenolic compounds strictly associated with red wine quality, which are significantly affected by these factors [4]. **The aim of this research is to assess the combined influence of different ripeness levels and withering rates on the standard chemical composition and phenolic profile of winegrape** in order to provide new insights and approaches to the management of withering, searching for the valorization of grape potentialities.

2.MATERIALS AND METHODS

A TWO-YEARS STUDY (VINTAGES 2019 AND 2020)

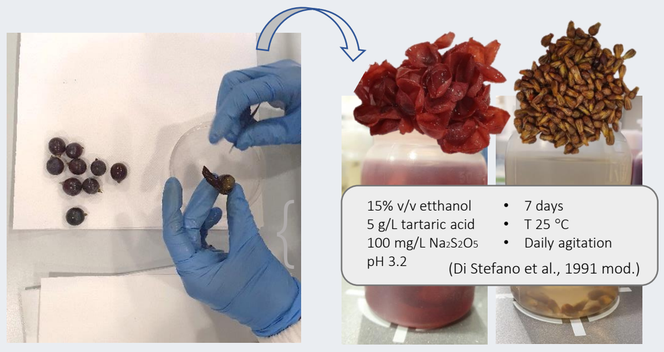
TWO VINEYARDS:

THREE BINOMIALS:

- Early harvest/long withering (**EL**)
- Medium harvest/medium withering (**MM**)
- Late harvest/short withering (**LS**)

ANALYSIS PERFORMED BEFORE AND AFTER THE WITHERING PROCESS:

- Grape must composition
- Grape mechanical properties
- Extractable phenolic profile of grape skins and seeds:
  - total polyphenols (IPT);
  - total anthocyanins (TA);
  - total flavonoids;
  - methylcellulose tannin assay.



3.RESULTS AND DISCUSSION

At the end of withering, EL thesis showed the highest values of sugars and acidity, and the lowest pH (**Tab 1** and **2**).

Table 1 – Grape must composition of withered grapes: harvest 2019

	Upper-Valley vineyard				Lower-Valley vineyard			
Parameter	EL	MM	LS	Sign	EL	MM	LS	Sign
SSC (Brix°)	28.0 ± 0.2a	27.5 ± 0.2b	26.7 ± 0.1c	***	28.3 ± 0.1a	27.1 ± 0.5b	26.6 ± 0.1b	**
pH	3.14 ± 0.02c	3.22 ± 0.02b	3.29 ± 0.02a	***	3.14 ± 0.03b	3.21 ± 0.03a	3.23 ± 0.01a	*
Total acidity (g/L tartaric acid)	9.50 ± 0.60a	7.73 ± 0.15b	8.07 ± 0.15b	**	9.13 ± 0.25a	8.93 ± 0.15a	8.10 ± 0.36b	**
Glycerol (g/L)	1.98 ± 1.03	1.58 ± 0.63	1.12 ± 0.09	ns	2.14 ± 0.97	2.11 ± 1.10	1.36 ± 0.52	ns

Table 2 – Grape must composition of withered grapes: harvest 2019

	Upper-Valley vineyard				Lower-Valley vineyard			
Parameter	EL	MM	LS	Sign	EL	MM	LS	Sign
SSC (Brix°)	27.2 ± 0.4 a	27.0 ± 0.2 a	26.1 ± 0.3 b	**	27.2 ± 0.2 a	26.6 ± 0.2 b	26.1 ± 0.3 b	**
pH	3.25 ± 0.01 c	3.36 ± 0.03 b	3.58 ± 0.01 a	**	3.35 ± 0.05	3.35 ± 0.02	3.36 ± 0.02	ns
Total acidity (g/L tartaric acid)	8.43 ± 0.08 a	7.33 ± 0.50 b	5.81 ± 0.24 c	***	7.46 ± 0.23	7.49 ± 0.14	7.03 ± 0.24	ns
Glycerol (g/L)	0.37 ± 0.13	0.76 ± 0.11	1.00 ± 0.34	ns	0.36 ± 0.09	0.45 ± 0.30	0.20 ± 0.16	ns

The content of **total polyphenols, flavonoids, and tannins in seeds** showed a decreasing trend by leaving the grapes on the plant longer, whereas their impact increased considerably after withering with respect to fresh samples, due to berry dehydration (**Fig. 1**).

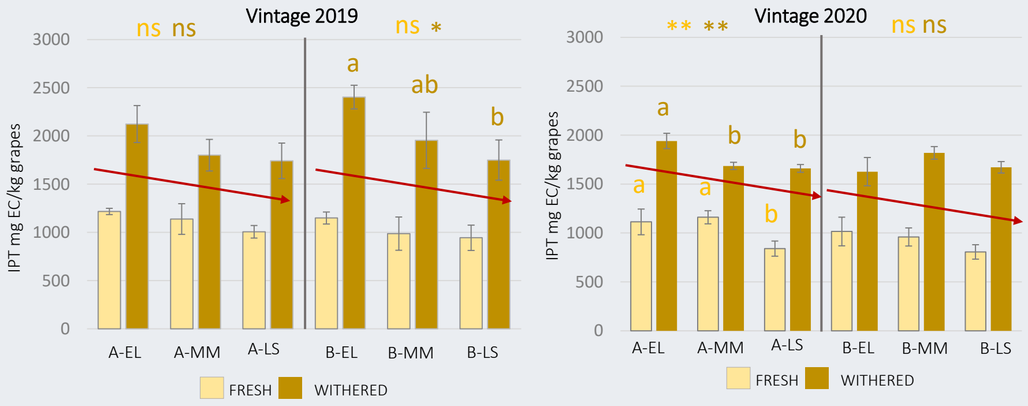


Fig. 1 – Seeds extractable phenolic compounds (mg epicatechin/kg of grapes)

Instead, **the skin phenolic compounds** were less influenced by harvest period, but their concentrations on grape weight increased after withering. **Skin extractable anthocyanins** experienced a distinct trend for the two vineyards studied: their concentration increased in withered samples from the upper-valley vineyard and decreased in those from the lower-valley (**Fig. 2**).

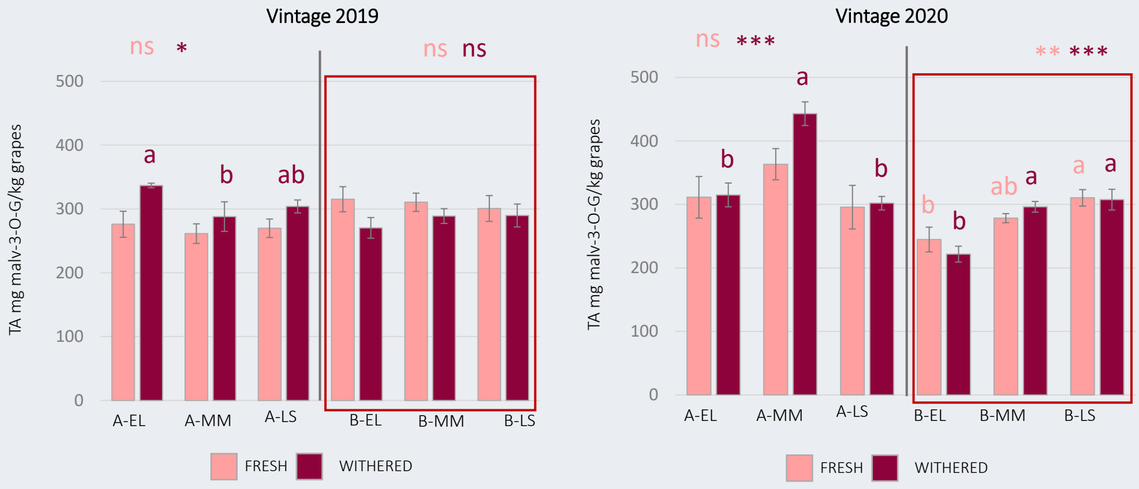


Fig. 2 – Skins extractable anthocyanins (mg epicatechin/kg of grapes)

The **grapes mechanical properties** (**Fig. 3**) may have influenced this aspect, as previously demonstrated [4].

HIGHER BERRY SKIN MAXIMUM BREAK FORCE (**Fsk**), **LOWER** SKIN THICKNESS (**Spsk**) ⇨ EASIER DISSOLUTION OF PHENOLS, PARTICULARLY FOR ANTHOCYANINS

Finally, **the differences highlighted between the three binomials** studied were more noticeable in vintage 2019 rather than in 2020, probably due to the higher rainfall in the final stage of grape ripening in vintage 2020.

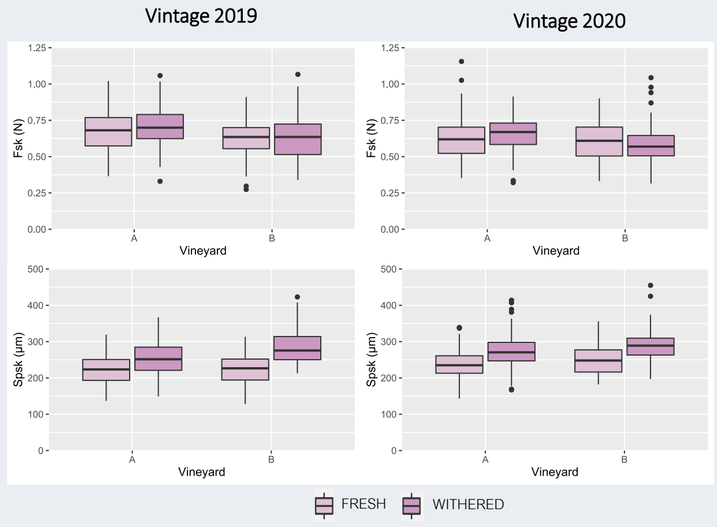


Fig. 2 – Velues of skins mechanical properties: berry skin maximum break force (Fsk) and skin thickness (Spsk)

4.CONCLUSIONS

Harvest time and withering length can be modulated according to the desired oenological objective. In general, **early/medium harvest and long/medium withering gave the higher phenolic contents, particularly for seeds polyphenols, although the vineyard location and the weather conditions of the year influenced the withered grape phenolic characteristics.**

5.ACKNOWLEDGEMENTS

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