Influence of irrigation frequency on berry phenolic composition of red grape varieties cultivated in four Spanish wine-growing regions

Moreno, D[1]., Montoro, A[2]., Yuste, J[3]., Cancela, J.J[4]., Martínez-Porro, D[3]., Torija, I[2]., Fandiño, M[4]., Vilanova, M[5]., Mancha, L.A[1]., Uriarte, D[1]

[1]Centro de Investigaciones Científicas y Tecnológicas de Extremadura, 06187 Badajoz (España)
[2]Instituto Técnico Agronómico Provincial, 02007 Albacete (España)
[3]Instituto Tecnológico Agrario de Castilla y León, 47071 Valladolid (España)
[4]Universidade de Santiago de Compostela - EPSE, 27002 Lugo (España)
[5]Instituto de Ciencias de la Vid y el Vino, 26007 Logroño (España)
daniel.moreno@juntaex.es

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INTRODUCTION

The global warming phenomenon involves the frequency of extreme meteorological events accompanied by a change in rainfall distribution. Thus the vineyards can be subjected to prolonged drought during the growing season because of changes in its distribution pattern. Irrigation frequency affects the spatial and temporal distribution of the water in the soil but its effects on the phenolic composition of the grape have been scarcely studied. The aim of this work was to evaluate the effects of deficit irrigation frequencies on berry phenolic composition at harvest.

MATERIALS AND METHODS

IRRIGATION TREATMENTS

Four deficit irrigation frequencies of 30 % ETo:
-One irrigation per day **(T01)**
-Two irrigations per week **(T03)**
-One irrigation per week **(T07)**
-One irrigation every two weeks **(T15)**

ANALYTICAL METHODOLOGY

Extraction of phenolic material from grapes, identification and quantification by HPLC of 36 phenolic compounds integrated in:

Anthocyanins	Glucosides Acetates Coumarates	Delphinidin
		Cyanidin
		Petunidin
		Peonidin
		Malvidin
Non-anthocyanidins	Flavanols	
	Flavonols	
	Fenolic acids	
	Stilbenes	

EXPERIMENTAL SITE AND PLANT MATERIAL

The experiment was carried out during two consecutive seasons (2021 and 2022), in vineyards of:

1. **Mencía** (**Lugo**: T01, T03, T07)
2. **Tempranillo** (**Valladolid**: T03, T07, T15)
3. **Garnacha Tinta** (**Badajoz**: T03, T07, T15)
4. **Syrah** (**Albacete**: T03, T07)

STATISTICAL ANALYSIS

-Statistical comparisons between values were established with ANOVA and Post-hoc Tukey ($p < 0.05$) and Student's t-test using Xlstat software.
All data are expressed as the mean of four blocks and three replicates per block.

RESULTS AND DISCUSSION

2021

Practically no effect on the accumulation of phenolic compounds caused by irrigation frequency was observed. Only the concentration of coumartes in Syrah and stilbenes compounds in Garnacha Tinta increased with the T07 treatment compared to T03 (Fig.1b and 1d).

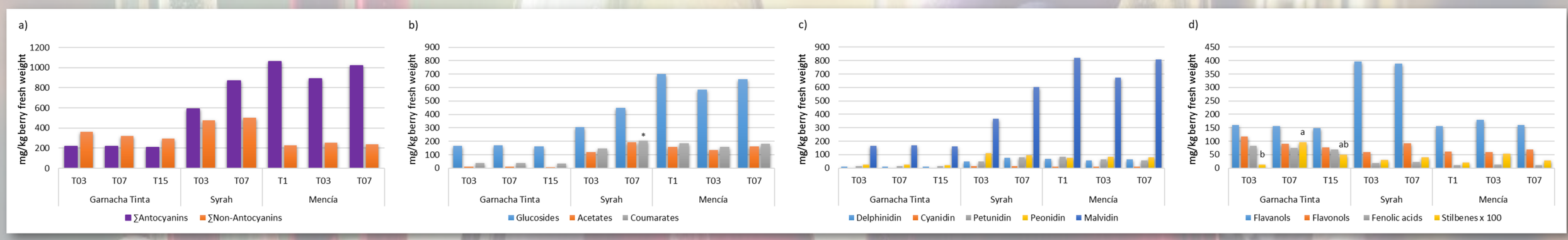

Figure 1. Effect of irrigation frecuency on berry phenolic composition in 2021 season. a) Total anthocyanins and non-anthocyanins. b) Monoglucoside forms (Glucosides), acetylglucoside forms (Acetates) and p-coumaroylglucoside forms (Coumarates). c) Delphinidin, cyanidin, petunidin, peonidin and malvidin derivates. d) Non-anthocyanins integrated in flavanols, flavonols, fenolic acids and stilbenes. For the each variety and parameter, different letters and * indicate significant differences (p<0.05) due to irrigation treatment.

2022

T07 compared to T03 favored the accumulation of anthocyanins compounds in Tempranillo and Syrah, while Mencía was hardly affected and Garnacha Tinta even decreased its values significantly (Fig.2a). In Tempranillo, T15 tended to slightly increase the glucosides content compared to T03, while in Garnacha Tinta the concentration of acetates tended to decrease (Fig.2b). T01 applied to Mencía tended to increase the anthocyanin content, mainly compared to T03 (Fig.2a,2b,2c). The non-anthocyanidin content was not significantly affected by irrigation frecuency in any of the cases (Fig.2d).

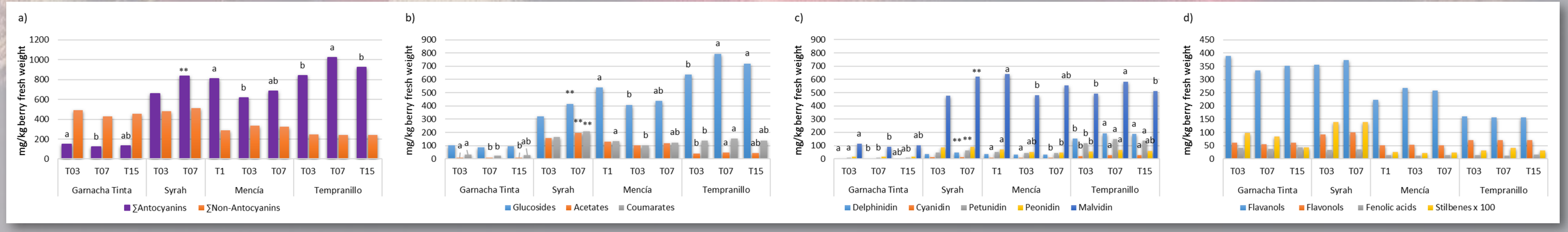

Figure 2. Effect of irrigation frecuency on berry phenolic composition in 2022 season. a) Total anthocyanins and non-anthocyanins compounds. b) Monoglucoside (Glucosides), acetylglucoside (Acetates) and p-coumaroylglucoside (Coumarates) forms. c) Delphinidin, cyanidin, petunidin, peonidin and malvidin derivates. d) Non-anthocyanins classifieds in flavanols, flavonols, fenolic acids and stilbenes. For the each variety and parameter, different letters and ** indicate significant differences, p<0.05 and p<0.01 respectively, due to irrigation treatment.

CONCLUSIONS

With the exception of Garnacha Tinta and Mencía, a higher frequency of irrigation tended to increase the anthocyanin content of the berries. These results show that the phenolic composition of grapes, mainly anthocyanins, can be affected by the irrigation strategy applied and its effects may vary depending on the variety and the year.

Acknowledgments

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