Pruning Level and Maceration-Fermentation Length Influence on Phenolic Composition of Cabernet Sauvignon in Tarnave Vineyard

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Abstract

Technological strategies on vines and winemaking conditions influenced the phenolic composition of wine. Cabernet Sauvignon vines were pruned at 20, 28 and 36 buds/vine. Grapes from each pruning variant were micro-vinified and macerated for 8 and 16 days. Gallic acid, trans-resveratrol, peonidin-3-monoglycoside and malvidin-3-acetyl glycoside were most significantly influenced by pruning level, maceration-fermentation period and interaction between these factors.

Keywords: bud loading levels, maceration and fermentation, wine polyphenols

Introduction

The phenol profile in a wine comes primarily from the grape berries (Urcan *et al.*, 2016) and secondly from winemaking technologies (Casassa, 2017). Phenolic compounds in wine are nonflavonoids and flavonoids (anthocyanins, flavanols, flavonols and dihydroflavonols) (Bora *et al.*, 2018). Fermentation and maceration are the most critical steps in the winemaking process, which affect red wine quality (Setford *et al.*, 2017). During grape growing, some technological strategies may be attempted to manipulate the phenolic composition of red wines (Kyrleou *et al.*, 2015; Kumar *et al.*, 2017). The aim of the study was to analyse the influence of different bud

loading level and maceration-fermentation period on phenolic profile of Cabernet Sauvignon wines.

Materials and methods

The study involved *Vitis vinifera* cv. Cabernet Sauvignon from Tarnave Vineyard (45°57'-46°32' N; 23°52'-24°48' E) during 2017. Vines were trained in Guyot system and applied three variants of pruning level: 20, 28 and 36 buds/vine. The grapes were harvested on full maturity (204 - 214 g L⁻¹ sugar content) on the third decade on September. Grapes from each pruning variant were micro-vinified in 20 L glass containers (three replicates per treatment, n = 3) at 16-17°C. After 8 and 16 day of maceration-

Table 1. Multiple analysis of variance (ANOVA) taking as factors the pruning level, maceration-fermentation period and interaction between the factors

Phenolic composition (mg L ⁻¹)	T1= 20 buds/vine		T2 = 36 buds/vine		Control = 28 buds/ vine		A	B	C
	8 days	16 days	8 days	16 days	8 days	16 days			
Gallic Acid	11.96± 0.31a	17.85± 0.30e	12.78± 0.66b	19.47± 0.47d	11.46± 0.15a	15.52± 0.09c	***	***	***
p-coumaric acid	0.90± 0.10b	0.67± 0.11a	1.44± 0.11c	0.69± 0.10a	1.23± 0.09bc	0.75± 0.17b	**	**	ns
Quercetin	0.75± 0.05 ^a	2.29± 0.94c	0.90± 0.10a	2.21± 0.02c	1.61± 0.06b	1.68± 0.11 ^b	ns	***	*
Trans-resveratrol	5.06± 0.03b	2.54± 0.51a	6.29± 0.09c	4.36± 0.05b	7.53± 0.06d	2.72± 0.16a	***	***	***
Catechin	3.49± 0.11a	8.06± 0.91d	4.60± 0.10b	7.45± 0.11c	4.64± 0.10b	8.37± 0.07d	*	***	**
Epicatechin	1.77± 0.13a	2.96± 0.87b	2.96± 0.14b	3.86± 0.12d	3.98± 0.10d	3.37± 0.16c	***	*	**
Delfinidine-3- monoglycoside	3.22± 0.11a	4.01± 0.32c	3.23± 0.13a	3.83± 0.10b	4.72± 0.05d	3.20± 0.10a	**	ns	***
Peonidin-3- monoglycoside	1.78± 0.12e	1.54± 0.22d	1.16± 0.14a	1.18± 0.05b	2.57± 0.08f	1.27± 0.03c	***	***	***
Petunidin-3- monoglycoside	3.48± 0.06b	4.89± 0.11c	3.31± 0.11ab	3.53± 0.12b	4.55± 0.12bc	3.15± 0.05a	***	ns	***
Malvidin-3- monoglycoside	31.00± 3.00d	25.95± 0.48bc	27.09± 0.41c	23.37± 0.01a	29.27± 0.19cd	24.31± 0.30b	**	**	ns
Peonidin-3- acetylglycoside	1.52± 0.18c	1.22± 0.03ab	1.39± 0.15bc	1.14± 0.06a	1.77± 0.21d	1.14± 0.03a	ns	***	ns
Malvidin-3-acetyl glycoside	12.20± 0.15c	10.73± 0.14b	10.82± 0.18b	9.89± 0.11a	11.38± 0.15bc	9.96± 0.07a	**	***	**
Peonidin-glucoside- coumaryl	0.40± 0.13a	0.41± 0.04a	0.43± 0.12a	0.42± 0.07a	0.50± 0.05a	0.38± 0.05a	ns	ns	ns
Malvidin-3-glucoside- coumaryl	1.59± 0.10bc	1.19± 0.04a	1.65± 0.02c	1.22± 0.03ab	1.84± 0.11d	1.03± 0.02a	ns	***	***

Note: Values are expressed as average ± standard deviation (n=3). Mean values/row followed by the same letter are not significantly different at p<0.05; A - influence of pruning level on phenolic composition; B - influence of maceration-fermentation period on phenolic composition; C - influence of interaction between pruning level and maceration-fermentation period; *:p<0.05; **:p<0.01; ***p<0.001; ns: not significant.

fermentation, the phenolic profile was analysed using high performance liquid chromatography with a Thermo Finnigan Surveyor Thermo Fisher Scientific Inc. (Whatman, USA) chromatographic system and Accuacore PFP column for separation according to Artem *et al.*, 2014.

In order to determine the factor with statistically significant influence on phenolic composition and to evaluate the significance of interactions between factors, a multifactorial variance analysis was made using the pruning level and maceration-fermentation period as factors.

Results and discussions

The length of maceration (the moment that crushed grapes are in contact with the must)

has importance for the extraction of phenolic compounds into the must.

After 16 days of maceration-fermentation, wines samples from T1 and T2 had a higher content of polyphenols, while in the control (28 bud/vines) it slowly decreased (Tab. 1). Prolonged maceration results in a significant increase in the concentration of gallic acid, quercetin, catechin and epicatehin as it was previously reported by Kudo and Sodeyama (2002). The decrease in the concentration of some anthocyanins (peonidin-3-monoglycoside, malvidin-3-monoglycoside, peonidin-3-acetylglycoside, malvidin-3-acetyl glycoside and malvidin-3-glucoside-coumaryl) can be explained by the absorption by grapes seeds, stems, skins, tannins and wine yeast during maceration (Şener, 2018).

Several studies found that phenolic composition concentration in grapes may increase or decrease with increasing canopy shade, due to pruning level, without consistency (Kumar *et al.*, 2017). As it may be seen from data of Table 1, between pruning variants, phenolic profile was significantly affected by this treatment ($p < 0.05$).

In this study, gallic acid, transresveratrol, peonidin-3-monoglycoside and malvidin-3-acetyl glycoside were most significantly influenced by pruning level, maceration-fermentation period and interaction between those factors.

Conclusions

Tarnave Vineyard is mainly known for white wines. Though red varieties, as Cabernet Sauvignon grapevine were planted in this area for many years, no studies were made regarding pruning level and length of maceration on phenolic profile. Some of phenolic compounds quantified were significantly influenced by pruning level, maceration-fermentation period and interaction between these factors. The results of the present study could be of importance to vineyard managers and winemakers in this wine growing center.

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