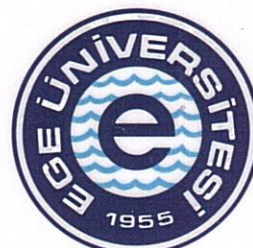


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**Faculty of Agriculture and Food  
Sciences  
University of Sarajevo  
Bosnia and Herzegovina**

**Faculty of Agriculture  
Ege University, Izmir  
Turkey**



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**22<sup>nd</sup> International Scientific-Expert Conference  
of Agriculture and Food Industry - Sarajevo  
2011**

**Proceedings**

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**Sarajevo  
September 28 - October 1, 2011**

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22<sup>nd</sup> International Scientific-Expert Conference of Agriculture and Food Industry – Sarajevo 2011

organized by

Faculty of Agriculture and Food Sciences, University of Sarajevo, Bosnia and Herzegovina

and

Faculty of Agriculture, Ege University Izmir, Turkey

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Communications presented at the Conference and positively reviewed are published in the Proceedings. Authors are fully responsible for contents, contact information and correctness of English.

The Proceedings has been indexed with CAB Publishing – UK (CAB Abstracts and Nutrition and Food Sciences Database) since 2010.

Publisher:

Faculty of Agriculture and Food Sciences, University of Sarajevo – Poljoprivredno-prehrambeni fakultet Univerziteta u Sarajevu

Editor: Prof. dr Milenko Blesić

Technical design: Prof. dr Milenko Blesić, Belma Dučić

Year of publishing: 2011; Year of printing: 2012

Printed by: Print Delivery and Service d.o.o., Ilidža – Sarajevo

CIP - Katalogizacija u publikaciji  
Nacionalna i univerzitetska biblioteka  
Bosne i Hercegovine, Sarajevo

631/635:664(082)

**INTERNATIONAL Scientific-Expert Conference of  
Agriculture and Food Industry (22nd ; 2011 ;  
Sarajevo)**

Proceedings / 22nd International  
Scientific-Expert Conference of Agriculture and  
Food Industry - Sarajevo 2011, Sarajevo, September  
28-October 1, 2011. - Sarajevo : Faculty of  
Agriculture and Food Sciences =  
Poljoprivredno-prehrambeni fakultet ; Izmir : Ege  
University, Faculty of Agriculture, 2012. - 381  
str. : graf. prikazi ; 30 cm

Bibliografija uz svaki rad.

ISBN 978-9958-597-27-5

COBISS.BH-ID 19395590

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## THE INFLUENCE OF CHIPS ON POLYPHENOLIC CONTENT AND SENSORIAL PROPERTIES OF VRANAC WINE

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Scientific paper

### Summary

The influence of oak chips on polyphenolic content, as well as sensorial characteristics of Vranac wines was studied. Wines were produced in a traditional way in the winery at the Biotechnical Faculty in Podgorica, Ljeskopolje area, Podgorica sub-region. 1 g/l of French oak chips was added in the wines in order to study its influence. It was found that the chips improved the extraction of polyphenols and sensorial characteristics of wines, compared to the control wine produced without chips. In addition, it was noticed that the obtained wines fermented with chips, presented a higher content of total polyphenols, anthocyanins, flavan-3-ols, better colour intensity and hue, as well as better sensorial properties of the wine. Actually, the chips influenced better colour permanence and improvement of sensorial wine profile.

Key words: *Vranac, oak chips, total polyphenols, anthocyanins, flavan-3-ols.*

### INTRODUCTION

The quality of wine depends on many factors, including the wine-making techniques applied for wine production. Addition of oak chips also affects the wine quality. Numerous studies have been carried out in order to find the way for getting the highest content of polyphenols in wine extracted from grapes. Chips is one of the alternative means which is produced from the same wood like oak barrels (such as French, Hungarian and American oak). Oak wood is extremely enriched with organic components which could be extracted into the wine. Harmonic accordance of wood (chips) and wine initiate suitable changes as a consequence of slow acting oxidation, followed by tannin modification. In addition, the wine colour and flavor persistence increase and stabilize during the ageing in bottles (Kovac et al., 2000). In our study, the French chips (Pronectar) was used, which was added before fermentation, in order to check its influence on the extraction of polyphenols from grapes into wine, sensorial characteristics, as well as, the wine quality.

### MATERIALS AND METHODS

**Grapes.** Vranac grape variety, which is an authentic Montenegrin variety, was used for wine production with addition of oak chips.

**Vinification.** After the harvest at technological maturity, the grapes without stalks were processed and the obtained must was divided into three fermentation tanks (PVC tanks, 100 L) in order to get three different sets: V-1, V-2, V-3. The first set (V-1) was the control wine, containing only selected yeast (BDX, Lallemand), the second set (V-2) contained selected yeast (BDX) and enzyme (Lallzyme EX-V, Lallemand) and the third set (V-3) contained yeast, enzyme and oak chips (French, Pronectar). The grape mashes were mixed mechanically during the fermentation. After the maceration and fermentation period, the wines were collected in tanks for aging.

**Analysis.** Analyses of polyphenolic content and sensorial characteristics of the wines were performed three months after wine aging. Spectrophotometric methods were used for the analyses of total polyphenols, anthocyanins and flavan-3-ols in the wine (Ivanova et al., 2009). Sensorial wine properties were determined by wine testing using point rating method (max. 20 points): clarity (0-2), colour (0-2), odour (0-4) and taste (max.12).

**Statistical analysis.** Statistical data processing included calculation of arithmetic mean, relative standard deviation and ANOVA (the student Newman-Klaus's test) in order to find possible and significant differences among studied wines.

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## RESULTS AND DISCUSSION

In order to evaluate the influence of chips on the polyphenols in wine and consequently the wine quality, total polyphenols, anthocyanins and flavan-3-ols, color intensity and hue, were measured in the wines containing oak chips and compared with the control wine. The results are presented in Table 1.

It was noticed that the chips influenced the wine polyphenols. Thus, total polyphenols (average 149 mg/l for all three years studied) were higher in the wine containing chips, compared to the control wine (V-1). The content of anthocyanins and flavan-3-ols was also higher in the wines fermented with chips. In addition, it was found that the content of polyphenols had a low influence on the wine hue which values were not significantly different in the studied wines ( $p < 0.05$ ). The wine variant V-3 contained high concentration of polyphenols and its colour intensity was higher compared to the control wine, which was in accordance with other studies (Jackson (2008), Sartini et al. 2007). Comparing the results for the wines, the highest content of polyphenols, anthocyanins and colour intensity was noticed for the wine harvested in 2009, while the content of flavan-3-ols was the highest in the wines from 2010, probably as a result of the climatic and cultivation factors.

Tab. 1: Polyphenolic content of wines Vranac

Year of harvest	Total polyphenols (mg/l)	Total anthocyanins (mg/l)	Total flavan-3-ols (mg/l)	Color intensity	Hue
V-1					
2008	1600 <sup>a</sup>	580	112 <sup>a</sup>	3.70	0.26
2009	1785 <sup>a, b</sup>	600	145 <sup>a</sup>	3.80	0.25
2010	1620 <sup>b</sup>	550	167 <sup>a</sup>	3.75	0.24
x	1668	577	142	3.75	0.25
CV%	6.08	4.36	19.86	1.33	4.0
V-2					
2008	1730 <sup>c</sup>	595	153 <sup>b</sup>	3.80	0.27
2009	1870 <sup>c, d</sup>	621	167 <sup>b</sup>	3.90	0.25
2010	1720 <sup>d</sup>	575	180 <sup>b</sup>	3.85	0.25
x	1773	597	167	3.85	0.26
CV%	4.73	3.86	8.01	1.29	4.49
V-3					
2008	1750 <sup>e</sup>	590	141	3.81	0.27
2009	1900 <sup>e</sup>	619	140	3.87	0.26
2010	1800	563	174	3.82	0.24
x	1817	591	152	3.83	0.26
CV%	4.20	4.74	12.76	0.84	5.95

\*Values with the same letter(s) as a superscript within a column are not significantly different at  $p > 0.05$  analyzed by the Student–Newman–Keul's test.

x – average value, CV % - coefficient of variation

Results are presented as average from 3 replicates.

## Sensorial properties of tested wines

The marks of accomplished wine tasting are shown in Table 2. The wines derived with chips treatment presented the best sensorial properties, obtaining highest marks, which were higher from the mark of the control wine. These wines had intensive ruby colour (which is characteristic of Vranec variety), full berry taste, soft tannins and gentle oak note. Chips enabled colour permanence and enhanced sensorial wine profile.

Tab. 2: Wine tasting marks

Year of harvest	Color	Clarity	Odor			Taste			Total		
	x	x	min	max	x	min	max	x	min	max	x
V-1											
2008	2	2	2.4	2.8	2.6	10.3	10.7	10.5	16.7	17.5	17.1
2009	2	2	2.5	2.9	2.7	10.4	10.8	10.6	16.9	17.7	17.3
2010	2	2	2.3	2.9	2.6	10.3	10.8	10.6	16.6	17.7	17.2
x	2	2	2.4	2.9	2.6	10.3	10.8	10.6	16.7	17.6	17.2
V-2											
2008	2	2	2.4	2.9	2.7	10.3	10.8	10.6	16.7	17.7	17.2
2009	2	2	2.5	3.0	2.8	10.4	10.9	10.7	16.9	17.9	17.4
2010	2	2	2.4	2.9	2.7	10.3	10.9	10.6	16.7	17.8	17.3
x	2	2	2.4	2.9	2.7	10.3	10.9	10.6	16.8	17.8	17.3
V-3											
2008	2	2	2.5	3.2	2.9	10.4	11.0	10.7	16.9	18.2	17.6
2009	2	2	2.6	3.3	2.9	10.5	11.2	10.9	17.1	18.5	17.8
2010	2	2	2.4	3.1	2.8	10.3	10.8	10.6	16.7	17.9	17.3
x	2	2	2.5	3.2	2.9	10.4	11.0	10.7	16.9	18.2	17.6

### CONCLUSIONS

Results of the study showed that chips significantly influence on polyphenols and sensorial properties of the Vranec wines compared to the control wine.

Adding of chips during fermentation enabled better extraction of polyphenols, including higher content of polyphenols, anthocyanins, flavan-3-ols, colour intensity and hue.

Furthermore, adding of chips enabled better sensorial wine properties, improved colour intensity, odour and taste of the wines.

Due to these results it can be concluded that chips played a significant role in winemaking of Vranec wines, affecting the colour, flavor, polyphenols and texture of the wine.

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