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INFLUENCE OF TANNIN ON CHEMICAL COMPOSITION AND SENSORY PROPERTIES OF VRANAC WINE

SUMMARY

Diverse oenological agents are used in red wine production with the aim to produce wines of ever better quality, i.e. better chemical composition and sensory properties of wines. This paper shows results of a three years' research into the influence of tannin on chemical composition and sensory properties of Vranac wine. The wine was traditionally produced, at the winery of the Biotechnical Faculty in Podgorica, Lješkopolje district, Podgorica sub-region. In production, oenological tannin was used (AEB - Italy) – a blend of Proanthocyanidic and Ellagic activities. Results of this research have shown that tannin did not significantly affect chemical composition of wine while it selectively influenced its sensory properties as compared with the control wine, where only selected yeast and other oenological agents were added to the spout.

Keywords: Vranac wine, oenological tannin, chemical composition, sensory properties

INTRODUCTION

Chemical composition and organoleptic (sensory) properties of wine determine its quality. Many factors affect these parameters, one of them being the use of different oenological agents in wine production.

One of the current topics in wine industry is the use of oenological tannins. A positive influence of oenological tannins on the quality of wine has been proved (Manfroi V. *et al.*, 2010, Zoecklein, 2005). Tannin matters affect intensity and stability of red wines' colour (Zoecklein, 2005). Instead of antocyan, which fades - deposits with time, they assume the role of colour bearer in old red wines.

Oenological tannins are used with the aim to eliminate unstable proteins, that is – they perform the role of a clearing agents due to bonding of proteins and changing of some organoleptic properties of wine -colour stabilisation in red wines, astringency and bitterness (Lurton *et al.*, 2002, Saucier *et al.* 2004).

Tannin's influence on the sense of taste is in tannin reacting with proteins in saliva which results in a feel of dryness in our mouth, which we perceive as astringency and, in some cases, bitterness (Gawel, 1998).

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There is a wide spectrum of tannins on the market and their role varies. However, questions still relevant considering positive influence of oenological tannins are product diversity and timing of adding of tannins.

The aim of this research is to find whether and to what extent tannin affected the chemical composition and quality of wine and, thus, obtain a proof of justification for the use of tannin in producing Vranac wine.

MATERIAL AND METHODS

Research into chemical composition of wine depending on oenological tannin was performed in time period 2008-2011. The research was conducted on autochthonic Montenegrin wine type Vranac. Vranac is a leading wine type in Montenegro (Popovic, 2013; Cindric, 2000; Bozinovic, 1996; Avramov, 1991; Ulicevic, 1966). With the aim to determine chemical composition and sensory properties of wine, the same vinification conditions were provided for all varieties in the research.

Grapes were picked in their complete technological maturity. After wine-press, where stems were separated, the spout was put into fermentation dishes (4 PVC dishes), the spout was sulphurised and depending on variety, oenological agents were added. In the first variety (V-1) only selected yeast was added to the spout (BDX, Lallemand) in the amount of 10 gr/hl, and in the second variety (V-2), the same amount of selected yeast (BDX) was added, along with enzyme (Lallzyme EX-V, Lallemand) in the amount of 2 gr/hl. In the third variety (V-3), except for yeast and enzyme, oak chips was added (French, Pronectar) in the amount of 100g/hl, while in the fourth variety tannins were added (AEB Italy) in the amount of 20g/hl (V-4). Tannins were added in the amount of 10 g/hl before fermentation, to the spout, and 10 g/hl was added after fermentation, before racking. Crushing of the spout was done manually. After fermentation was completed, racking into dishes for wine ageing was performed.

The analysis of the chemical composition of must and wine was performed 3 months after the end of fermentation.

The chemical analyses were performed at the oenological laboratory of the Biotechnical faculty and the laboratory of the company "13.jul Plantaze" in Podgorica. They were performed under the Rules on quality and other requirements for wine (the Official Gazette of no. 54/99 and 39/2002).

Sensory properties of the wine were determined by tasting with the pointing-scoring method according to Buxbaum (max. 20 points). The properties evaluated were: clarity (0-2), colour (0-2), smell (0-4) and taste (max.12). The organoleptic evaluation was carried by a tasting committee consisting of 6 members.

The statistical processing of the obtained data was performed by calculating the average value, a variable expressed as a percentage and ANOVA (Student Newman Klaus test) in order to determine possible significant differences between all the analyzed wines.

RESULTS AND DISCUSSION

Chemical composition of the must and wine of the examined Vranac wine variety. Chemical composition of must is of great importance for wine quality, not only concerning the quantity of particular ingredients, but also their ratio of their quantities. Knowledge of chemical composition of must is of substantial significance in wine technology, since wine quality is for its major part in direct dependence on it.

Table 1. Chemical composition of must

Vintage year	Sugar (%)	Total acidity (g/l)	pH	Sweetness index
2008	22.9	4.95	3.40	46.3
2009	23.2	4.60	3.51	50.4
2010	22.7	5.10	3.31	44.5
x	22.9	4.88	3.41	47.1
CV	1.10	5.25	2.94	6.42

The average sugar content during the three-year research amounted to 22.9 %, with total acids of 4.88 g/l, which is characteristic of Vranac wine kind. By using the Student Newman-Klaus test it was confirmed that there was no statistically important variety ($p < 0.05$) in the values of researched parameters of must in three different years of grape harvesting.

As it can be clearly seen from the table, sugar content in must was fairly high, while the content of total acids was on a low level characteristic of this kind. Ph value of the researched must was in accordance with the content of total acids in the must.

With the aim to get a better picture of the quality and the stage of grape maturity, except sugar and acids, sweetness index or glucoacidometric index, which represents the ratio of sugar and acids content in grapes, was determined. High sugar content and low acids content resulted in a fairly high sweetness index of the tested kind: 47.07.

After the research into the chemical composition of the must of Vranac wine, a conclusion may be drawn that grapes of vranac kind were of excellent quality and there was no substantial variety in their quality by years of research, which was another fact found in the research (Raicevic et. al, 2012).

Chemical composition of Vranac wines. Chemical composition of wine, similarly with chemical composition of grapes and must, is rich and very complex (Table 2.).

Table 2. Chemical composition of Vranac wines

Vintage year	Relative density	Alcohol (vol%)	Total extract (g/l)	Total acidity (g/l)	Volatile acids (g/l)	pH	Tartaric acid (g/l)	Potassium (mg/l)	Reducing sugar (g/l)
V-1									
2008	0.9938	13	27.9	5.65	0.46	3.46	3.31	836	1.9
2009	0.994	13.3	29.4	5.5	0.45	3.38	3.32	837	2
2010	0.993	12.8	25.5	5.95	0.45	3.31	3.32	836	2.3
x	0.99	13.03	27.60	5.70	0.45	3.38	3.32	836.33	2.07
CV%	0.05	1.93	7.13	4.02	1.27	2.22	0.17	0.07	10.07
V-2									
2008	0.9937	13.3	28.7	5.9	0.43	3.34	3.25	850	2
2009	0.9939	13.5	29.7	5.6	0.44	3.38	3.33	838	2.1
2010	0.994	13	28.7	5.98	0.43	3.3	3.33	839	2.3
x	0.99	13.27	29.03	5.83	0.43	3.34	3.30	842.33	2.13
CV%	0.02	1.90	1.99	3.44	1.33	1.20	1.40	0.79	7.16
V-3									
2008	0.9939	13.3	28.8	5.8	0.44	3.35	3.2	845	2.1
2009	0.994	13.5	29.8	5.5	0.44	3.39	3.4	840	2.2
2010	0.9941	13.1	29	5.81	0.42	3.33	3.35	831	2.31
x	0.9940	13.30	29.2	5.70	0.43	3.36	3.32	839	2.20
CV%	0.01	1.50	1.81	3.09	2.66	0.91	3.14	0.85	4.77
V-4									
2008	0.9938	13.5	28.5	5.7	0.41	3.4	3.3	847	2
2009	0.9939	13.30	29.0	5.75	0.44	3.37	3.34	837	2.3
2010	0.994	13.2	28.8	5.89	0.44	3.33	3.4	835	2
x	0.9939	13.33	28.77	5.78	0.43	3.37	3.35	840	2.10
CV%	0.01	1.15	0.87	1.70	4.03	1.04	1.50	0.77	8.25

Based on the tabular overview of chemical composition of tested wines, we may come to the conclusion that all wines have averagely high alcohol content in accordance with sugar content in the must. It varies from 12.8 to 13.5 vol%, which concords with the research of Pajovic, 2013. The specific weight of wine varied from 0,9930 to 0,9941, on average.

Analogically with the high sugar content in the must, the content of total extract in tested wines was also high. Obtained average values vary from 25.50 to 29.80 g/l. In the wines produced, a high content of total acids was evident, varying from 5.5 to 5.98 g/l.

Concerning reducing sugar, all wines were dry and there was no difference between varieties. Based on the mentioned parameters of chemical composition of tested wines a conclusion may be drawn that all wines have excellent

characteristics, typical of the climate of Podgorica region, characterised with high alcohol and extract content (Raicevic, 2012, Pajovic, 2013).

Based on the obtained results on the chemical composition of wines produced, it may be concluded that tested wines are of roughly equivalent chemical composition, and that tannin, as an oenological agent, does not have a statistically significant influence ($p > 0.05$) on the chemical composition of wine.

Sensory properties of wine in the wines tested. Based on the average tasting score for the 3 years of research, we have obtained results for all the vinification methods, which are shown in Table 3.

Table 3: Wine tasting marks

Year of harvest	Color	Clarity	Odor			Taste			Total		
	x	x	min	max	x	min	max	x	min	max	x
V1											
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	10.55	16.6	17.7	17.15
x	2	2	2.4	2.9	2.6	10.3	10.8	10.55	16.7	17.6	17.2
V2											
2008	2	2	2.4	2.9	2.7	10.3	10.8	10.55	16.7	17.7	17.2
2009	2	2	2.5	3	2.8	10.4	10.9	10.65	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	10.86	10.6	16.8	17.8	17.3
V3											
2008	2	2	2.5	3.2	2.85	10.4	11	10.7	16.9	18.2	17.55
2009	2	2	2.6	3.3	2.95	10.5	11.2	10.85	17.1	18.5	17.8
2010	2	2	2.4	3.1	2.75	10.3	10.8	10.55	16.7	17.9	17.3
x	2	2	2.50	3.20	2.85	10.40	11.00	10.70	16.90	18.20	17.6
V4											
2008	2	2	2.6	3.3	2.9	10.45	11	10.7	17	18.30	17.7
2009	2	2	2.6	3.3	2.9	10.47	11.1	10.8	17.03	18.41	17.7
2010	2	2	2.4	3.1	2.7	10.2	10.8	10.5	16.59	17.90	17.2
x	2	2	2.5	3.2	2.9	10.4	11.0	10.7	16.87	18.20	17.5

Based on sensory marks shown in Table 3, it may be concluded that use of tannin has a positive influence on sensory properties of wine in relation with the control wine (Manfroi *et al.* 2010, Vidal *et al.*, 2004).

Wine produced by adding tannin has an average higher tasting mark, for the three years, than the control wine by 0.3 points, without a more important difference in wine colour and smell (Main G. L. and Morris J. R. 2007, Sims and Morris, 1986) and by 0.2 points than wine with the addition of enzymes, but lower compared with wine to which oat chips was added. All the differences found were of no statistical importance.

A delicate question poses itself here – is it necessary to add tannin to Vranac wine, already rich in soft tannin content?! A bigger quantity of tannin may even have a negative influence on the taste of wine, giving it a pronounced astringency and bitterness, which was also found in other researches (Bautista-Ortín *et al.*, 2005; Manfroi V. *et al.* 2010).

CONCLUSIONS

Based on the results obtained during three years long research, the following may be concluded:

- The analysed results of chemical composition of must and vranac wine shown are mostly in accordance with the results of previous research.

- Oenological tannin did not significantly affect the chemical composition of wines tested, i.e. all wines had a roughly equivalent chemical composition.

- Based on average sensory marks it may be stated that tannin had a positive influence on sensory quality, as compared with the control wine and wine with the addition of enzymes, while the difference in relation with oat chips was only by 0,1 point lower.

All the established differences in the sensory marks of wine did not reach the limit of statistical significance.

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UTICAJ TANINA NA HEMIJSKI SASTAV I SENZORNA SVOJSTVA VINA VRANAC

SAŽETAK

U proizvodnji crvenih vina, u cilju postizanja boljeg hemijskog sastava i senzornih svojstava vina, tj. dobijanja vina što boljeg kvaliteta, koriste se različita enološka sredstva.

U ovom radu su prikazani rezultati trogodišnjeg ispitivanja uticaja tanina na hemijski sastav i na senzorna svojstva vina Vranac. Proizvodnja vina je obavljena na tradicionalan način, u vinarskom podrumu Biotehničkog fakulteta, koji se nalazi na Oglednom imanju u Podgorici, lokalitet Lješkopolje, Podgorički subregion. U proizvodnji je korišćen enološki tanin (AEB - Italy) -blend of Proanthocyanidic and Ellagic activities.

Rezultati istraživanja pokazuju da je tanin nije značajno uticao na hemijski sastav vina, dok je selektivno uticao na senzorna svojstva vina u odnosu na kontrolno vino, gdje je u kljuk dodat samo selekcionisani kvasac i druga enološka sredstva.

Ključne riječi: vino Vranac, enološki tanin, hemijski sastav, senzorna svojstva