An Insight Into Selected Properties of Merlot Wines Obtained from Three New Clone Candidates

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Covering the period 2009-2012, the quality of Merlot wines obtained from three new clone candidates (namely Nos. 022, 025 and 029, respectively; fourth phase of clonal selection) developed in the Republic of Serbia was examined. The following parameters were determined: Folin-Ciocalteu (FC) index, pH value, total acidity, volatile acids, aldehydes, esters, relative density and ash. In comparison with the standard Merlot wine (originating from mother vine), FC index (from 35.73 to 37.15) and tasting score (from 17.89 to 17.95) were higher for the wines of all three clone candidates tested. These findings are in good agreement with the observed trend for the viticultural parameters indicating better properties of the new Merlot clone candidates versus mother.

Keywords: wine, Merlot, new clone candidates, Republic of Serbia, selected wine properties

Viticulture and enology have a long tradition in Serbia which dates back to Roman times. Merlot is one of the most important grape varieties in wine industry. As adaptable to climatic conditions in Serbia, it is grown on more than 23% of the 50.723 hectares of vineyards [1]. Clonal selection is the process of producing healthy genotypes within a variety, demonstrating positive change in relation to the mother plant [2]. The long lasting work on the clonal selection of Merlot variety in France and Italy produced clones with a number of positive properties, important for the production of grapes and top quality red wines [3]. Individual clonal selection is actually the best way to eliminate the negative influence of mutations in the vineyard [4]. Different clones of a same variety may vary in their productive properties and ability to give wines of different organoleptic properties [5]. The quality of wine depends on a grape variety, climate and technology of wine production. The interaction of these factors influences the profile of a compound as well as organoleptic properties of wine [6]. Organoleptic properties of wine mainly depend on the content of sugar and total acids, but are affected by the content of polyphenolic compounds as well. The polyphenolics also affect astringency, bitterness and, in particular, the wine colour. They are attractive because of their antioxidant properties and ability to *capture* free radicals in the body, thus making a moderate consumption of wine useful for human health due to its ability to prevent cardiovascular disease including hypertension, diabetes and cancer [7-9].

The aim of this study was to compare the selected properties (Folin-Ciocalteu /FC/ index, *p*H value, total acidity, volatile acids, aldehydes, esters, relative density and ash) of the wines produced from three new Merlot clone candidates (fourth phase of clonal selection; Nos. 022, 025 and 029, respectively) versus the mother wine used as standard. Until now, the clonal selection of Merlot variety has not been done in the Republic of Serbia and there are no recognised clones.

Experimental part

Climatic conditions

Air temperature (at a height of 1.0 km) and rainfall were monitored in an automatic weather station 'Meteos-Pessi' (Radmilovac-Vinca, Belgrade, Serbia) located less than 1.0 km from the experimental site.

Microvinification

In the third phase of selection process, the experimental site has been planted with Merlot variety population and three new clone candidates (Nos. 022, 025 and 029, respectively) on Radmilovac locality (Grocka vineyards) which belongs to the Faculty of Agriculture of the University of Belgrade. The site is located at 44°45'24.66' (north latitude) and 20°34'54.50' (east longitude), at an altitude of 153 m.

Immediately after harvest, the grape was processed in laboratory conditions, using microvinification technique. For the purpose of microvinification, 20 kg of grapes, both for the standard and clone candidates, were used. Crushing was done manually using grape crusher with rollers and supplement for separating the stems. In the stum was added 100mg/L potassium metabisulfite. The fermentation took place in the glass of a capacity 10 L at a temperature of 20-25 °C. During maceration, must mixing was done twice a day. After maceration, the must was leached and obtained wine was separated into glass balloons sealed with a cork stopper, which prevented the penetration of air into the space above the surface of the wine. When the phase of quiet fermentation and sedimentation was finished, the wine was decanted. First decanting was done after a month. On the occasion of decanting, the wine was tested for SO_2 and the necessary corrections were done to make the total and free content of SO_2 around 80 mg/L and 20-25 mg/L, respectively. Upon the completion of the fermentation, the wine was decanted from the litter, bottled and stored at 10-12 °C, until chemical analysis and tasting. After two months aging in a bottle, classic parameters of wines of standard and clone candidates

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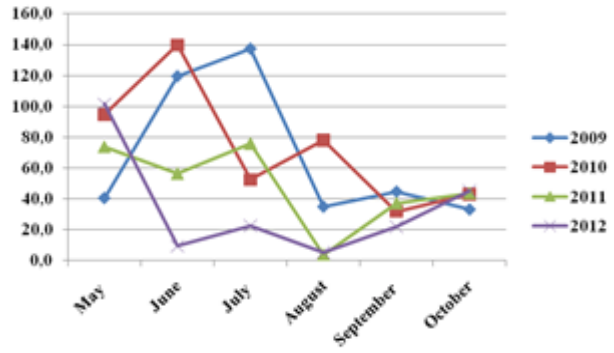
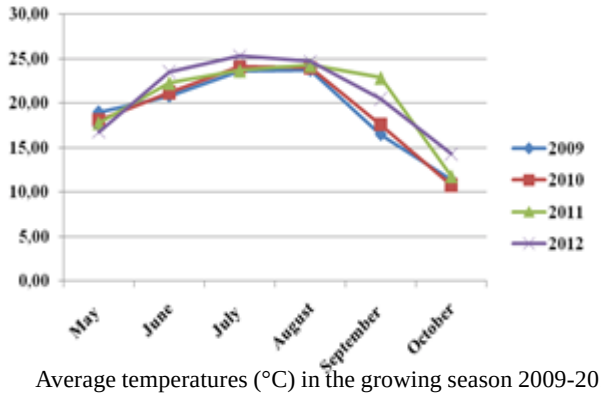
Parameter	Reference method
Total acids	Volumetric (titration with NaOH up to pH 7 with bromothymol blue)
pH	Potentiometry
Volatile acids	Destilation, vapour dragging and titration with NaOH using phenolphthalein as an indicator
Aldehydes	Volumetric (iodometry in acid medium)
Esters	Volumetric (destilation and titration of destilate with NaOH using phenolphthalein as an indicator)
Relative density	Densitometry/Picnometry
Ash	Gravimetry

Table 1
EXPERIMENTAL PARAMETERS AND METHODS



Amount of precipitation (mm) in the growing season 2009-2012



Average temperatures (°C) in the growing season 2009-2012

Fig. 1. Climatic conditions at the experimental field *Radmilovac* (Grocka Vineyards, Vinca) from 2009 To 2012

were analysed following the standard of the International Organisation of Vine and Wine (O.I.V.) (table 1) [10].

Wine tasting evaluation was done at the Faculty of Agriculture of the University of Belgrade, by a committee consisting of five members. Each of the committee members evaluated the wine samples according to pre-established order. When the tasting was finished, the average mark was calculated for all the wines. The organoleptic properties of wines were evaluated using sensory methods of positive point system from 0 to 20. The individual properties were valued as follows: colour - from 0 to 2 points; clarity - from 0 to 2 points; odour - from 0 to 4 points; taste - from 0 to 12 points. Considering the overall score, the wines are classified as: table wines with geographical indications - ≥15.00 points; quality wines with geographical origin - ≥16.50 points; high quality wines with geographical origin - ≥18.51 points [11].

Statistical analysis

The analysis of the acquired experimental data was performed using the statistical package IBM SPSS Statistics 20. First of all, indicators of descriptive statistics were calculated for all the observed properties: mean and standard error of the mean (*Sx*). In order to reach more objective conclusions, ANOVA and LSD test ($p<0.05$) were applied [12].

Results and discussions

Climatic conditions 2009-2012

The average temperatures and amount of precipitation in vegetation period (May-October), recorded at the experimental field of Radmilovac during the period of study 2009-2012, are shown in figure 1. The highest/lowest average temperature during the growing season was recorded in 2012 (20.9 °C) and 2009 (19.2 °C), respectively. On the other hand, the highest/lowest precipitation in the vegetation period was recorded in 2010 (440.1 mm) and 2012 (205.9 mm), respectively.

Selected properties of the tested Merlot wines

The polyphenolic compounds characteristic for the wines are known to have a high antioxidant capacity. It's noteworthy to mention that FC index values of the mother wine (34.62) and new three Merlot clone candidates (from 35.73 to 37.15) do show statistically significant difference. Substances that affect the acidity of the wine, in addition to carbohydrates, play an important role because they characterise technological value of each variety. The total content of acid (and their acid salts) and real acidity (*p*H) was found to vary in the range 5.66-5.68 mg/L and 3.55-3.58 respectively, indicating optimal acidity. The content of volatile acids, expressed as acetic acid, ranging from 0.65 to 0.68 mg/L, showed no statistically significant difference between the mother (standard) and clone candidates wines. On the other hand, the clone candidate No. 025 was found to have the highest content of aldehydes and esters (495.37 and 349.59 mg/L, respectively) (table 2).

One of the indicators of complex chemical and physico-chemical changes in the composition of the must is represented with the relative wine density. This parameter may range from 0.985 to 0.997 and depend on the content of sugar, alcohol and total extracts. The values of the relative density of all three new clone candidates wines (ranging from 0.994 to 0.995) versus the mother wine were statistically different (table 2).

Ash content is one of the important indicators of the wine originality. The commercial wine with less than 1.2 g/L of ash was suspected to be falsified [13]. The values of ash content ranging from 2.62 to 2.74 g/L actually confirmed the authenticity of the tested samples (table 2).

The sensory characteristics of a wine are influenced by broad spectrum of factors including grape type, soil, cultural and enological conditions (production area factor) as well as climatic conditions (vintage factor) [14]. Interestingly, all three wines (obtained from new Merlot clone candidates) exhibited better tasting score (ranging from 17.89 to 17.95), compared with the mother wine, but with no statistical difference (table 2). According to the tasting

$\bar{X} \pm S\bar{x}$				
Parameters	**Standard Merlot Wine***	**Merlot 022 Wine****	**Merlot 025 Wine****	**Merlot 029 Wine****
Folin-Ciocalteu index	$34.620^{d} \pm 0.057$	$35.730^{c} \pm 0.281$	$36.630^{b} \pm 0.071$	$37.150^{a} \pm 0.071$
Total acids (g/L tartaric acid)	$5.678^{a} \pm 0.035$	$5.670^{a} \pm 0.025$	$5.658^{a} \pm 0.021$	$5.658^{a} \pm 0.023$
pH	$3.545^{a} \pm 0.010$	$3.563^{a} \pm 0.020$	$3.580^{a} \pm 0.015$	$3.550^{a} \pm 0.012$
Volatile acids (g/L acetic acid)	$0.678^{a} \pm 0.010$	$0.670^{a} \pm 0.014$	$0.655^{a} \pm 0.022$	$0.650^{a} \pm 0.021$
Aldehydes (mg/L acetaldehyde)	$462.144^{b} \pm 0.926$	$450.300^{c} \pm 0.786$	$495.368^{a} \pm 0.858$	$450.448^{c} \pm 0.819$
Esters (mg/L ethylacetate)	$312.505^{c} \pm 0.503$	$328.364^{b} \pm 0.592$	$349.588^{a} \pm 0.866$	$296.414^{d} \pm 0.831$
Relative density 20/20	$0.993^{b} \pm 0.001$	$0.994^{a} \pm 0.000$	$0.995^{a} \pm 0.001$	$0.994^{a} \pm 0.000$
Ash (g/L)	$2.748^{a} \pm 0.027$	$2.623^{a} \pm 0.024$	$2.645^{a} \pm 0.021$	$2.658^{a} \pm 0.021$
Tasting score	$17.843^{a} \pm 0.021$	$17.893^{a} \pm 0.021$	$17.953^{a} \pm 0.015$	$17.928^{a} \pm 0.014$

Table 2
SELECTED PARAMETERS OF THE TESTED MERLOT WINES

Within the same row, indicated letters mean significant differences, $p<0.05$ (ANOVA, Fisher's LSD).

*mother wine. **clone candidate wine.

scores achieved the wines of the clones may be classified as quality wines with geographical origin [11].

Taken all experimental data classified by years (not shown here), the best/poorest vintage was in 2009 and 2011, respectively. The observed trend is likely to depend on the climatic conditions in a considerable extent.

Conlusions

The clonal selection of Merlot variety described herein has been lasting for a number of years. Till date three new clone candidates (Nos. 022, 025 and 029, respectively) have been successfully developed. Promising values of FC index (from 35.73 to 37.15) and tasting score (from 17.89 to 17.95) of the three new Merlot clone candidates, together with improved viticultural parameters (versus the mother vine) indicate the real need for further research work, in order to better understand their characteristics and potential for the market.

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