Vitis **54** (Special Issue), 165–168 (2015)

New Serbian grapevine genotypes for red wine production

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Summary

This paper describes some ampelographic characteristics of young shoot, mature leaf, bunch and berry, ripening time, grape yield, mechanical characteristics of bunch and berry, grape and wine quality of five new grapevine genotypes created for red wine production. All features of the examined genotypes were compared to the reference cultivar 'Merlot'. The influence of genotype was significant for all of the studied traits. Genotype 8417 appeared to be the most promising for yield and grape quality. Wines have been produced and analyzed. Genotypes 13283 and 8417 obtained high scores in sensory evaluation. All the investigated genotypes have been proposed to the Committee on new varieties in Serbia.

K e y w o r d s : selection; ampelographic characteristics; grape yield; grape quality.

Introduction

Grapevine (*Vitis vinifera* L.) is economically the most important fruit species in the world. Approximately 71 % of grape production is used for wine, 27 % as fresh fruit, and 2 % as dried fruit (Conde *et al.* 2007). Cultivar selection is a major viticultural factor in increasing the yield and quality of grapes. To be a paid off investment in production vineyards, new cultivars with high yield and fruit quality are being constantly created (Nikolić 2012). Increasing the existing assortment is also connected to the consumer tastes of grape and wine. Apart from sugars, acids and mineral elements, grape contains a number of vitamins, polysaccharides, proteins, pectin, aroma and tannin substances with nutritional and health value in human diet (Hamilton and Coombe 2004). It is also a source of antioxidant compounds (such as phenolics) (Yilmaz and Toledo 2004).

It is well known that grape production also depends on cultivar selection. Thus, breeding could improve the cultivar genetic potentials (Nikolić 2012).

In the breeding process parental materials selection has a key role. Therefore, the preservation of grapevine genetic resources is a priority task for breeding purposes. Mostly of Serbian viticulture is made by international cultivars and their clones. However, in certain regions, traditional indigenous cultivars are also cultivated (Bešlić *et al.* 2012). During the 1960s, Serbian research institutions focused their attention on breeding activities, creating new cultivars (Avramov 1991, Cindrić *et al.* 1994, Nikolić 2012). Until now, the Faculty of Agriculture in Belgrade has created 23 cultivars (15 for fresh consumption and 8 wine production). Moreover, eight clones of autochthonous cultivar 'Prokupac' were selected and recognized.

The aim of this study was to present data concerning ampelographic characteristics, ripening time, grape yield, bunch and berry morphology, grape and wine quality of the five most promising genotypes obtained for red wine production.

Material and Methods

Investigations were repeated in 2010, 2011 and 2012 at the Experimental Station 'Radmilovac' of the Faculty of Agriculture, University of Belgrade. Five new genotypes for red wine production were tested (7763, 8211, 8417, 13283 and 15212) (Tab. 1). 'Merlot' was selected as reference cultivar. For each genotype, 6 vines were considered as replications. All grapevines were grafted on *V. berlandieri x V. riparia* Kober 5BB rootstock and planted at a distance of 3.0 x 0.75 m. The training system was double Guyot.

Ampelographic characteristics, ripening time, grape yield, bunch and berry morphology, grape and wine quality were studied. Ampelographic characteristics of young shoot, mature leaf, bunch and berry were described by the Ipgri, Upov, Oiv descriptors (1997). Ripening time was determined on the basis of sugar content by refractometer. Grape yield was established by measuring the weight of all bunches of each vine. Bunch length, width and weight was calculated based on the average of all bunches produced by 10 shoots. Berry length, width and weight were the average values of 100 berry measurements. Sugar content of the must was established by refractometer and total acids content in the must was determined by titration with n/4 NaOH.

Wines were produced by microvinification of each considered genotype. Six months after bottling wines were analyzed by the official OIV methods (EEC 2676/90 Regulations, European Commision 1990). The following parameters were considered: alcohol, total extract, tartaric acid, total phenols, color intensity, color hue. Sensory evaluation were performed by an accredited sensory committee. A score method (0-100 points) (Regulation on the procedure of production and quality of table wines and wines with geographical origin "RS Official Gazette", No. 41/09) was used. Wine categories were established: at least

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Table 1

Origin, ripening time and ampelographic characteristics of the investigated genotypes and reference cultivar

Origin and ripening time		
Genotype	Origin	Ripening time
7763	Začinak x Pinot Noir	11 days before
8211	Prokupac x Tenturier of Župa	3 days before
8417	Merlot x Tenturier of Župa	8 days before
13283	Začinak x Prokupac	4 days before
15212	Alicante Bouschet x Vranac	2 days before
Merlot	Reference cultivar	26 September

Ampelographic characteristics											
	Young shoot			Mature leaf					Bunch	Berry	
	OIV 001	OIV 003	OIV 004	OIV 067	OIV 068	OIV 076	OIV 079	OIV 084	OIV 204	OIV 223	OIV 225
7763	5	3	7	1	3	2	3	5	5	4	6
8211	5	7	9	1	2	5	2	5	5	4	6
8417	5	5	7	4	3	2	6	5	7	4	6
13283	5	5	7	1	3	5	4	1	7	4	6
15212	5	5	7	3	3	5	4	7	7	4	6
Merlot	5	5	9	3	2	5	3	3	5	4	6

OIV001: young shoot form of tip; OIV003: young shoot anthocyanin colouration of tip; OIV004: young shoot density of prostrate hairs on tip; OIV067: mature leaf shape of blade; OIV068: mature leaf number of lobes; OIV076: mature leaf shape of teeth; OIV079: mature leaf general shape of petiole sinus; OIV084: mature leaf density of prostrate hairs between veins; OIV204: bunch density; OIV223: berry shape; OIV225: berry skin colour.

39 points - table wine (wine without geographic origin); at least 59 points - regional wine; at least 79 points - quality wine with controlled geographical origin; at least 89 points - top-quality wine with controlled and guaranteed geographical origin and quality.

Statistical analyses were performed with the software Statistica (StatSoft, Inc., Tulsa, OK, USA). Analysis of variance was applied to distinguish the effect of the genotype on the studied traits. Individual testing was done by Dunnett's test. For both tests, probabilities which were applied were 0.05 and 0.01.

Results and Discussion

Origin, ripening time and ampelographic characteristics of the studied genotypes are shown in Tab. 1. All of the tested genotypes are designed for red wine production. New varieties were obtained by crossing seven parental cultivars. For the three-year research period, all the tested genotypes ripened earlier than 'Merlot'. Ampelographic description are reported in Tab. 1. The study of yield production depends not only on the genotype, but also on many other factors such as environmental conditions, vineyard management, etc. All new genotypes had a higher yield per vine than 'Merlot' (Tab. 2). For this feature, significant differences were found between genotypes as well as almost all the features of bunches and berries. Grape yield in the genotypes ranged from 3.42 kg·vine^{-1} (genotype 8211) to 5.87 kg·vine^{-1} (genotype 8417). Very significantly higher grape yield and bunch weight compared to the reference cultivar had genotypes 8417 and 13283. In terms of berry length, width and weight the tested genotypes surpassed the reference cultivar. Berry size is considered to be of great importance to winemakers due to the belief that smaller berries make better wines (Matthews and Krie-

Table 2

Mean values of yield components and grape quality of investigated genotypes and reference cultivar (2010-2012)

Genotype	Characteristic								
	Grape yield (kg·vine^{-1})	Bunch			Berry			Grape quality	
		Length (cm)	Width (cm)	Weight (g)	Length (mm)	Width (mm)	Weight (g)	Sugar (%)	Titr. acidity (g·L^{-1})
7763	3.57	16.6	9.3	230.2b	17.53a	16.55a	2.9a	21.47	7.27b
8211	3.42	14.7	8.7	190.1	14.57	13.99	2.3b	21.39	7.43
8417	5.87a	17.4b	10.4a	252.8a	14.78	13.95	2.2	23.00b	7.61
13283	4.66a	15.5	9.7	246.3a	16.38a	16.31a	3.0a	21.00	7.35
15212	3.97	16.2	9.4	227.0	16.04a	16.08a	3.0a	21.72	7.44
Merlot	2.99	15.7	9.0	195.0	14.29	13.37	1.9	21.77	7.73

a; b: significant in respect to 'Merlot' at 1 and 5 % of probability, respectively, by the Dunnett's test.

DEMANN 2006), though this is not necessarily the case. This was confirmed by the results of our work where the wine of good quality was obtained from genotype with larger berries.

The chemical composition of the grape was variable from year to year, depending on the cultivar, yield and environmental conditions-climate, soil, cultural practices, maturity of the grapes etc. (VAUDOUR 2002). It was found that the increase in yield was not so much affected by reducing sugar in the grape (provided that the yield is not too high) as the cultivar and climatic conditions of the year (BURIĆ *et al.* 1985). In our work, sugar content and total acids content in the must were dependent on the genotype (Tab. 2). The genotype 8417 (23.0 %) had the significantly higher sugar content in the must than 'Merlot' (21.77 %). The total acids content in all genotypes was slightly lower than 'Merlot' cultivar. Significant differences in yield, bunch and berry characteristics and total sugar and acids content in the must were determined by NIKOLIĆ *et al.* (2003, 2007) at promising grapevine genotypes from different crossing combinations.

Average values of the chemical and sensorial characteristics of wines produced from the investigated genotypes and reference cultivar 'Merlot' in all three years of study are shown in Tab. 3. The resulting wines were different from the reference cultivar in all chemical parameters. Significantly higher alcohol compared to the 'Merlot' had genotypes 7763, 8211 and 15212. Genotypes 7763, 8417 and 13283 were different in the total extract and genotypes 8211, 8417 and 15212 in the tartaric acid in relation to the 'Merlot'.

Phenolic compounds have a very large impact on the quality of red wines primarily by giving it a special character, color, smell and taste (PUŠKAŠ 2010), and positive effects of phenolic compounds on human health were found as well (BAPTISTA *et al.* 2001, DELL'AGLI *et al.* 2004). Phenolic compounds in grapes are extracted using the process of maceration. The degree of extraction among others depends on the grape cultivar, berry size and length of the period of ripening grape (KENNEDY *et al.* 2002). In this paper the different concentrations of total phenols in wine in the genotypes and reference cultivar were determined. The highest content of total phenols was in the genotype 8211 (1.17 $g \cdot L^{-1}$), and the lowest in the genotype 8417 (0.72 $g \cdot L^{-1}$). These two genotypes and the genotype 15212 were significantly different compared to 'Merlot' in which the average content of total phenols was 0.85 $g \cdot L^{-1}$.

The color of the wine is another characteristic that can be perceived to affect its quality. Wines have certain colors in relation to their age, the type of grape, its chemical components, the style, or the region where it is from (BALDY 1995). Wines produced from all investigated genotypes had a dark-red color in all of the examined years just like 'Merlot' cultivar. A significant deviation was not found for the color intensity in genotype 15212, and color hue in genotypes 8417 and 13283 compared to 'Merlot'. The genotype 13283 had the highest sensory assessment (75 points) and the lowest the genotype 7763 (64 points). The average score for the wine of the tested 'Merlot' cultivar was 72 points (Tab. 3). From all investigated genotypes only the wine of genotype 7763 was differed significantly in sensory evaluation than the reference cultivar.

Conclusions

All of the genotypes examined in this paper satisfied the aims of selection. The genotypes showed a lot of similarities, as well as certain differences in the relation to the reference 'Merlot' cultivar. The differences of the genotypes from the reference cultivar in terms of the largest number of investigated properties was found in the genotypes 7763, 8417 and 13283. As the best regarding yield and grape quality was the genotype 8417. Wines from the investigated genotypes had a satisfactory quality. High sensory evaluation had wines from the genotypes 13283 and 8417. All of the investigated genotypes have been proposed to the Committee on new varieties in Serbia.

Acknowledgements

This study was supported by the Ministry of Education, Science and Technological Development of Republic Serbia Project TR 31063. Joint publication of the COST Action FA1003 "East-West Collaboration for Grapevine Diversity Exploration and Mobilization of Adaptive Traits for Breeding".

References

AVRAMOV, L.; 1991: Vinogradarstvo. Nolit, Beograd.

BALDY, M. W.; 1995: The University Wine Course. The Wine Appreciation Guild, San Francisco.

Table 3

Chemical and sensorial characteristics of wine of investigated genotypes and reference cultivar (average 2010-2012)

Genotype	Alcohol (vol %)	Total extract ($g \cdot L^{-1}$)	Tartaric acid ($g \cdot L^{-1}$)	Total phenols ($g \cdot L^{-1}$)	Color intensity	Color hue	Sensory evaluation
7763	12.50b	23.20b	2.45	0.75	4.09b	0.94a	64a
8211	14.02a	24.80	5.00a	1.17a	5.00a	1.05a	70
8417	9.04	33.60a	1.20b	0.72b	3.29a	0.50	74
13283	11.07	20.60a	2.45	0.74	3.62a	0.55	75
15212	14.80a	28.70	5.20a	1.05a	4.25	0.58b	70
Merlot	10.18	26.60	2.95	0.85	4.40	0.53	72

a; b: significant in respect to 'Merlot' at 1 and 5 % of probability, respectively, by the Dunnett's test.

BAPTISTA, J.; TAVARES, J.; CARVALHO, R.; 2001: Comparison of polyphenols and aroma in red wines from Portuguese mainland *versus* Azores Islands. Food Res. Int. **34**, 345-355.

BEŠLIĆ, Z.; TODIĆ, S.; KORAĆ, N.; LORENZI, S.; EMANUELLI, F.; GRANDO, M. S.; 2012: Genetic characterization and relationships of traditional grape cultivars from Serbia. Vitis **51**, 183-189.

BURIĆ, D.; RAJKOVIĆ, Đ.; PAPRIĆ, Đ.; 1985: Uticaj klimatskih uslova vegetacionog perioda na količinu šećera i kiseline u grožđu. Savremena Poljoprivreda **33**, 209-224.

CINDRIĆ, P.; KORAĆ, N.; KOVAČ, V.; 1994: Sorte vinove loze. Prometej, Novi Sad.

CONDE, C.; SILVA, P.; FONTES, N.; DIAS, A. C. P.; TAVARES, R. M.; SOUSA, M. J.; AGASSE, A.; DELROT, S.; GEROS, H.; 2007: Biochemical changes throughout grape berry development and fruit and wine quality. Global Science Books, Food **1**, 1-22.

DELL'AGLI, M.; BUSCIALA, A.; BOSIO, E.; 2004: Vascular effects of wine polyphenols. Cardiovascular Res. **63**, 593-602.

EUROPEAN COMMISION; 1990: Regulation (EEC) Nº 2676/90 of 17 September (1990): Community methods for the analysis of wines. Off. J. Eur. Commun. **L272**, 1-192.

HAMILTON, R. P.; COOMBE, B. G.; 2004: Harvesting of wine grapes. In: B. G. COOMBE, P. R. DRY (Eds): Viticulture, Vol. 2 (Practices), 302-327. Winetitles, Adelaide, Australia.

IPGRI; UPOV; OIV; 1997: Descriptors for Grapevine (*Vitis* spp.). Int. Union Protect. New Var. Plants (UPOV), Geneva, Switzerland, O.I.V. (Off. Int. Vigne Vin), Paris, France, Int. Plant Genet. Resour. Institute (IPGRI), Rome, Italy.

KENNEDY, J.; MATTHEWS, M.; WATERHOUSE, A.; 2002: Effect of maturity and vine water status on grape skin and wine flavonoids. Am. J. Enol. Vitic. **53**, 268-274.

MATTHEWS, M. A.; KRIEDEMANN, P. E.; 2006: Water deficit, yield, and berry size as factors for composition and sensory attributes of red wine. In: D. OAG, K. DEGARIS, S. PARTRIDGE, C. DUNDON, M. FRANCIS, R. JOHNSTONE, R. HAMILTON (Eds): 'Finishing the Job' - optimal ripening of Cabernet Sauvignon and Shiraz, 46-54. Proc. Aust. Soc. Oenol. Vitic., Mildura Arts Centre, Mildura, Victoria.

NIKOLIĆ, D.; 2012: Oplemenjivanje vinove loze. Fleš, Zemun.

NIKOLIĆ, D.; MILUTINOVIĆ, M.; RAKONJAC, V.; FOTIRIĆ, M.; 2003: Characteristics of promising grapevine hybrids from different crossings. Acta Hortic. **603**, 731-734.

NIKOLIĆ, D.; MILUTINOVIĆ, M.; RAKONJAC, V.; 2007: Morphological and disease resistance characteristics of table grape hybrids. Acta Hortic. **760**, 415-418.

PUŠKAŠ, V.; 2010: Uticaj tehnoloških faktora u proizvodnji crvenih vina na sadržaj i stabilnost katehina i njihovih oligomera. Doktorska disertacija, Novi Sad, 1-143.

VAUDOUR, E.; 2002: The quality of grapes and wine in relation to geography: notions of *terroir* at various scales. J. Wine Res. **13**, 117-141.

YILMAZ, Y.; TOLEDO, R. T.; 2004: Major flavonoids in grape seeds and skins: antioxidant capacity of catechin, epicatechin, and gallic acid. J. Agric. Food Chem. **52**, 255-260.