PRODUCTION AND TECHNOLOGICAL CHARACTERISTICS OF PROSPECTIVE VINE HYBRIDS IN THE NIS WINE-GROWING REGION

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Abstract: This paper presents the results on the study of promising vine hybrids in the Nis wine-growing region. The following promising vine hybrids were obtained from three different crossing combinations: NI 11-92 (Prokupac x Gamay Noir), NI 8-92 (Smederevka x Traminer Savagnin rose), and NI 2-92 (Smederevka x Riesling Rhine). The hybrids were created in the "Centre for Viticulture and Winemaking" in Niš.

The tested hybrids differed in their cropping potential, grape yield and quality, chemical composition and sensory evaluation of the wine.

Key words: phenology, hybridization, yield, grape quality, wine quality.

Introduction

The aim of vine breeding is to obtain new high-yielding and high-quality varieties. This goal can be achieved most quickly by crossing between different species. Various methods of vine breeding have created many new varieties that have helped to increase yields many times over, maintain or improve the quality of grapes and to increase the resistance of many varieties to adverse environmental factors (Singh and Murthy, 1993; Nikolić, 2018). The creation of new vine varieties in our country started in the 1960s. A certain number of newly created varieties have been studied and described in detail by many authors (Avramov, 1991; Burić, 1995; Tarailo *et al.*,1997; Garić *et al.*, 1998; Cindrić *et al.*, 2000; Korać *et al.*, 2002; Nikolić, 2018; Žunić and Garić 2017) and others. At the experimental estate of the "Centre for Viticulture and Winemaking" in Nis, work has been going on for several years on the creation

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of new vine varieties by hybridization, with the aim of combining the desirable characteristics of selected parents in the genotype of one of their offspring. A large number of hybrids have been obtained from numerous crossing combinations, which are interesting for recognition as a new variety or for further breeding. This paper presents the results of testing the biological and productive characteristics of promising vine hybrids from three combinations of crosses between varieties.

Materials and methods

The tests were carried out in the vineyard of varieties collection of the "Centre for Viticulture and Winemaking" in Nis. The object belongs to the Nis wine-growing region. The altitude of the object is 210 m, the slope of the terrain is gentle and the exposure is north. The vineyard was planted in 1995. year on an area of 2 ha, with over 200 vine genotypes. Newly created cross-varietal vine hybrids were used as test material, resulting from three different crossing combinations: NI 11-92 (Prokupac x Gamay Noir), NI 8- 92 (Smederevka x Traminer/Savagnin rose), and NI 2-92 (Smederevka x Riesling Rhine). All the newly created wine hybrids were planted at a distance of 3.0 x 1.2 m. The rootstock on which they are grafted is Berlandieri x Riparia Kober 5 BB. The training system is the "Karlovac cultivation form" with a tree height of 80 cm, using mixed pruning . The support is a trellis consisting of a wooden stake, a concrete pillar and wire serves as support and ensures correct arrangement of the shoots, leaves and grapes in the space. When pruning, a condir with 2 meshes and two curves with 10 meshes each were left on the vine wood. In this way, all vine woods were loaded with the same number of buds, eliminating the influence of different vine loads on the yield and quality of the grapes. The tests were carried out in the period 2011-2013 and were divided into two parts: the field part of the experiment and the laboratory chemical analysis of grapes and wine. The field part of the experiment included 10 vine wood cuttings for each treatment. The experiment was conducted using the random selection method, with ten repetitions (10 vine woods within each variant, with each vine cutting serving as a separate experimental unit. The laboratory tests were carried out in the laboratories of the "Centre for Viticulture and Winemaking" in Nis, the Agricultural Extension Service in Nis and the Faculty of Agriculture in Belgrade. The research included the following indicators: phenological observations, reproductive potential, yield and mechanical composition of the

grapes, quality of the grapes, chemical composition of the wine and wine regulatory assessment.

Results and discussion

The timing of certain phenophases in the annual development cycle of the examined hybrids could be seen read the data shown in Table 1. The hybrid NI 11-92 had the earliest activation of the bud burst (12 April), the beginning of flowering (30 May) and the ripening time (28 September). The latest activation of buds (17 April) and ripening time (30 September) were found in the hybrid NI 8-92 , while the hybrids NI 8-92 and NI 2-92 had the same start of flowering (31 May).

Table 1. Mean values of the phenological phases of the tested hybrids (average 2011-2013. years)

Characteristic	Hybrid		
	NI 11-92	NI 8-92	NI 2-92
Activation of bud burst	12.04.	17.04.	13.04.
Beginning of flowering	30.05.	31.05.	31.05.
End of flowering	12.06.	16.06.	12.06.
Development of Berries	19.06.	21.06.	18.06.
Maturation	30.07.	30.07.	04.08.
Time of ripening	28.09.	30.09.	29.09.
Number of days	169	165	169

Grape yield and quality

From the data shown in Table 2, it can be seen that the highest grape yield per vine (4.55 kg), number of bunches per vine (24.83) and width of the bunch (9.47 cm) were recorded for   the hybrid NI 8-92, while the highest average weight of grapes was for the hybrid NI 2-92 (183.75 g).

Table. 2. Mean values and indicators of yield variability, grape quality and characteristics of the examined hybrids (average 2011-2013)

Characteristic	Hybrid								
	NI -92			NI 8-92			NI 2-92		
	$\overline{X}$	S	Cv(%)	$\overline{X}$	S	Cv(%)	$\overline{X}$	S	Cv(%)
Grape yield per vine wood (kg)	3.52	0.67	18.93	4.55	0.99	21.68	3.65	0.55	15.02
Number of bunches per vine wood	20.50	3.06	14.93	**24.83**	3.91	15.76	20.10	2.35	11.71
Bunch mass (g)	177.89	39.95	22.46	181.95	45.40	24.95	**183.75**	33.41	18.18
Bunch length (cm)	**16.27**	2.77	17.00	14.00	1.84	13.13	13.93	2.52	18.07
Bunch width (cm)	8.27	1.76	21.29	9.47	1.66	17.49	7.63	1.75	22.95
Number of berries per bunch cluster	**140.30**	44.41	31.65	89.00	34.01	38.21	83.80	17.40	20.76
Mass of gooseberries (g)	5.96	1.58	26.58	2.69	0.82	30.30	5.01	1.45	28.98
The sugar content in the must (%)	**24.03**	1.68	6.98	21.52	1.37	6.36	21.65	1.22	5.64
Content of total acids (g/l)	7.83	0.81	1.34	7.80	1.20	15.34	**8.34**	0.90	10.83
Alcohol content in the wine (% Vol.)	13.76			13.23			12.92		
Sensory evaluation of wine	63			66			64		

The hybrid NI 11-92 had the highest average values for bunch length (16.27), number of berries per bunch (140.30) and gooseberry mass (5.96 g). The hybrid NI 11-92 had the lowest grape yield per vine wood (3.52 kg) and bunch weight (177.89 g). The lowest number of bunches per vine wood (20.10), bunch length (13.93 cm), bunch width (7.63 cm) and number of berries in a bunch (83.80) were obtained from the hybrid NI 2-92, while the hybrid NI 8-92 had the lowest mass of gooseberries (2.69 g). The greatest variation in grape yield per bunch, number of bunches per bunch, bunch weight, number of berries per bunch and gooseberry weight was found in the hybrid NI 8-92 (Cv = 21.68%; Cv = 15.76%; Cv = 24.95 %; Cv =38.21%; Cv=30.30%), and bunch length and bunch width in hybrid NI 2-92 (Cv = 18.07%; Cv =22.95%). The highest content of sugar in the must was found in hybrid NI 11-92 (24.03%), and the highest content of total acids in the must was found in hybrid NI 2-92 (8.34 g/L). The sugar content in the must of the hybrid NI 8-92 was 21.52%, and in hybrid NI 2-92 it was (21.65%). The content of total acids in the must of the hybrid NI 11-92 was 7.83 g/L and in the hybrid NI 8-92 (7.80 g/l). The greatest variation in sugar content in the must was found in the hybrid NI 2-92 (Cv=6.98%) and the content

of total acids in the must in the hybrid NI 8-92 (Cv=15.34%). The alcohol values in the wine of the tested hybrids ranged from 12.92 % Vol. in the hybrid NI 2-92 to 13.76 % Vol. in the hybrid NI 11-92. The sensory evaluation of the wines of the examined hybrids ranged from 63 to 66 points.

Table 3. Statistical significance of the influence of the year on the yield and grapes characteristics of the examined hybrids

Year		Grape yield per vine wood		Number of bunches per vine wood		Bunch length	
		Environment differences	*by value*	Environment differences	*by value*	Environment differences	*by value*
2011	2012	-0.11^{nz}	0.80	-1.93*	0.03	0.07^{nz}	0.99
	2013	-0.69**	0.00	-2.90**	0.00	-1.77**	0.008
2012	2011	0.11^{nz}	0.80	1.93*	0.03	-0.07^{nz}	0.99
	2013	-0.57**	0.006	-0.97^{nz}	0.41	-1.83**	0.005
2013	2011	0.69**	0.00	2.90**	0.00	1.77**	0.008
	2012	0.57**	0.006	0.97^{nz}	0.41	1.83**	0.005

nz for $p > 0.05$*; for $p < 0,05$; ** for $p < 0,01$.

Table 3 shows that the yield of grapes per vine wood was statistically significantly higher in 2013 than in 2011 and 2012. The yield of grapes per vine wood was not significantly different between 2011 and 2012. The number of bunches per bush in 2013 was significantly higher than in 2011, and was not different from the number of bunches per bush in 2012. In 2012, the number of bunches per bush was significantly higher than in 2011. The length of the bunch in 2013 was statistically particularly higher than in 2011 and 2012. It was not different significantly between 2011 and 2012.

Table 4. Statistical significance of the influence of genotype and year on the content of sugar and total acids of the must in the examined hybrids

Sources of variation	Sugar content in the must		Content of total acids in the must	
	ANOVA			
	F-value	*by value*	*F-value*	*by value*
Hybrid	34.90**	0.00	3.03^{nz}	0.05
Year	3.53*	0.03	0.21^{nz}	0.81
Hybrid x year	4.00**	0.005	3.60*	0.01

nz za p>0.05;* za p<0.05;** za p<0.01

The results of the analysis of variance in Table 4 showed that very significant differences were found for the content of sugar in the must between

the studied hybrids, while the differences in the content of total acids in the must were not significant. The influence of the year was significant for the sugar content in the must, but it was not significant for the content of total acids in the must (p>0.05). The joint influence of genotype and year was very significant for the content of sugar in the must and significant for the content of total acids in the must.

Conclusion

Based on the results of the examination of promising vine hybrids in the Nis wine-growing region, the following conclusions were drawn:
Hybrid NI 11-92 had the earliest budburst activation (12 April), easliest flowering start (30 May) and earliest ripening time (28 September). The latest activation of budbursts (17 April) and ripening time (30 September) were recorded in the hybrid NI 8-92 , while the hybrids NI 8-92 and NI 2-92 had the same start of flowering (31 May).
The highest yield of grapes per vine wood (4.55 kg), the number of bunches per vine wood (24.83) and the width of the bunch (9.47 cm) was recorded for the hybrid NI 8-92, while the highest average weight of bunches was in hybrid NI 2-92 (183.75 g). The yield of grapes per vine wood in 2013 was statistically significantly higher than in 2011 and 2012. The yield of grapes per vine wood was not significantly different between 2011 and 2012. The highest sugar content in the must was recorded in the NI 11-92 hybrid (24.03%), and the total acid content in the NI 2-92 hybrid (8.34 g/l). The content of sugar in the must of the hybrid NI 8-92 was 21.52%, and of the hybrid NI 2-92 it was (21.65%). The greatest variation in sugar content was found in the hybrid NI 2-92 (Cv=6.98%), and in total acid content in the hybrid NI 8-92 (Cv=15.34%). The alcohol values in the wine of the tested hybrids ranged from 12.92 % Vol. in the hybrid NI 2-92 to 13.76 % Vol. in the hybrid NI 11-92. The sensory evaluation of the wines of the examined hybrids ranged from 63 to 66 points. The results of the analysis of variance showed that very significant differences in the sugar content of the must were found between the tested hybrids, and that the differences in the content of total acids of the must were not significant. Under the conditions of the Nis wine-growing region and similar agro-ecological conditions, examined vine hybrids can be grown successfully

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