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Technological and oenological characteristics of the Ferdinand de Lesseps and Muskat ruža wine grape varieties

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Abstract

The aim of this paper is to present comparative results of the research for the Ferdinand de Lesseps and Muskat ruža varieties grown in the conditions of the Župa wine region, Serbia. The research included phenological observation, yield, mechanical (ampelographic) characteristics of the bunch and berries, qualitative parameters of grape juice – must, physico-chemical analysis, and sensory evaluation of wine. A later date was determined for the start of a bleeding phenophase, flowering, and berry growth for the Muskat ruža variety, while the Ferdinand de Lesseps variety entered the phenophase of budburst and shoot growth later. Furthermore, the Muskat ruža variety was characterized by higher fertility with an average of more developed reproductive shoots per trunk (9.2). Based on the mechanical (ampelographic) characteristics of the bunch and berries, it was found that the Muskat ruža variety had higher values for the following parameters: developed berries, the average weight and length of the bunch, the number of seeds in 100 berries, and the proportion of the bunch stem, the berry skin, the proportion of seeds, and a higher grape skeleton. On the other hand, the Ferdinand de Lesseps variety had a higher value for the average bunch mass and all berries in a bunch, the average berry width, the mass of 100 berries, the mass of berry skins in 100 berries, the mass of 100 seeds, and the proportion of mesocarp in a bunch. A higher sugar content (21.3%) was found in the grape juice of the Muskat ruža variety than in the Ferdinand de Lesseps variety (20.4%). As far as the physico-chemical analysis of the wine is concerned, the wine of both varieties meets the criteria for the wine production with protected geographical origin. The wine made from Ferdinand de Lesseps received a

sensory score of 19 points, while the Muskat ruža variety received 17 points. It can be stated that both varieties have their typical varietal characteristics.

Key words: Ferdinand de Lesseps, Muskat ruža, Ampelographic characteristics, Grape, Wine.

Introduction

The grapevine had been growing on Earth before humans, as fossil remains from ancient geological periods have shown (Gerrath et al., 2015). Due to the widespread distribution of wild forms of the grapevine, it is difficult to determine the exact date when the "domestication" of the grapevine began, but the oldest evidence of grapevine cultivation dates back to the Neolithic period, i.e., 5 500-6 000 years before Christ (Mc Goveren, 2003). It is assumed that the cultivation of viticulture originally began on the eastern coast of the Black Sea in Transcaucasia, having further spread to the continental part of Europe and also to the area of the Balkan Peninsula (Marković, 2023). The area of today's Župa Aleksandrovačka is one of the oldest vineyard areas on the territory of the Republic of Serbia. Historical data show that grapevine has been cultivated in this area for over three thousand years. Celtic warriors, Roman legionaries, Byzantine nobles, monastery monks, Serbian prefects, and kings drank wine from these areas (Štetić, 2021). The Župa wine growing area belongs to the Tri Morava region, which is located in the central part of Serbia, in the lower basin of the Western Morava, the lower basin of the Southern Morava, and the upper basin of the Velika Morava and its tributaries. The region covers an area of 286,929.90 hectares, with the Župa vineyard accounting for 7.69% of the region, i.e., 22.067,82 hectares (Ivanišević et al., 2015). Out of 1,535.45 hectares of the total cultivated land, 1,496.05 hectares (97.5%) are planted with wine varieties and only 39.40 hectares with table varieties (Statistical Office of the Republic of Serbia, 2023).

As far as the percentage of the total assortment is concerned, the Prokupac variety is the most present one, as well as Tamjanika, which was probably introduced by the Turks during the Ottoman Empire, but there is also a large number of introduced varieties, primarily from France and Italy (Cabernet Sauvignon, Cabernet Franc, Merlot, Sauvignon Blanc, Chardonnay, Riesling, etc.). Nowadays, there are varieties with a local character that deserve attention on the market both for their rarity and for the specific style of the wine produced, which differs from the standard international varieties, among which the Muskat ruža and Ferdinand de Lesseps varieties stand out in particular (Ivanišević et al., 2015).

Both varieties are important for preserving rare grape varieties, thereby preserving the existing gene pool and wine tradition and promoting the wine-growing regions where these varieties are cultivated (Pržić & Marković, 2019).

The aim of the study is to present, for the first time, comparative results for the Ferdinand de Lesseps and Muskat ruža varieties grown under the conditions of the Župa vineyard in terms of phenological observations, fertility, yield, and quality of the grapes and the wine produced.

Material and Methods

The Ferdinand de Lesseps and Muskat ruža varieties were examined for the first time. According to the current zoning of wine-growing regions in the Republic of Serbia, the vineyard under study belongs to the Tri Morava region and the Župa vineyard (GPS 45.05°N and 19.82°E). It currently occupies the southern exposure, it is a VSP type with an inter-row spacing of 2.80 m and a row spacing of 0.80 m. The Guyot training system was formed by applying mixed pruning, selected test trunks of similar condition were pruned uniformly, a spur with 2 normally developed buds and a cane with a length of 8 buds.

The Muskat ruža variety is the result of a mutation of the Muscat à petits grains blanc variety. It is a high vigour variety with a pronounced rose scent that ripens in mid-September. Mixed pruning is appropriate for this variety. The bunch is loose to medium-compact, elongated-pyramidal, medium-long, and the berry is small, round, light red to ruby red. It is sensitive to *Botryris cinerea*. The grape juice (must) is colourless and sweet, with a typical muscat flavour. It can accumulate up to 25% sugar and produces wines with 14-15% vol. The wine has pronounced floral tones with the presence of flavours, fruity aromas, red cherries, strawberries, and raspberry jelly, along with notes of cinnamon, cloves, and nutmeg. The Ferdinand de Lesseps variety is a cross of Chasselas Blanc and Isabella, having combined characteristics. In Serbia it is known under the synonym Jagoda (Tello et al., 2024). Due to its specific aroma, it is used as a table grape when fresh or for the production of wine with very pronounced *foxy* aroma, especially strawberry, which is probably where its name in Serbia comes from.

The research included the study of the phenology, the yield, the mechanical properties of the bunch and berries, the qualitative parameters of the grape juice – must, the physico-chemical analysis, and the sensory evaluation of the wine. The phenological observations were used to determine the beginning and end of the phenophases of bleeding, budburst, shoot and berry growth, and ripening, which were carried out according to Lorenz et al. (1994). Fertility was determined by counting the inflorescences developed during the flowering phenophase on the spur and the cane on ten representative, randomly selected

trunks, on the basis of which the number of fertile and infertile shoots and the coefficients of potential, relative, and absolute fertility were determined.

Mechanical (ampelographic) composition of the bunch and berries was carried out according to the descriptive methods by Marković (2023) and Marković & Pržić (2020) in the laboratory of the Department of Viticulture, Faculty of Agriculture University of Belgrade. The harvested grapes were measured in terms of their weight, length, and width. The number of berries per bunch, the mass of berries per bunch, and the mass of bunch stems were measured separately for ten bunches per tested variety on an analytical balance. From each variety, 100 representative berries were selected and after measuring their mass, the berry skin and seeds were physically separated and measured on an analytical balance. Other structural components and indicators presented in the paper were calculated.

The chemical parameters of grape juice (must) were represented in the study by the sugar content (%), the total acidity expressed as tartaric acid (g/L), and the pH value. The sugar content was determined by physico-chemical methods using the Oeshle hydrometer (Tera rossa, Italy), the values of which were calculated using the Dujardin-Salleron tables. Total acidity was determined by titration with n/4 NaOH (Merck, Germany) and pH with a pH metre (MA 5724, Iskra, Slovenia). The glycoacidometric index (GAI) was calculated from the ratio of sugar and acid content.

Wine was produced from the harvested grapes using the microvinification process, which was tested by applying physico-chemical and sensory analyses. The physico-chemical parameters of the wine were used to examine the relative density (the AL-DM-04/a method), the actual and total alcohol content (the AL-DM-04/b method), the total extract (the AL-DM-04/c method), the reducing sugar (the AL-DM-02 method), the extract without sugar (the AL-DM-04/d method), the total and volatile acidity (the OIV-MA-EAS313-01 and SRPS ISO 6632:2003 methods), the total and free SO2 (the AL-DM-09/b and AL-DM-09/a methods), the ash (the AL-DM-05 method), the pH value (the OIV-A31MA-EAS313-15 method) and the content of certain heavy metals (the AL-DM-32 method). A 20-point scale was used by a sensor panel for the sensory evaluation of the one-year aged wine, whereby the colour (maximum 2 points), the clarity (maximum 2 points), the aroma (maximum 8 points), and the taste of the wine (maximum 8 points) were evaluated.

Results and Discussion

Phenological observations

The results of the phenological observations are shown in Tables 1 and 2. The phenological phenophase of ripening of the Ferdinand de Lesseps variety began on 18 March and lasted until 30 March 2021, i.e., 13 days. Budburst occurred on 14 April and lasted until 23 April 2021. The beginning of flowering was recorded on 19 May and lasted until 1 June 2021, i.e., 14 days. Veraison took place on 19 August 2021, and the grapes were harvested at full ripeness on 17 September 2021.

Tab. 1 Phenological observations of the Ferdinand de Lesseps and Muskat ruža varieties

Phenophase	Beginning	End	Duration (days)
Bleeding (Cod. 00-03)			
Ferdinand de Lesseps	18 Mar 20201	30 Mar 2021	13
Muskat ruža	22 Mar 2021	08 Apr 2021	18
Budburst (Cod. 05-08)			
Ferdinand de Lesseps	14 Apr 2021	23 Apr 2021	10
Muskat ruža	12 Apr 2021	18 Apr 2021	7
Shoot growing (Cod. 11-19)			
Ferdinand de Lesseps	27 Apr 2021	15 Jun 2021	50
Muskat ruža	20 Apr 2021	10 Jun 2021	52
Flowering (Cod. 60-69)			
Ferdinand de Lesseps	19 May 2021	01 Jun 2021	14
Muskat ruža	22 May 2021	03 Jun 2021	13
Development of berries (Cod. 71-79)			
Ferdinand de Lesseps	12 Jun 2021	19 Aug 2021	69
Muskat ruža	22 May 2021	03Aug 2021	74
Ripening			
Ferdinand de Lesseps / Muskat ruža	*Veraison* (Cod. 81-83)	19 Aug 2021	30
		24 Aug 2021	
Ferdinand de Lesseps / Muskat ruža	Harvest (full maturity, Cod. 85-89)	17 Aug 2021	
		22 Aug 2021	130
Days from bleeding to harvest		Ferdinand de Lesseps	186
		Muskat ruža	190

Observation of the ripening period of the grapes showed that ripening lasted 30 days, and 186 days passed from bleeding to harvest. In the Muskat ruža variety, the bleeding phenophase began on 22 March, the budburst of the buds began on 12 April and lasted until 18 April 2021. The flowering phenophase occurred on May 22 and lasted 13 days. Veraison started on 24 August 2021,

while the grape harvest took place at full maturity on 22 September 2021. Observation of the ripening period of the grapes showed that ripening lasted 30 days and 190 days passed from flowering to harvest.

It can be noted that there was a slight difference in the number of days that elapsed from the bleeding phenophase to harvest in both varieties, with the Muskat ruža variety showing a later time for the start of the bleeding phenophase, flowering, and berry growth, while the Ferdinand de Lesseps variety entered the budburst phenophase and shoot growth later. The development of different phenophases varies from variety to variety and can be strongly influenced by external factors. Depending on the temperature, the same variety can show large differences in the length of the phenophases under different thermal conditions (Jones & Davis, 2000; Malheiro et al., 2013; Jovanović-Cvetković et al., 2023; Sgubin et al., 2023).

Fertility

By counting the inflorescences of the variety Ferdinand de Lesseps, it was shown that on average 14.5±0.95 were developed on the shoots on the canes and 2.1±0.78 on the shoots on the spur. In addition, there were on average of 7.4 fertile and 2.6 infertile shoots per trunk. The Ferdinand de Lesseps variety did not show large variations in the number of inflorescences developed per trunk, while the spur variety showed a lower average variation in the number of inflorescences developed, 0.78 compared to 0.95 on the canes (Table 2). From the results obtained, it can be concluded that this variety is fully suitable for mixed pruning.

Tab. 2 Number of inflorescences, fertile, and infertile shoots of the Ferdinand de Lesseps variety (X±SD)

Trunk number	Number of fertile shoots	Number of infertile shoots	Total number of inflorescences on the spur	Total number of inflorescences on the cane
1.	5	5	3	9
2.	6	4	2	13
3.	10	0	4	20
4.	9	1	1	19
5.	4	6	0	10
6.	8	2	3	13
7.	8	2	2	14
8.	6	4	0	14
9.	8	2	2	15
10	10	0	4	18
Average	7.4±1.96	2.6±2.06	2.1±0.78	14.5±0.95

The coefficient of relative fertility had the value of 1.66, while the coefficient of absolute fertility had the value of 1.96.

Tab. 3 Fertility coefficients of the Ferdinand de Lesseps variety

Parameter	Value
Coefficient of relative fertility	1.66
Coefficient of absolute fertility	1.96

There were 27±0.35 inflorescences developed on the spur and 135±0.56 on the cane observed in the Muskat ruža variety. On average, there were 9.2 fertile and 0.8 infertile shoots per trunk (Table 4). The coefficient of relative fertility was 1.62 and the absolute fertility 1.76.

Tab. 4 Number of inflorescences, fertile, and infertile shoots of the Muskat ruža variety (X±SD)

Trunk number	Number of fertile shoots	Number of infertile shoots	Total number of inflorescences on the spur	Total number of inflorescences on the cane
1.	10	0	3	16
2.	9	1	2	15
3.	8	2	4	12
4.	10	0	3	15
5.	8	2	2	12
6.	10	0	4	16
7.	9	1	1	11
8.	9	1	1	12
9.	9	1	3	12
10	10	0	4	14
Average	9.2±0.79	0.8±0.79	2.7±0.35	13.5±0.56

With an average of more developed reproductive shoots per shoot (9.2) compared to the Ferdinand de Lesseps variety (7.4) the Muskat ruža variety had a higher fertility potential. In addition, the Muskat ruža variety had a significantly lower average number of infertile shoots developed (0.8). Compared to the Muskat ruža variety, the Ferdinand de Lesseps variety showed a greater variation in the developed inflorescences on the spur and the cane. These results indicate a high degree of differentiation of buds on spurs and canes of Muskat ruža. Based on Avramov and Žunić (2001), Žunić and Garić (2010; 2017), and Marković and Pržić (2020), the investigated varieties are categorised into the group of varieties with very high fertility coefficients according to the values obtained for them.

Tab. 5 Fertility coefficients of the Muskat ruža variety

Parameter	Value
Coefficient of relative fertility	1.62
Coefficient of absolute fertility	1.76

Grape yield

The grapes were harvested at full ripeness, on 17 September 2021 for the Ferdinand de Lesseps variety and on 22 September 2021 for the Muskat ruža variety. The yield of the Ferdinand de Lesseps grapes varied between 2,253 and 3,250 kg, while the average yield per trunk was 2,640±0.33 kg. The yield of the Muskat ruža variety fluctuated between 2,662 and 4,321 kg. The average yield per trunk was 3.540±0.61 kg. The statistical analysis showed that there was a significant difference in the average yield of grapes per vine.

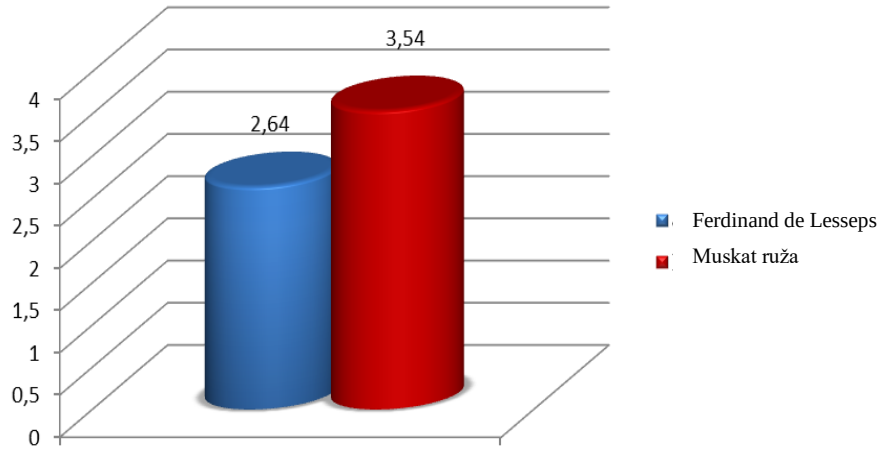

Figure 1. Average yield per trunk for the Ferdinand de Lesseps and Muskat ruža varieties

Mechanical composition of bunches and berries

The average weight of a bunch of the Ferdinand de Lesseps variety was 223.7 g, and the average number of berries in a bunch was 84.5. The average weight of all berries was 211.5 g and the average weight of the bunch stem was 6.3 g. The average length of the petiole was 0.97 cm. The number of seeds in 100 berries of the Ferdinand de Lesseps variety was 175. The results with ±SD are presented in Table 6.

In the Muskat ruža variety, the bunch weight was 210.6 g and the average number of berries in a bunch was 146.1. The average weight of the berries was 206.3 g and the weight of the bunch stem was 6.6 g. The average length of the petiole was 2.81 cm. The number of seeds in 100 berries was 238.

On average, the Ferdinand de Lesseps variety had a higher bunch mass (223.7±46.13 g) compared to the Muskat ruža variety, which had a bunch mass of 210.6±67.29 g. No statistically significant difference was found for the average weight of the bunch, while a statistically significant difference was found for the average number of berries in the bunch. The Ferdinand de Lesseps variety had an average of 84.5±25.55 berries, while the Muskat ruža variety had 146.1±20.12 berries.

Tab. 6 Mechanical composition of the bunch of the Ferdinand de Lesseps and Muskat ruža varieties

Parameters		Ferdinand de Lesseps	Muskat ruža
Bunch mass (g)		223.7±46.13	210.6±67.29
Bunch length (cm)		14.45±1.71	15.6±2.25
Bunch width (cm)		10.0±1.65	9.7±1.29
Number of berries in a bunch		84.5±25.55	146.1±20.12
Mass of all berries in a bunch (g)		211.5±40.74	212.3±60.86
Weight of 100 berries (g)		326.0	150.0
Weight of the skins of 100 berries (g)		6.81	6.05
Seed weight of 100 berries (g)		5.94	4.75
Number of seeds per 100 berries (g)		175	238
Mass of a bunch stem (g)		6.3±2.49	6.6±2.91
Weight of 100 seeds (g)		3.25	1,90
Length of a petiole (cm)		0.97±1.23	2.81±3.23
Berry dimensions	Length (mm)	16.56±0.84	13.17±0.74
	Width (mm)	16.22±0.87	13.33±1.43

The same trend was observed for the average mass of berries. Ferdinand de Lesseps had a lower berry weight (211.5±40.74 g) than the Muskat ruža variety (212.3±60.86 g).

Tab. 7 Mechanical composition of the bunch and berries of the Ferdinand de Lesseps and Muskat ruža variety

Nº	Parameters	Ferdinand de Lesseps	Muskat ruža
1.	Average mass of all berries in a bunch (g)	211.5	212.3
2.	Average mass of berry skin in a bunch (g)	5.75	5.84
3.	Average mass of seeds in a bunch (g)	5.02	6.94
4.	Average mass of mesocarp in a bunch (g)	206.63	188.22
5.	Average number of seeds in a cluster	145.34	347.72
6.	% of bunch stem in a bunch (%)	2.82	3.13
7.	% of berries in a bunch (%)	97.18	96.87
8.	% of berry skin in a bunch (%)	2.57	4.20
9.	% of seeds in a bunch (%)	2.24	3.30
10.	% of mesocarp in a bunch (%)	92.37	89.37
11.	Bunch skeleton	5.39	7.33
12.	Hard (firm) rest of a bunch	7.63	10.63
13.	Indicator of the weight composition of a bunch	34.51	30.91
14.	Bunch structure indicator	12.10	8.41
15.	Average mass of a berry (g)	3.26	1.50
16.	Average weight of the berry skin of a berry (g)	0.07	0.06
17.	Average mass of seeds of a berry (g)	0.06	0.05
18.	Average number of seeds in a berry	1.72	2.38
19.	Average mass of mesocarp in 100 berries (g)	313.25	177.75
20.	% of berry skin in a berry (%)	2.09	6.44
21.	% of seeds in a berry (%)	1.82	2.41
22.	% of mesocarp in a berry (%)	96.09	91.15
23.	Berry indicator	37.77	47.96
24.	Indicator of the weight composition of a berry	46.00	14.16
25.	Average weight of 100 seeds (g)	3.25	2.98
26.	Average mass of a seed (g)	0.03	0.03

The Muskat ruža variety had an average larger bunch length (15.6 cm) compared to the Ferdinand de Lesseps variety, whose bunch length was 14.45 cm. In terms of width, the Ferdinand de Lesseps variety had a larger average bunch width (10.0 cm) than the Muskat ruža variety, whose average length was 9.7 cm. The Muskat ruža variety had longer and looser bunches, while the Ferdinand de Lesseps variety had shorter and more compact bunches.

The Ferdinand de Lesseps variety had higher values for the mass of 100 berries (326 g), the mass of the skin of 100 berries (6.81 g), the mass of the seeds of 100 berries (5.94 g) and the mass of 100 seeds (3.25 g) compared to the Muskat ruža variety, in which the weight of 100 berries was 150 g, the weight of the skin in 100 berries was 6.05 g, the weight of the seeds in 100 berries amounted to 4.75 g and the weight of 100 seeds to 1.90 g. The Muskat ruža variety had higher values for the mass of 100 berries (326 g), the mass of the skin in 100 berries (6.81 g), the mass of the seeds in 100 berries (5.94 g), and the mass of 100 seeds

(3.25 g). The Muskat ruža variety had a higher number of seeds per 100 berries (238) than the Ferdinand de Lesseps variety (175).

In terms of average berry length, the Ferdinand de Lesseps variety had a higher average berry length (16.56 mm) than the Muskat ruža variety (13.17 mm) and a higher average berry width (16.22 mm) than the Muskat ruža variety (13.33 mm).

The participation of skin, mesocarp, and seeds in the bunch and berry has a major influence on the oenological potential of the variety (Živković et al., 2016; Zdunić et al., 2019). The Muskat ruža variety was characterized by a significantly higher proportion of skin in the bunch, while the Ferdinand de Lesseps variety was characterized by a larger proportion of mesocarp. A larger proportion of the skin influences a higher content of colour pigments, while a larger proportion of the mesocarp increases the yield of grape juice – must.

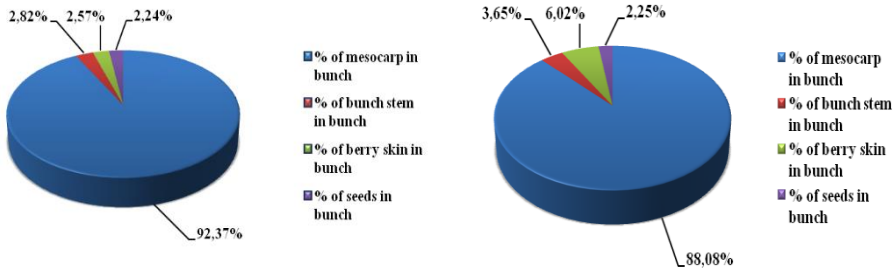

Figure 2. Bunch structure indicators of the Ferdinand de Lesseps (left) and Muskat ruža varieties (right)

Quality of the grape juice (content of sugar, acid, and pH content)

As the Ferdinand de Lesseps and Muskat ruža varieties are wine varieties, the content of accumulated sugar and total acids in the grape juice is of great importance. The percentage of alcohol produced in the wine during alcoholic fermentation depends on the sugar content, while the total acids, expressed as tartaric acid, contribute to the freshness of the wine. A low content results in wines that taste bland, while a high content has a negative effect on how aromas are expressed.

The sugar content of the grape juice obtained from the Ferdinand de Lesseps variety was 88.0°Oe, i.e., 20.4%, while that of the Muskat ruža variety was 91.4°Oe, i.e., 21.3%. The total acid content in the grape juice of the Ferdinand de Lesseps variety was 7.7 g/l, while that of the Muskat ruža variety was 6.4 g/l. The results of grape juice – must quality are shown in Table 8.

Tab. 8 Grape quality parameters of the Ferdinand de Lesseps and Muskat ruža varieties

Varieties	Sugar content		Total acids content	pH	Glycoacidometric index
	°Oe	%	g/l		
Ferdinand de Lesseps	88.0	20.4	7.7	2.28	2.63
Muskat ruža	91.4	21.3	6.3	3.05	3.38

The physico-chemical analysis of the wine

It can be stated that the values of all parameters of the physico-chemical analysis of the Ferdinand de Lesseps and Muskat ruža wines were within the reference values and in accordance with the literature (Blesić, 2016).

Tab. 9 Results of the physico-chemical analysis of the wines made from the Ferdinand de Lesseps and Muskat ruža varieties

Parameters	Unit	Method	Reference values	Ferdinand de Lesseps	Muskat ruža
Relative density 20/20°C	-	AL-DM-04/a	-	0.9912	0.9897
Real alcohol	%vol	AL-DM-04/b	min 9	13.58	13.94
Total alcohol	%vol	Calculated	-	13.94	14.04
Total extract	g/l	AL-DM-04/c	-	21.6	19.0
Reducing sugar	g/l	AL-DM-02	max 4,0	1.66	1.75
Sugar-free extract	g/l	AL-DM-04/d	min 15,0	20.94	18.24
Total acids	g/l	OIV-MA-EAS313-01	min 3,5	6.15	5.02
Volatile acids	meq/l	SRPS ISO 6632:2003	max 18	4.5	6.5
Total SO2	mg/l	AL-DM-09/b	max 200	79	40
Free SO2	mg/l	AL-DM-09/a	-	8	6
Ashes	g/l	AL-DM-05	min 1,1	1.45	1.71
pH	-	OIV-A31MA-EAS313-15	-	3.29	3.52
Lead (Pb)-AAS	mg/kg	AL-DM-32	max 0,15	<0.1	<0.1
Arsenic (As)-AAS	mg/kg	AL-DM-32	-	<0.01	<0.01
Cadmium (Cd)-AAS	mg/kg	AL-DM-32	-	<0.01	<0.01
Zinc (Zn)-AAS	mg/kg	AL-DM-32	-	0.61	0.50
Iron (Fe)-AAS	mg/kg	AL-DM-32	-	3.65	1.66
Copper (Cu)-AAS	mg/kg	AL-DM-32	-	0.39	0.17

The Muskat ruža wine had fewer total extracts and sugar-free extracts than the Ferdinand de Lesseps wine (21.6 and 20.94 g/l). Total acids were more pronounced in the Ferdinand de Lesseps wine, while volatile acids were more pronounced in the Muskat ruža wine. There was a significant difference in the total SO2 content, which was 39 mg/l higher in the Ferdinand de Lesseps wine than in the Muskat ruža wine. The results are shown in Table 9.

Sensory evaluation of the Ferdinand de Lesseps and Muskat ruža wine

To carry out sensory evaluation of wine made during a microvinification process, a 20-point scale was used. The wine from the Muskat ruža variety has received a sensory rating of 17 points and thus belongs to the category of quality wines with geographical origin, while the wine from the Ferdinand de Lesseps variety has received a rating of 19 points and thus belongs to the category of high-quality wines with geographical origin.

The Muskat ruža wine had a light pink colour, apricot taste, clean smell, with pronounced floral tones, intense, moderate fullness, and it was harmonious and drinkable, while the Ferdinand de Lesseps wine had a light-yellow colour with hints of green tones, clean smell, and it was fresh, varietal, with pronounced fruity character, moderate fullness, harmonious, drinkable and with good finish. Both wines have specific variety characteristics specific to the locality of the Župa vine growing area. In general, the Ferdinand de Lesseps and Muskat ruža varieties are promising varieties suitable for expansion and further cultivation.

Tab. 10 Score list for sensory evaluation of the Ferdinand de Lesseps and Muskat ruža wines

Character	Ferdinand de Lesseps	Muskat ruža
Colour	2	2
Clarity	1	2
Aroma	8	6
Taste	8	7
Total	19	17

Conclusion

The duration of phenophases was 190 days for the Muskat ruža variety and 186 days for the Ferdinand de Lesseps variety. There was no statistically significant difference between the varieties in terms of the number of inflorescences developed, but there was a difference between them in terms of yield, with the Muskat ruža variety having a higher yield compared to the Ferdinand de Lesseps variety.

When examining the mechanical (ampelographic) properties of bunches and berries, it was found that the Muskat Ruža variety had a higher number of berries per bunch, average bunch weight, higher average bunch length, a higher number of seeds per 100 berries, a higher proportion of bunches, a higher proportion of seeds and a higher bunch skeleton, proportion of seeds and bunch skeleton compared to the Ferdinand de Lesseps variety, which had higher average bunch mass, average bunch width and length, average berry width, the

mass of 100 berries, the mass of skins in 100 berries, the mass of seeds in 100 berries, the mass of 100 seeds, and the proportion of mesocarp in a bunch.

In terms of qualitative parameters, the Muskat ruža variety had a higher sugar content than the Ferdinand de Lesseps variety, while the total acid of the Ferdinand de Lesseps variety was higher than that of the Muskat ruža variety. Based on the sugar and acid content in the grape juice, it can be concluded that both varieties meet the standards for quality wine production.

As far as the physico-chemical analysis of the wine is concerned, the Muskat ruža variety had a lower acid and a higher alcohol content in the wine compared to the Ferdinand de Lesseps variety. The wine made from the Ferdinand de Lesseps variety received a sensory score of 19 points, while the Muskat ruža variety received 17 points, establishing them as top-quality wines with geographical origin. It can be stated that both varieties have their varietal characteristics, from which conclusions can be drawn about varietal differences.

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Технолошке и енолошке карактеристике винских сорти *Ferdinand de Lesseps* и Мускат ружа

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Сажетак

Циљ рада је да се, по први пут, прикажу упоредни резултати истраживања за сорте Ferdinand de Leseps и Мускат ружа. Обе сорте су гајене у условима Жупског виногорја, Србија. Истраживање је обухватило фенолошка осматрања, утврђивање приноса, механичких (ампелографских) карактеристика грозда и бобица, квалитативних параметара грожђаног сока-шире, као и физичко-хемијску анализу и сензорну оцену вина. За сорту Мускат ружа утврђен је каснији датум почетка фенофазе сузења, цветања и пораста бобица, док је сорта Ferdinand de Leseps касније ушла у фенофазу бубрења окаца и интезивног развоја ластара и пораста цвасти. Такође, сорта Мускат ружа се одликовала већом родношћу са 9,2 просечно развијенијих родних ластара по чокоту у односу на сорту Ferdinand de Lesseps која је развијала просечно 7,4 родних ластара. На основу механичких (ампелографских) карактеристика грозда и бобица, утврђено је да сорта Мускат ружа имала је веће вредности за следеће параметре: број развијених бобица у грозду, просечну масу шепурине и дужину грозда, број семена у 100 бобица и процентуални удео шепурине у грозду, покожице и семенки у бобици и скелет грожђа. С друге стране, сорта Ferdinand de Leseps истицала се већим вредностима за просечну масу грозда и свих бобица у грозду, просечну ширину бобице, масу 100 бобица, масу покожица у 100 бобица, масу 100 семена и учешће мезокарп у грозду. Већи садржај шећера (21,3%) утврђен је у грожђаном соку сорте Мускат ружа у односу на сорту Ferdinand de Leseps (20,4%). Што се тиче физичко-хемијске анализе вина, вино обе сорте испуњава критеријуме за производњу вина са заштићеним географским пореклом и одликовала су се својим типичним сортним карактеристикама. Вино сорте Ferdinand de Leseps сензорно је оцењена са 19 поена, док је сорта Мускат ружа оцењена са 17 поена.

Кључне ријечи: Ferdinand de Leseps, Мускат ружа, ампелографске карактеристике, грожђе, вино

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