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CHARACTERISTICS AND QUALITY OF GRAPES AND WINES OF THE VRANAC VARIETY

Abstract: Vranac (synonyms: vranac, crmnički vranac, crnogorski vranac) is an autochthonous Montenegrin grapevine variety and belongs to the ecological and geographical group Proles pontica (Convarietas pontica). Vine of Vranac is vigorous, hermaphrodite flower, medium-sized berry, oblong, thin skin, blue colour with plenty of ash. The cluster is cylindrical, medium-sized, rarely redundant, weighing 160 to 250 g. Grape ripens in the III epoch (late variety). To obtain a good yield, the vines should be cultivated with perfectly sunny positions and in warm, extensively-gravelly land, in a permeable, moderately fertile soil. The wine of this variety is pleasant, harmonious, with a specific variety flavor and taste, alcohol content 11–14% and 5–6 g/l acids. It is also recognizable by its intense color. Due to its quality characteristics, it is ideal for blend with other varieties wines. Today, Vranac is the leading grapevine variety for the production of red (black) wines in Montenegro.

Respecting the tradition company Plantaze grows Vranac for more than 50 years. About 70% of the vineyard is planted with the Vranac variety, whose wine has become a national brand and at the same time the most recognizable and best product of the company "13. jul — Plantaže". Vineyard of the Ćemovsko polje, is planted on shallow, skeletal lands, sunny with over 2,500 hours of sunshine annually, give a premium quality grape with a consistent sugar and acid ratio, that with the modern processing technology, gives superior wine. Respecting and nurturing the tradition in Montenegro, Plantaze adopt new, modern production technologies in order to preserve and improve the products quality, and specially wines produced from the Vranac variety. Vranac wine is powerful wine of the south, dark red color, rich in taste, rich in alcohol and extract and it is highly recognizable and valued. Its aromas and taste resembles ripe sour cherries and savory tones that leave the subsequent taste of fullness and warmth. It is pleasant astringency with great aging and maturation possibility. Thanks to the rich oenological potential of the Vranac variety, it is possible to create multiprofiles and styles of Vranac wines.

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Grape processing according to the most up-to-date methods, produces superior quality wines. Plantaze today, from the Vranac variety, produces the following wines: *Vrhunski Vranac, Vranac Pro Corde, Vranac Barrique, Vranac Reserve, Premier, Vranac Old Cellar, Medun*. All these wines are served at a temperature of 18–20 °C, except for the *Vrhunski Vranac*, which may be cooler for few degrees. They are recommended with all the meals of red meat, spicy and greasy, with all the game, prosciutto, as well as with all the fatty cheeses of a stronger aromas. *Vranac Reserve* and *Medun* are also served with cakes.

Wines produced from Vranac grape won the highest recognitions in various world competition. In addition, the Vranac wine is exported to over 40 countries worldwide.

Key words: *Vranac, wine, Montenegro, autochthonous grapevine variety*

INTRODUCTION

The Vranac variety is the most significant autochthonous grape variety in Montenegro, a variety from which wines are produced that represent a national brand and are at the same time the most representative and the best product of the company "13. jul — Plantaže". Numerous awards and recognitions at international evaluations are an indicator of the quality of Vranac wines, which at the same time promote Montenegro as a significant wine destination, making it a small country of great wines.

Vranac, an old Montenegrin autochthonous variety, has been studied by many authors [1–4]. Ulićević [4] gave a detailed description of the Vranac variety, stating the synonyms of the variety: including Vranac Crmnički, Crmnička loza, as well as that the variety was named because of the black color of the ripe berry. Also, the author states that during the First World War, Vranac was widespread only in Crmnica, from which it later began to be grown in other winegrowing regions throughout Montenegro. The Vranac variety was later transferred to Macedonia during the 1950s [5]. Bearing in mind the importance of the Vranac variety, a number of studies have been done in the last decade to identify the origin of the variety [6–9], then to improve the quality of the grapes [10, 11], as well as the wine itself [12–22].

The purpose of this paper is to analyse the quality of grapes of the Vranac variety and to describe the wines of this variety which it best demonstrated its oenological potential. The paper includes an ampelographic description of the Vranac variety, followed by a description of the production of Vranac wines and a description of their sensory characteristics.

MATERIALS AND METHODS

Ampelographic data of Vranac variety will be presented on the basis of a literature survey. Basic chemical parameters of quality of must (sugar content (%), pH of total acids (g/L)) and wine (alcohol (vol%), pH, reducing sugars

(g/L), total extract (g/L), total acids (g/L), volatile acids (g/L), free and total SO_2 (mg/L)) were determined in accordance with European Union regulations (EC) 606/09 [23]. The content of total polyphenols (g/L) was determined by the Folin-Ciocalteu index method [24] and total anthocyanins (mg/L) were determined using the pH differential method [25].

Vineyards of the Vranac variety are located in Ćemovsko polje, and 70% of the total vineyards are under the plantations of this variety. The altitude of the vineyards varies between 45 and 70 m, influenced by the Adriatic and moderately continental climate and highly skeletal soil. The grapes are harvested by hand or by machine, depending on the type of wine for which it was intended. Alcoholic fermentation is inoculated with selected dry yeasts (mainly Saccharomyces cerevisiae) and takes place under controlled conditions (T = 20–28 °C) in fermenters with capacity of 800 hl, 202 hl and in oak barrels of 100 hl. Malolactic fermentation (silent fermentation) is carried out completely spontaneously or with inoculation with selective lactic acid bacteria (Oenococcus oeni) at a temperature of 20°C. Care and storage of the wine takes place in stainless steel vessels and/or in oak barrels, barrique barrels, all depending on the type of wine. During this process, a regular sensory and laboratory control of the health of the wine is performed, on the basis of which further actions are determined. After aging, a standardization is performed whereby two or more wines are mixed in a specific relationship to create wines with the characteristics desired. Then, depending on the degree of turbidity of the wine, rough, medium and/or fine filtration is performed. Filtered wine is prepared for bottling after the addition of appropriate oenological agents. Bottling of wine is done by passing through the microfiltration process after transfer to the bottle, after which it is filled into bottles which are closed with a suitable stopper.

RESULTS AND DISCUSSION

CHARACTERISTICS AND QUALITY OF GRAPES OF THE VRANAC VARIETY

Table 1 presents an ampelographic description of the Vranac variety using 26 OIV codes [9]. From the table it can be seen that the sugar content of grapes of the Vranac variety is very high about 24% and more, with a slightly lower content of total acids (6 g/L) and a high pH in the broad, which is in accordance with the values obtained in the author's research Kosmerl [12]. The cluster is cylindrical-conical in shape, very density with oval-shaped berries of medium firmness and a dark-black skin. In addition, Milosavljević [26] states that the Vranac vine is lush, the flower is hermaphroditic, the berry is

medium in size, oblong, the skin is thin, blue with abundant ash. For good yield, the vines should be grown in well-sunny locations and on warm, loose gravel, permeable, moderately fertile soils [26].

Table 1. Ampelographic description of Vranac variety using 26 OIV codes [9]

Number of OIV code	Description of OIV code	Ampleographic description of Vranac variety
3	Young shoot: intensity of anthocyanin coloration on prostrate hairs of the shoot tip	3
4	Young shoot: density of prostrate hairs on the shoot tip	5
51	Young leaf: color of upper side of blade (fourth leaf)	3
53	Young leaf: density of prostrate hairs between main veins on lower side of blade (fourth leaf)	5
67	Mature leaf: shape of blade	3
68	Mature leaf: number of lobes	3
70	Mature leaf: area of anthocyanin coloration of main veins on the upper side of blade	1
76	Mature leaf: shape of teeth	2
79	Mature leaf: degree of opening/overlapping of petiole sinus	7
80	Mature leaf: shape of base of petiole sinus	1
84	Mature leaf: density of prostrate hairs between main veins on lower side of blade	5
87	Mature leaf: density of erect hairs on main veins on lower side of blade	3
151	Flower: sexual organs	3
155	Shoot: fertility of basal buds	5
202	Bunch: length (peduncle excluded)	7
204	Bunch: density	7
206	Bunch: length of peduncle of primary bunch	1
208	Bunch: shape	2
220	Berry: length	3–5
223	Berry: shape	2
225	Berry: color of skin	6
235	Berry: firmness of flesh	2
236	Berry: particular flavor	1
505	Sugar content of must (°Oe)	9
506	Total acidity of must (g/L)	3
508	Must specific pH	7

CHARACTERISTICS AND QUALITY OF VRANAC WINE

Vranac, using modern technologies in the cellars of the company "13. jul — Plantaže" gave a wide pallet of wines that, with their sensory characteristics,

stood out in numerous international wine evaluations. The pallet of wines produced exclusively (100%) of the Vranac variety includes *Vrhunski Vranac, Vranac Pro Corde, Vranac Barrique, Vranac Reserve, Premijer, Vranac Stari Podrum* and *Medun*.

Wine *Vranac Vrhunski* is produced from grapes with a yield of 8–10 t/ha, harvesting is manual and takes place in September. Alcoholic fermentation is carried out in stainless steel fermenters, with a controlled T of 23–25 °C, with an average duration of 8–10 days. Malolactic fermentation takes place spontaneously, without the addition of lactic acid bacteria and the wine is then aged in a stainless steel vessel for up to two years. The wine is an intense ruby red color. Fragrant aroma of small berries, blackberries and blueberries, with discrete dry spices. On the palate, the wine is fruity with a dominant blackberry aroma, harmonious acidity and moderate tannic structure.

Table 2 presents the chemical parameters of five different vessels of wine *Vrhunski Vranac* from vintage 2017 in the phase after the end of the malolactic fermentation. Wine *Vrhnuski Vranac* from vintage 2017 has a high alcohol content, ranging from 12.87 to 14.26 vol%, with total acids from 5.71 to 7.54 g/L. Also high in total polyphenols, averaging 3.08 g/L and total anthocyanins averaging 826.4 mg/L. More recently, Pajović-Šćepanović [22] reported slightly lower average content of total polyphenols, as expected in bottled Vranac wines, from nine different locations in Montenegro and from three harvests (2008–2010); whereby the content of total polyphenols in this study varied from 2.00 g/L in vintage 2010 to 2.12 g/L in vintage 2008. Also, the total anthocyanin content of bottled products is expected to be lower and range from an average of 446 mg/L in 2010 to 516 mg/L in 2008 [22]. In addition, Mitić [27] studied the content of total polyphenols and the antioxidant potential of Vranac wines from the Balkans, and in the researches of this author, wine *Vrhunski Vranac* from vintage 2009, company "13. jul — Plantaže" achieved the highest content of total polyphenols i. e. 3.94 g/L, compared to eight other Vranac wines.

Table 2. Chemical parameters of wine *Vrhunski Vranac*, vintage 2017, after malolactic fermentation

Chemical parameters	Vrhunski Vranac				
	vessel 1	vessel 2	vessel 3	vessel 4	vessel 5
Alcohol (vol %)	14.26	13.30	13.37	13.80	12.87
Total acids (g/L)	7.54	6.13	5.71	6.93	6.40
pH	3.49	3.63	3.47	3.45	3.66
Volatile acids (g/L)	0.60	0.55	0.55	0.45	0.30
Total polyphenols (g/L)	3.32	2.97	3.42	3.15	2.55
Total anthocyanins (mg/L)	999	797	710	848	778

Wine *Vranac Pro Corde* is the result of seven years of research and dozens of different micro and macro experiments. In the process of wine *Pro Corde* production, it is present naturally increases the amount of bioactive substances proanthocyanidins, which is known as a powerful antioxidant and has a beneficial effect on the human body. The grape yield is 7–8 t/ha, the harvest is manual and takes place in September. Alcoholic fermentation is carried out in stainless steel fermenters, with a controlled T of 25–27 °C, with an average length of 10–12 days. Malolactic fermentation is carried out with co-inoculation at the start of alcoholic fermentation with the addition of lactic acid bacteria. The wine is aged for three years, with 35% aging in French oak barrels and 65% in stainless steel tanks. Wine has deep dark ruby red colour. The aroma of pronounced fruity aroma dominated by blackberries and cherries. Well balanced wine with noticeable tannins that are well matched to the tones of ripe red fruit. The wine is tight body, full and long-lasting. Table 3 presents the chemical parameters from eight different vessels of *Pro Corde* wine from the 2017 vintage at the stage after the completion of the malolactic fermentation. Compared to wine *Vrhunski Vranac*, *Pro Corde* wine has a higher alcohol content that varies from 13.81 to 14.53 vol%. The average content of total polyphenols (3.11 g/L) and total anthocyanins (954 mg/L) is also higher than that of *Vrhunski Vranac* wine. On the contrary, Mitić [27] reported a slightly lower content of total polyphenols (3.85 g/L) in *Pro Corde* wine from vintage 2009, compared to *Vrhunski Vranac* from vintage 2009 (3.94 g/L).

Table 3. Chemical parameters of wine *Vranac Pro Corde*, vintage 2017, after malolactic fermentation

Chemical parameters	Pro Corde							
	vessel 1	vessel 2	vessel 3	vessel 4	vessel 5	vessel 6	vessel 7	vessel 8
Alcohol (vol %)	13.81	14.30	14.31	14.10	14.26	13.95	14.11	14.53
Total acids (g/L)	7.10	6.56	6.80	6.82	6.83	6.22	6.60	6.45
pH	3.45	3.52	3.48	3.48	3.49	3.65	3.61	3.50
Volatile acids (g/L)	0.50	0.60	0.60	0.60	0.50	0.55	0.55	0.55
Total polyphenols (g/L)	3.21	2.86	3.25	3.23	3.09	3.44	2.58	3.18
Total anthocyanins (mg/L)	978	995	912	890	942	1118	906	891

Vranac Barrique is produced from grapes with a yield of 6–8 t/ha. The harvesting is also manual and takes place in the second half of September. Alcoholic fermentation carried out in stainless steel fermenters, with a controlled T of 25–27 °C, with a slightly longer average length of 12–14 days.

After the alcoholic fermentation is complete, the malolactic fermentation is inoculated with lactic acid bacteria and take place in barrique barrels. The wine is aged for three years, with one year in barrique barrels (80% French and 20% American oak), one year in stainless steel and then a year in the bottle. The wine is a dark ruby red colour with purple hues, a multi-layered aroma of black fruit, black currant, blackberry backed with tons of chocolate, caramel and dessert. Flavor complex, full of fruity tones of cherry, plum, creamy chocolate and caramel. Extractive, with an intense finish and well integrated oak.

Vranac Reserve is a wine that is produced only in the best vintages. Yield is also lower than 6–8 t/ha, harvesting is manual and takes place in the second half of September. Alcoholic fermentation carried out in stainless steel fermenters, with a controlled T of 25–27 °C, with an average duration of 12–14 days. After the alcoholic fermentation is complete, the malolactic fermentation is inoculated with lactic acid bacteria and takes place in wooden vessels. After aging in wooden vessels (3 years) and aging in a bottle (2 years), the wine develops its full, characteristic and very distinctive bouquet. The wine is dark, ruby red. It smells of ripe and very intense aromas of forest fruits. The taste of the wine is very rich, warm and ripe, with dominant jam notes of forest fruit, laced with aromas of coffee, tobacco, sweet vanilla and dried figs. Impressive, long, strong and pleasant finish.

Wine *Premijer* represents the chosen cuvee of the best Vranac wine reserves from the cellar of the company "13. jul — Plantaže". As with *Vranca Reserve* and *Vranac Barrique*, the yield is 6–8 t/ha, harvesting is manual and takes place in the second half of September. Alcoholic fermentation takes place in stainless steel fermenters, with a controlled T of 25–27 °C and an average duration of 12–14 days. When alcoholic fermentation is complete, malolactic fermentation is initiated by lactic acid bacteria and takes place in wooden vessels. The wine has matured for seven years, i. e. four years in oak barrels and three years in a bottle. The wine is deep purple in red, with a distinct purple glare on the rim. A layered, complex and developed aroma of black forest berries, topped by sweet layers of licorice and black chocolate. The palate is strong, full and jam-like, with dominant aromas of blueberries, blackberries and prunes. *Premijer* is a powerful wine of sumptuous tannins, vitally acids, great harmony and extractiveness. The finish is extremely long and has a fruity and spicy aroma. Developed and rich in bouquet, patina character, richness and refinement of taste and aroma give it a special charm.

Vranac Stari Podrum was created in 2011, in the vintage that gave the best wines and represents the golden vintage in the last twenty years. Extremely favorable climatic conditions this year resulted in significantly lower grape yield and exceptional quality. During the period of grapes ripening,

Table 4. Chemical parameters of bottled Vranac wine products

Chemical parameters	WINE / Vintage						
	Vrhunski Vranac	Vranac Pro Corde	Vranac Barrique	Vranac Reserve	Vranac Premijer	Stari Podrum Vranac	Medun
	2016	2016	2013	2013	2011	2013	2015
Alcohol (vol %)	13.00	13.90	14.90	14.35	15.00	15.23	15.90
Total extract (g/L)	22.90	27.90	31.50	25.50	31.50	27.60	98.50
Reducing sugar (g/L)	2.87	2.11	3.29	3.83	3.16	2.80	64.06
Titratable acids (g/L)	5.25	5.25	6.60	6.15	6.22	5.92	6.45
Volatile acids (g/L)	0.68	0.62	1.05	0.95	1.18	1.04	0.95
Total SO_2 (mg/L)	81.45	71.04	107.52	129.28	143.5	155.14	109.88
pH	3.45	3.42	3.32	3.41	3.60	3.36	3.41

the berries were dried on the grapevines, which contributed to the exceptional concentration and richness of the luxurious aromas, polyphenols and colored substances that have been turned into wine by modern technology. Grape harvesting is manual and takes place at the end of September, with a yield of 4–5 t/ha. Alcoholic fermentation carried out in stainless steel fermenters, with a constant temperature of 26–28 °C and lasts longer i. e. up to 18 days. When alcoholic fermentation is complete, malolactic fermentation is initiated by lactic acid bacteria and takes place in wooden vessels. The wine is aged for four years, one year in oak barrique barrels, then two years in oak barrels and one year in a bottle. The wine is a color of black ripe cherry with a purple glow. It is characterized by intense aromas of prunes, cherries and licorice, well balanced with spicy notes that give it class and complexity.

Medun is a naturally sweet wine, produced from partially dried grapes of the Vranac variety of late harvest and in strictly limited quantities. The yield of grapes used for the production of *Medun* is as high as 3.5 t/ha, harvesting is manual and takes place in October. Alcoholic fermentation carried out in stainless steel fermenters at a constant temperature of 27–28 °C. After the alcoholic fermentation is completed, the wine, without silent fermentation, is aged in French oak barrels for up to three years. The wine is a dark ruby red color, of exceptional fullness, rounded and very rich bouquet, in which intertwine the aromas and flavors of chocolate, coffee, dried cherries, figs and dried black grapes. It has a very striking and warm chocolate finish.

Table 4 presents the chemical parameters of bottled products of variety Vranac. Based on the results obtained, it can be concluded that Vranac wines have a high alcohol content on average of 14.61 vol%. In addition, all wines

of the variety Vranac are dry, i. e. contain less than 4 g/L of reducing sugars other than *Medun*, a naturally sweet wine containing a minimum of 50 g/L of reducing sugars. As can be seen, *Medun* from the harvest 2015 has 64.06 g/L of reducing sugars, the highest alcohol content (15.90%) and, as expected, the highest total extract content (98.50 g/L). The lowest alcohol content, as well as the lowest total extract content, was determined in the wine *Vrhunski Vranac* from vintage 2016.

CONCLUSION

Based on the literature review and the presented results, it can be concluded that the Montenegrin autochthonous variety Vranac, which is grown in agro-ecological conditions of Ćemovsko Polje, produces wines that have enormous oenological potential both for maturation in stainless steel tanks and in contact with oak. The sensory characteristics as well as the chemical parameters of the obtained wines confirm the fact that Vranac varieties grown in Montenegrin vineyards give the best expression of its varietal characteristics both in terms of grape quality and quality of wine, which is recognized at all world evaluations wines and exported to more than 40 countries.

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KARAKTERISTIKE I KVALITET GROŽĐA I VINA SORTE VRANAC

Sažetak

Vranac (sinonimi: vranac, crmnički vranac, crnogorski vranac) je autohtona crnogorska sorta i pripada ekološko-geografskoj grupi *proles pontica (convarietas pontica*). Čokot vranca je bujan, cvijet hermafroditan, bobica je srednje veličine, duguljasta, pokožica tanka, plave boje sa obilnim pepeljkom. Grozd je cilindričan, srednje zbijen, rijetko rehuljav, mase od 160 do 250 g. Grožđe sazrijeva u III epohi (pozna sorta). Za dobijanje kvalitetnog prinosa, lozu treba gajiti na dobro osunčanim položajima i na toplim, rastresito-šljunkovitim zemljištima, propusnim, umjereno plodnim. Vino ove sorte je prijatno, harmonično, specifičnog sortnog mirisa i ukusa sa udjelom od 11 do 14% alkohola i 5–6 g/L kisjelina. Prepoznatljivo je i po intenzivnoj boji. Zbog svojih kvalitetnih osobina idealno je i za kupažu sa vinima drugih sorti.

Vranac je danas vodeća sorta vinove loze za proizvodnju crvenih (crnih) vina u Crnoj Gori. Poštujući tradiciju, „Plantaže" više od 50 godina gaje vranac. Oko 70% vinograda je podignuto sa sortom vranac, čije je vino postalo nacionalni brend i ujedno najprepoznatljiviji i najbolji proizvod kompanije „13 jul — Plantaže". Vinogradi Ćemovskog polja, podignuti na plitkim, skeletnim zemljištima, osunčani sa preko 2500 sati sunca godišnje, daju grožđe vrhunskog kvaliteta sa skladnim odnosom šećera i kisjelina, koje se uz savremenu tehnologiju prerade pretače u vrhunsko vino.

Poštujući i njegujući tradiciju u Crnoj Gori, „Plantaže" usvajaju nove, savremene tehnologije proizvodnje kako bi očuvale i unaprijedile kvalitet svojih proizvoda, a posebno vina proizvedenih od sorte vranac. Vino vranac je moćno i snažno vino juga, tamnocrvene boje, na ukusu puno, bogato alkoholom i ekstraktom, što ga čini vrlo prepoznatljivim i visoko cijenjenim. Svojim aromama i ukusom podsjeća na zrele višnje i šumsko voće sa vanilskim tonovima koji ostavljaju naknadni ukus punoće i topline. Prijatne je oporosti koja mu daje mogućnost odležavanja i sazrijevanja. Zahvaljujući bogatom enološkom potencijalu sorte vranac, moguće je kreirati više profila i stilova vina vranac.

Preradom grožđa po najsavremenijim metodama, od dobrog se grožđa proizvodi vrhunsko vino. „Plantaže" danas, od sorte vranac, proizvode sljedeća vina: „Vrhunski vranac", vranac „Pro Corde", vranac „Barrique", vranac „Reserve", „Premijer", „Stari podrum", „Medun". Sva ova vina se služe na temperaturi od 18 do 20 °C, sem „Vrhunskog vranca", koji može biti hladniji par stepeni. Preporučuju se uz sva jela od crvenog mesa, začinjena i masnija, uz svu divljač, pršut, kao i uz sve masne sireve jačeg, izraženog mirisa. Vranac „Reserve" i „Medun" se pak odlično slažu i uz kolače.

Vina od grožđa sorte vranac dobijaju najveća priznanja u ozbiljnoj, svjetskoj konkurenciji. Inače, vino vranac se izvozi u preko 40 zemalja svijeta.

Ključne riječi: vranac, vino, Crna Gora, autohtona sorta vinove loze