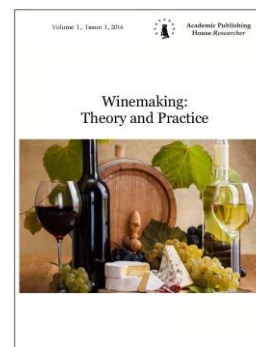




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## Articles

### Production of Red Table Wines as the Sorts of Local Grapes

Movlud Arastun Huseynov <sup>a, \*</sup>

<sup>a</sup> Azerbaijan Scientific Research Institute of Viticulture and Winemaking, Baku, Azerbaijan

#### Abstract

The study of the mechanical and chemical composition of local and locally adapted red grape varieties chosen for the preparation of high-quality red table wines has shown that, depending on agrotechnical activities, territory, climate variability and other conditions, even in the technically maturing phase, small and large values of such parameters are possible, As titratable acidity and sugar content. In view of this, it becomes necessary to regulate the chemical composition of the grape must obtained in these conditions in accordance with the chosen technology.

Scientifically substantiated and defined the direction of improving the technology of cooking natural red wine using Mattress, as the main variety. The possibility of using other grape with red berries grown in Azerbaijan along with the grape of Matras is also indicated. A model has been developed that reflects the dynamics of the anthocyanin complex and the intensity of the color of the wine that is subject to prolonged heat treatment in the presence of atmospheric air.

**Keywords:** wine, red wine, grape, hybrid, quality, physico-chemical and sensor analysis.

#### 1. Introduction

The richness of various grape genotypes of Azerbaijan Republic, the favorable condition of the country's soil-climate for vineyard, as well as, the variety of physical-chemical composition of grapes grown in this country create a suitable basis and possibility for production of high quality wines of all kinds with a wide range of high-consumption properties, rich bouquet, delicate flavor, full color, and harmonic properties (Guseinov et al., 2018; Laura et al., 2014; Lorenzis et al., 2015; Maghradze et al., 2015; Maul et al., 2015).

The Viticulture has the wide industrial characteristic possessing special weight among the spheres of agriculture yet from ancient times in Azerbaijan, the grape were grown and wine were produced here always. Today the Viticulture is also considered on the priority spheres by the point of increasing the country's economy. In recent years, the numbers of local selection sorts have increased in the volume of total product's growing. That is why, their technological compliance is required in preparing of the table wines from these sorts. In other words, conduction of research towards the investigation of grape, material of wine and chemical composition of wine, selection of sorts creating the opportunity for getting the product which is more qualitative and sustainable for the competition, improvement of processing technology of grape are required. In relations with

\* Corresponding author

E-mail addresses: [movludh@mail.ru](mailto:movludh@mail.ru) (M.A. Huseynov)

this, red table wines require special attention which is rich for its natural substances, especially with different prostanoid substances, vitamins, minerals and possessing functional importance with other components. From this point of view, one of the problems is extraction color and phenol substances in an optimal amount from the grape in processing the wine by red method. The phenol compounds in grape actually combine on the cover of the nipple, in seeds and in other hard structure elements of cluster. There are some issues which were not settled in this sphere though different methods were applied for strengthening of extraction of these units in practice.

## 2. Material and methods

The main purpose in research work is improvement of technological parameters of preparation of high-quality red table wines from grape sorts grown in Azerbaijan (Perez-Magarino, Gonzalez-Sandoze, 2006; Panahov, 2015; Salimov et al., 2018; Salimov et al., 2020).

Local, introduced and hybrid grape sorts grown in Azerbaijan (Matrasa, Tavkveri, Khindogni, Kaverne-Sovninyon, Izabella, Saperavi), the wine material prepared from them and wines were taken as the object of research.

Local red grape sorts providing to obtain juices and wine blending material possessing any color of intensity in the result of research were chosen. It was defined that the dependence of temperature of the quantity of anthocyanins in wine in affect of air is expressed with the kinetic model of reaction at first. The parameters of anthocyanin composition of local Matrasa grape sort were studied, the chemical structure formula of pigment in the form of 3-O-P-O glucyloxy – 4, 5, 7-trihydroxy – 3, 5-dimethoxy flavilium chloride was defined. The improved alternative of production technology of natural red table wine by using local technical red grape sorts grown in soil-climate condition of Azerbaijan were worked out, its physico-chemical properties, technological peculiarities were studied and its quality was assessed by degustation. The maximum term of working with heat without losing the color of wine's material obtained in the result of research was defined. The pasteurization of bruise and positive effect of fermenting within 8 days were defined experimentally.

Appropriate technological documents were compiled by us and the production of high-quality red table wine by industrial method in "ASPI AGRO" LLC company situated in Gabala city on the basis of suggestions and recommendations submitted to the production was organized.

Short description of selected grape sorts (Amanov et al., 2012; Pipia et al., 2012; Salimov et al., 2015).

Matrasa sort. It is most ancient, most precious sort of Azerbaijan. The size of leaves is average (length is 17...21 cm, width is 16...20 cm), it has round form and it is 5 slices. The thickness of its peel is average, its surface is covered with the layer of wax. The flesh is juicy. It has 1-2 seed in its nipple. It grows up in the middle period. Vegetation period is 145 days. It is selected with its tolerance (3-3,5 points) against oidium and anthracnose disease in Absheron condition, its sustainability against brown rot disease (2 points). It is high productive sort.

Sugariness in its nipples is 19,0 g/100 cm<sup>3</sup>, the titratable acidity is 4,8 g/dm<sup>3</sup>. The product of Matrasa sort is fully available for obtaining high-quality red table wines and wines of dessert type (cagor). It is grown up in most regions of the Republic by regionizing (Irrigated lowlands along Kur, Shirvan–Garabagh irrigated lowlands, Foothill steppe, Low mountainous and shaki – Zagatala regions).

Khindogni sort is ancient local technical grape sort of Azerbaijan. Its leaves in round form with 5 slices. Its flower is bisexual. The color of nipple is dark blue, or black, and its form is circular. Its peel is thin, the flesh is juicy. Its wine is red. There are 2-4 pieces of seed in its nipple. Its sort ripens tardy. The vegetation period continues 155 days. The leaves of sort are tolerance (3-3,5 points) against oidium disease and its clusters are very unstable (5 points). The sort is unstable against anthracnose disease (4-4,5 points) and it is tolerance against brown rot disease (3-3,5 points). It has 18,7 g/100 cm<sup>3</sup> sugariness in its nipples, the titratable acidity is 5,27 g/dm<sup>3</sup>. The sort is precious source for obtaining high-quality red table wines.

The country of Izabella sort is North America. It is considered natural hybrid of *V. Labruska* L. and *V. vinifera* L. types. This sort is included to the sort standards of Azerbaijan. Its leaves are in round form, with 3 slices. Its nipples are circular, they are black or dark brown (brown). Its peel thick and strong, its surface is covered with the layer of wax. The flesh is juicy. Its nipple has 1-4 seeds. Its sort ripens tardy the vegetation period continues 172 days. The sort is selected for its

sustainability against oidium, anthracnose and brown rot disease (2-2,5 points). It is high productive sort. The sugariness in its nipple is 18,3 q/100 cm<sup>3</sup>, its titratable acidity is 5,6 g/dm<sup>3</sup>. The sort is a precious material for the production of wines selected for their special taste and smell.

The country of Kaberne-Sovinyon sort is France and it was grown up in Azerbaijan since the end of 19<sup>th</sup> century. Its flower is bisexual. Its clusters in average size (length 12...16 cm, width 7...9 cm), cylindrical-conical, in middle density. Its nipples are in average size (length 13...16 mm, width 12...16 mm), form is round, its color is dark-blue. Its surface is covered with the layer of wax. The peel is thick, the flesh is juicy. The sort is middle and ripens tardy. Its vegetation period continues 155-160 days in the condition of Absheron. It shows tolerancy against oidium and brown rot disease (3-3,5 points). The cluster weakly spreads with its list. It is high productive sort. The sugariness in its nipple is 19,2-21,2 q/100 cm<sup>3</sup>, its titratable acidity changes between 5,6-7,2 g/dm<sup>3</sup>. The sort is a precious source for obtaining high-quality wines, champagne materials. Wide spreading is observed in layout and foothills of our Republic.

Saperavi is local grape sort of Georgia and it is grown up in our Republic for a long years. The sort belongs to the group of Black Sea basin (convar pontica Negr.). its flower is bisexual. Its clusters are in average size, are conical. Its nipples are oval, dark-blue, it is covered with the layer of wax. Its peel is relatively mild. Its juice is weak pink. Its sort ripens tardy. The vegetation period continues among 155-162 days. It is high productive sort. The sugariness in its nipples 18,2-22,6 g/100 cm<sup>3</sup>, the titratable acidity changes among 5,26-7,46 g/dm<sup>3</sup>. The product of sort is precious material for obtaining high-quality table, desert and dark wines.

Tavkveri sort is local grape sort of Georgia and it has been grown up in Azerbaijan for a long years. It belongs to Eastern technical sorts subgroup (convar orientalis subconvar caspica Negr.). Its nipples are in middle size (length 14...16mm, width 13...15mm), round form. It is dark blue. The nipple has 2-3 seeds. Its sort ripens tardy. The vegetation period continues 160 days. It is high productive sort. The juice extraction is 85,7 %, sugariness is 17,9 g/100 cm<sup>3</sup>, titratable acidity is 4,87 g/dm<sup>3</sup>, the general humidity is 74,8 %, dry substance 25,2 %, ashes is 5,56 % for total mass of its clusters. The sort is a precious materials for table, desert wines and for the production of grape juice.

The most important indicators for preparation of wine in studying the chemical composition of juice obtained from grape, also, titratable acidity with the account of wine acid, the mass concentration of sugar were defined (Tables 1, 2).

It was defined in the result of research that there is need to regulate of this indicator to prepare high-quality wine because of the average price of mass concentration of sugar is low in juice obtained from quickly ripened red sorts. The blend with other red grape sorts (specially with Khindogni) of "Matrasa" juice in recommended regulation alternative of titratable acidity is not considered.

**Table 1.** Mass concentration of sugar (g/dm<sup>3</sup>)

Years	Grape					
	Mədrəsə	Khindogni	Izabella	Kaberne-Sovinyon	Saperavi	Tavkveri
2016	146,7±2,3	150,5±1,5	186,8±1,8	158,3±1,6	119,8±0,6	120,8±1,5
2017	132,7±0,8	114,9±0,4	204,1±0,7	175,7±2,4	-	147,3±1,4
2018	130,1±1,5	106,3±0,8	146,1±0,6	-	-	141,2±1,4
2019	118,1±0,5	148,1±1,5	-	-	-	-
Average price	130,0±1,5	135,2±0,8	158,2±0,8	152,3±1,6	122,7±0,7	123,2±1,4

**Table 2.** Mass concentration of acids (g/dm<sup>3</sup>)

Years	Grape					
	Mədrəsə	Khindogni	Izabella	Kaberne-Sovinyon	Saperavi	Tavkveri
2016	4,2±0,1	9,2±0,1	12,2±0,1	13,5±0,2	16,6±0,1	10,9±0,2
2017	4,0±0,2	10,9±0,1	10,7±0,1	13,6±0,4	-	10,1±0,2
2018	6,6±0,3	12,7±0,1	14,7±0,2	-	-	9,1±0,3
2019	4,7±0,2	8,1±0,1	-	-	-	-
Average price	5,1±0,2	9,1±0,1	13,1±0,2	14,2±0,3	16,6±0,2	11,0±0,2

The indicator is glucosidometric indicator representing more effectivity of the juice to prepare the wine. This indicator has more optimal price in “Matrasa” sort. That is why, this sort was preferred as main raw material in the research.

The improved technology of preparation of high-quality red table wine by using “Matrasa” grape and “Khindogni” grape to regulate the titratable acidity was suggested. The description of technological process is as following.

New collected grape is poured to the dosage-nourishing spiral conveyor receiving bunker in required relation of sorts from transport. The raw material is transferred to plunger thinner-dumping from here. Obtained crunch is issued to pasterizator by pump, it worked-out with heat. It worked out here with pectolytic enzyme preparation or ultra-sound if required. Pasterizator was supplied with steam shirts and mixers. Prepared crunch is kept for 1 hour by heating up to 65±2°C. Cooled crunch is issued to vertical vinifier by pump (fermentation by swimming “shapka” method). At the same time, the yeast is issued to vinifier in a calculated amount. The fermentation period is carried out by active mixing (by pump) of fermented environment on periodical scheme. Fermented juice is divided from crunch, two fractions – the wine material and moonshine are obtained. Moonshine is extracted from technological line and it is used for obtaining alcohol. The juice divided from crunch is issued to tank for fermentation up to the end. Stored and partially luminous wine material is transferred to luminating device with bentonit (by ultra-sound effect if required). The fluid on the sediments are decantated, but the sediment is transferred to centrifuge, remaining wine material is divided from sediment. Luminated wine material is filtered from filter-cardboard and it is issued to filter-press. The product is kept in the tank with thermostat provided that not being more than 5±2°C. It is used with the purpose of blend if required. The main anthocyanins of grape contain monoglycosides of malvidin, petunidin, delphinidin, petunidine, in small quantities of acidized monoglycosides of petunidin and malvidin, cyanidine. The composition of anthocyanins depends on the types of grape, of its growing condition. Its color diversity is explained with structural specifications of anthocyanins, creation of complexes possessing K (dark red), Mg, Ca (blue), Ni and Cu (white) and existence of pH environment (Panahov 2015; Panahov 2016).

The existence of anthocyanins in grape depends on the process of photosynthesis. This is defined by the illumination of leaves intensively. That is why, collection of anthocyanins in grape are not in the same order in different sorts, it depends on sort and growing condition. The quantity of coloring substances always increase as grape grows (Perez-Magarino, Gonzalez-Sandoze, 2006; Salimov et al., 2017), it is 2,5...2,8 % compared to the mass of peel of dry nippel with Kaberne-Sovinyon sort. This number is 5-6 % in the peel of Saperavi sort, it is 250...260 mg/dm<sup>3</sup> in the juice of crunch. It should be noted that the dependence between collection of tan in peel and the sugariness of juice were not observed. But the quantity of coloring substances increases by increasing the sugariness. The quantity of anthocyanins decreases in an important degree when the grape grown up fully. Selection of grape sort for the production of natural red sour wine is implemented for their technological composition of colored substances. This becomes 450 mg in 1 kg grape in good sorts. Kaberne-Sovinyon, Saperavi, Merlot, Matrasa, Khindogni, Murverd, Rara Neagra, Magarach lalai and other meet this requirement.

There are phenol compounds with names from 15 to 60 in red wines and these directly effect to the formation of smell and color of wine. The degustation price increases with the increase of concentration of phenol compounds (Perez-Magarino, Gonzalez-Sandoze, 2006). Wine possesses

empty and water taste if these are missing, they possess rough and shocking taste in case if they are over (Salimov, Musayev, 2012).

### 3. Discussion

The expertise was carried out with the modern research methods on wine examples prepared in the result of conducted scientific-research works.

The physico-chemical (Table 5) and sensor analysis of prepared wine materials was conducted on the basis of approved methodology and modern research methods.

The transparency, color, taste, smell (bucket) and typicality of wines by organoleptic methods (Tables 3, 4).

Researched wine materials possessed normal dynamic (from 1105 to 1890 mg/dm<sup>3</sup>) in decreasing of total quantity of phenol compounds. Phenol composition indicators and chromatic characteristics of wine materials are issued in Table 6.

Following methods were applied in increasion of titratable acidity of wine material: adding oxidizing (wine acid E334, citric acid E330, apple acid E296, milk acid E270), blending with wine material obtained from the grape with high acidity. The organoleptic assessment of the effect of acids (wine acid E334, citric acid E330, apple acid E296, milk acid E270) to the taste and color of wine material to define the oxidizing agent for optimal acidity of acidic wine material was conducted (Panahov, 2014; Panahov, 2016). That is why, the certain acids were added to wine material until the acidity will be 7 q/dm<sup>3</sup>. Organoleptic assessment, control and pH of acid added examples are issued in Table 6.

**Table 3.** Organoleptic essence of Wine

Nº	Indicator	Essence
1	Transparency	Transparent, without sediment and additional impurities
2	Color	From dark red to dark pomegranate color
3	Smell	According to sort, without outside shade and acetic acid
4	Taste	Clear, light, fresh, harmonic, according to sort

**Table 4.** Physico-chemical indicators of Matrassa wine materials

Years	Indicator				
	Mass concentration of sugar, g/dm <sup>3</sup>	Mass concentration of acids g/dm <sup>3</sup>	pH	Mass concentration of volatile acids, g/dm <sup>3</sup>	Volume share of Ethyl alcohol, h%
2016	0,9±0,2	3,4±0,1	4,00±0,0 5	0,6±0,1	10,7±0,2
2017	1,2±0,1	3,8±0,1	4,00±0,0 5	0,5±0,1	12,0±0,3
2018	1,2±0,2	3,5±0,1	3,95±0,0 5	0,3±0,1	11,0±0,4
2019	1,1±0,2	3,6±0,1	3,75±0,0 5	0,4±0,1	13,0±0,4

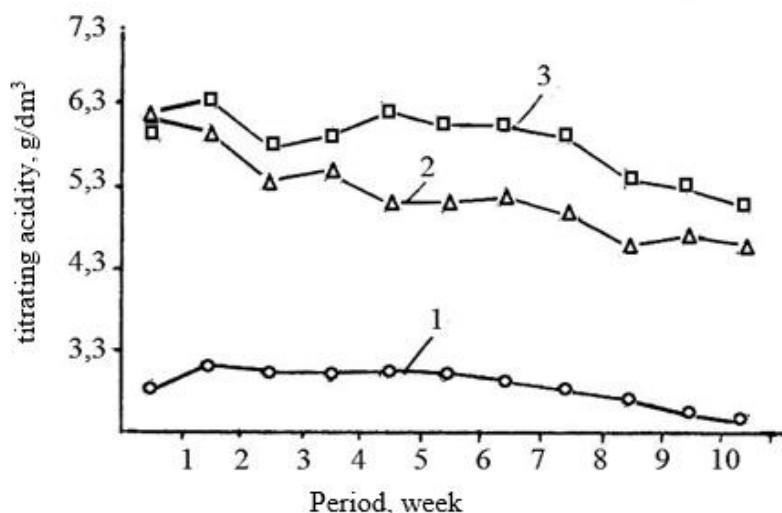
**Table 5.** Phenol and color composition indicators of wine materials prepared from Matrassa grape sort

Years	Idicators									
	Mass concentration of phenol compounds, mg/dm <sup>3</sup>	Quantity of monomer anthocyanins, mg/dm <sup>3</sup>	Mass concentration of colored substances, mg/dm <sup>3</sup>	Maximum of visible area of spectrum (pH 1,0) nm	Color caused by polymers, %	Intensity of color, ( $\bar{I}_{520}$ )	Intensity of color, ( $\bar{I}_s$ )	Total quantity of flavans, mg/dm <sup>3</sup>	Total quantity of flavans, mg/dm <sup>3</sup>	Mass concentration of leuco-anthocyanins, mg/dm <sup>3</sup>
2016	1105±16	18±2	28±2	512±1	63,3±1,2	2,89±0,12	1,83±0,08	-	78±3	124±8
2017	1510±21	50±2	52±3	521±3	47,0±0,4	2,92±0,21	1,37±0,12	-	69±3	360±11
2018	1890±25	173±9	120±8	521±1	43,1±0,5	2,17±0,17	0,98±0,06	-	61±4	315±12
2019	1990±23	170±7	123±6	541±1	42,1±0,5	2,19±0,19	0,99±0,05	-	64±8	365±16

**Table 6.** Organoleptic assessment and pH by adding different acids to Matrassa wine until the acidity will reach to 7 g/dm<sup>3</sup> (by considering wine acid)

Nº	Examples	Color	Taste	pH
1	Control (without adding acid)	Light brown shade with red differ from acid added examples	Not known, empty, pleasant bitterness, acidity is not felt	4,00±0,05
2	By adding citric acid	Red with pink shade	sour, sharp, pleasant bitterness, full	3,65±0,05
3	By adding apple acid	Red with dark pink shade	sharp strong sour, not clear known, no bitterness	3,65±0,05
4	By adding wine acid	Red with pink shade, full	pleasant, sour, full	3,50±0,05
5	By adding milk acid	Red with dark pink shade	Not known, empty, no bitterness, is not sour	3,50±0,05

Following methods were studied while increasing the acidity of juice: adding citric acid, adding grape juice with high acidity, working with heating, fermentative working and working with physical affect (ultra sound) (Figure 1).



**Fig. 1.** Changing of titratable acidity in wine material 1 – control; 2 – blend; 3 – Citric acid, in case of usage

#### 4. Conclusion

1. Studying the mechanical and chemical composition of red grape sorts adapted to local and local soil climate condition selected for the preparation of high- quality red table wines showed that the titratable acidity, sugariness percentage can be more or less in the phase of technical growing depending on agrotechnical measures, territory, changing climate and etc. According to selected technology the chemical composition of juice obtained from these should be regulated.

2. Heating, fermentative physical working regimes are defined experimentally in preparation of wine, their affect to the chemical composition of wine were clarified. It was defined that *Rapidase CR* drug accelerates in an important degree the fermentation in 30°C temperature within four hours, the titratable acidity and color intensity of wine prepared from matrassa grape increase.

3. It was revealed that the working with ultra sound (more than 10W/sm<sup>2</sup>) with 22±1,65 Hz frequency as physical effect supports to the collection of polyphenol and anthocyanins. Also, it was approved that the processing of bruise in 60°C temperature supports to enrichment of juice with extractive substances. The fermentation period for bruise was defined for eight days optimally by experimental method.

4. Organoleptic analysis of prepared wines were carried out, the relations of its main components were defined precisely. Here the blend scheme for Matrassa and Khindogni sorts are considered superior for production technology by being 1:1.

5. It was defined that if the investigation put for new product cannot be able to prove its value economically, it provides taking 172410 AZN income from realization of 100000 bottles of wine during the season.

6. Appropriate technological documents were worked out by us and the production of high qualitative red table wine was organized by industrial method at “ASPI AGRO” LLC enterprise situated at Gabala city on the basis of suggestions and recommendations submitted to the production by us.

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