TECHNOLOGY DEVELOPMENT FOR PRODUCTION OF RED DRY WINES WITH ADVANCED CONTENT OF BIOLOGICAL ACTIVE COMPOUNDS

Taran Nicolae[1], Soldatenco Eugenia[2], Soldatenco Olga[2], Bostan Victor[3], Chiosa Nicolae[3], Vasiucovici Svetlana[3], Morari Boris[2], Cichir Liudmila[3]

[1]Technical University of Moldova, Chisinau, Republic of Moldova
[2]Practical Scientific Institute of Horticulture and Food Technology
[3]ÎM "Vinăria Purcari" SRL

Soldatenco Olga: olea_g@rambler.ru

Summary: In the article the results regarding the content of biological active compounds (BAC) in different red dry wines obtained at "Purcari Winery" were presented. The dynamic of BAC evaluation during the maturation of Cabernet Sauvignon grapes and development of new technological processes for production of red dry wines with advanced BAS content was studied.

Keywords: red dry wines, proanthocyanidins, biologically active compounds

Introduction

Red dry wines are distinguished from white wines with more valuable compounds content, the major fraction of them are phenolic substances, significant quantities of them passage into the must from peel, seeds and bunches, which imparts new biochemical, organoleptic and physiological properties to the wine. Due to its advanced content of phenolic substances, red wine possesses curative, antioxidant, anti-inflammatory and antibacterial properties. Phenolic substances, anthocyanins, proanthocyanidins, routine, quercetin, resveratrol, ascorbic and gallic acids are part of the biologically active compounds that are currently being studied in countries with wine traditions (Italy, France, Germany, Portugal, Romania, R. Moldova). Content of phenolic and coloring compounds depends on grape variety, the red wine production technology, as well as the structure and composition of the soil [1].

The specialized literature presents different technological processes elaborated in order to intensify the processes of BAC extracting from the solid parts of the grape. Traditional technology of red dry wines production provides the pulp maceration and fermentation at 28-32°C within 8-10 days with the cap mixing 3-4 times per day [2]. The use of thermovinification process of the pomace at 70°C within 30 minutes, with subsequent fermentation of the must, allows to intensify the technological process of BAC extraction, but does not allow to obtain high quality red wines [3].

Furthermore, technological processes for the production of BAC-rich red dry wines were elaborated, which requires fermentation-maceration during 10-30 days as well as fermentation-maceration under the pressure of released CO_2 at the pressure value of 300-500 kPa, but for a number of reasons, they did't come in a common use [4,5].

The aim of the study consists in scientific arguing and development of technology for red dry wines production containing advanced BAC, phenolic substances, anthocyanins, resvaratrol, rutin, quercetin and proanthocyanidins.

Research methods and objects

As the research subjects grapes of Cabernet Sauvignon variety, raw material for red wine of Cabernet Sauvignon, Malbec, Feteasca Neagra, Pinot Noir, Rara Neagra, Saperavi, produced at "Purcari Winery" LLC (r.y. 2017) were used. Different technological schemes for the production of dry red wines: traditional fermentation-maceration method, fermentation-maceration process up to 28 days, addition of fresh grape seeds during fermentation-maceration process of pomace and others were studied. The dynamic of BAC concentration in dry red wines was studied, depending on grapes maturity in the range of 180-220 g/L of sugars. Determination of the concentration of the phenolic substances was carried out by the Colorimetric method with the Folin-Ciocalteu reagent, the concentration of the anthocyanins was determined using spectrophotometric method with acidification of sample. Identification of resveratrol, quercitin, routine, ascorbic and gallic acids content was performed using HPLC method [6]. Content of proanthocyanidins in red wines was identified by the spectrophotometric method according to OIV requirements.

Results and discussions

The concentration of BAC depends on the grape variety used for the production of red wines. In order to argue the opportunity of using a grape variety in the production of red wines with advanced BAC content, concentration of this compounds were determinated in various wines produced at "Purcari Winery" LLC in 2017.

Concentrations of phenolic substances, anthocyanins, routine, quercetin and resveratrol in different red wines are presented in Table 1.

Table 1. *Concentration of BAC in dry red wines produced at Purcari Winery.*

№	Wine	Phenolic compounds, mg/dm^3	Anthocyanins, mg/dm^3	Resveratrol, mg/dm^3	Routine, mg/dm^3	Quercetin, mg/dm^3
1.	**Cabernet-Sauvignon**	2480	377	5,8	17,5	2,5
2.	**Merlot**	2184	324	4,2	7,8	1,6
3.	**Pinot Noir**	1896	229	2,9	7,5	2,1
4.	**Malbec**	2860	376	3,2	4,5	0,6
5.	**Saperavi**	3020	588	4,3	4,0	1,3
6.	**Rară-Neagră**	1790	210	2,4	6,1	0,6
7.	**Fetească-Neagră**	2089	248	4,7	4,7	0,8

According to the data presented in Table 1, Cabernet-Sauvignon and Saperavi varieties are distinguished by higher concentrations of phenolic substances, anthocyanins, resveratrol compared to other dry wines. The lowest concentrations of phenolic substances and anthocyanin's, resveratrol were determined in wines obtained from grape varieties Rara Neagra and Pinot Noir. According to obtained results and the available surfaces, Cabernet-Sauvignon variety was selected as object of research. The purpose of the research is to develop a technology for the production of dry red wines with a high content of BAC, including phenolic substances and anthocyanin's and rich in tannins which imparts a rich aroma of dried fruits and full velvety taste. For this purpose technological procedure for the production of dry red wine was elaborated and includes the following operations: crushing and destemming of well-matured grapes (sugar content

must be more than 22%), from obtained crushed grapes a part of must (10-20%) is eliminated, after which maceration-fermentation of the pomace is carried out during 5-10 days. After completion of the fermentation-maceration process, the wine is removed from the yeast sediment and directed to post-fermentation and preservation. Technological result of this process for the production of wines with advanced content of BAC, is due to the fact that:

- In the production process red grape varieties with a high content of phenolic compounds and with advanced seed content are used;
- Red grape varieties accumulate high concentrations of sugars (over 22%) and the grain seeds must be ripened;
- The elimination of 10-20% of the must contributes to a considerable increase of rapport between must and crushed grapes, which intensifies process of the extraction of the proanthocyanidins from seeds as well as the anthocyanins in the grape skin. The result is the enrichment of red wine with oligomeric phenolic compounds, with the predominance of catechins and monomeric epicatechins (from 2 to 5 catechin molecules), which make up the basic component of proanthocyanidins, which are the main phenols with antioxidant properties;
- After completion of the fermentation process, the wine is required to be removed from the yeast sediment to avoid absorption of BAS's by yeast cells.

One of the essential conditions of the technological process is the use of grapes of red varieties rich in phenolic compounds: catechins, epicatehins, proantocianidines, anthocyanins and others whose concentration depends on the amount of sugar in the must. The higher maturity of the grapes, the higher the BAC concentration in the must and in the obtained wines.

In Table 2 the results of phenolic compounds content in red wine Cabernet Sauvignon (h.y. 2017), harvested at different maturity level of graped (fermentation-maceration process during 5 days) are presented.

Table 2. *Physico-chemical indices of dry red wines obtained at different concentrations of sugars in grapes (Cabernet Sauvignon h.y. 2017)*

Nr.	Physico-chemical indices	Unit of measurement	Concentration of sugars in must		
			18%	20%	22%
1.	**Alcohol**	%vol	10,50	11,90	13,10
2.	**Sugars**	g/L	1,60	1,65	1,82
3.	**Titratable acids**	g/L	8,5	7,4	6,5
4.	**Volatile acids**	g/L	0,36	0,38	0,42
5.	**pH.**		3,15	3,21	3,35
6.	**Phenolic substances**	mg/L	1650	1964	2450
7.	**Anthocyanins**	mg/L	208	256	324
8.	**Proanthocyanidins**	mg/L	306	384	465
9.	**Organoleptic note**	point	7,8	7,9	8,1

From the data presented in Table 2, it is to be noted that increase of the sugars content in grapes contributes to essential increase of phenolic and color compounds

concentration in obtained red dry wines, as well as of the proanthocyanidins, which have strong antioxidant properties.

In 2017, Cabernet Sauvignon grapes with 22% sugar content of 10 tonnes were processed by crushing and destemming. The sulphitated-crushed grapes where transported to a tank equipped with a recycling and extraction system, from which a part of the must is separated, which is used in the production of rosé wines. Must enriched with the solid phase was subjected to fermentation-maceration process with mixing 3-4 times per day.

After the completion of the fermentation process, the wine has reached a good structure, a pronounced extraction and intense color, the pomace was pressed and sulphited and directed to preservation. The physico-chemical indices of the Cabernet Sauvignon wine obtained according to elaborated technological scheme are shown in Table 3.

Table 3. *Physico-chemical and organoleptic indices of dry red wines from Cabernet - Sauvignon variety with advanced BAC content.*

Nr.	Physical-chemical and organoleptic indices	Variants				
		Control	Elimination of must from crushed grapes,%			
			5	10	20	30
1.	**Alcohol,% vol**	13,0	13,0	12,90	12,8	12,6
2.	**Sugar, g/dm³**	1,78	1,68	1,64	1,64	1,56
3.	**Titratable acids, g/L**	8,5	8,0	7,5	7,2	7,2
4.	**Volatile acids, g/L**	0,33	0,38	0,40	0,40	0,46
5.	**pH.**	3,20	3,24	3,28	3,30	3,30
6.	**Phenolic substances, mg/L**	2300	2500	2750	3000	3000
7.	**Anthocyanins, mg/L**	510	520	540	560	530
8.	**Resveratrol, mg/L**	5,4	5,6	5,8	6,5	5,7
9.	**Routine, mg/L**	6,1	7,2	8,5	9,2	8,4
10.	**Quercetin, mg/L**	0,4	0,6	1,2	1,4	1,4
11.	**Proanthocyanidins, mg/L**	680	720	780	830	800
12.	**Organoleptic note, points**	7,8	7,85	8,0	8,10	7,80
13.	**Color**	Ruby	Deep ruby	Deep ruby	Ruby dark, intense	Dark Ruby, very intense
14.	**Flavor**	Clean, typical	Rich, composed, with typical nuances	Rich, intense, expressive	Rich, intense, expressive	Simple, vegetal shades
15.	**Taste**	Clean, light, slightly astringent	Clean, light, little tan	Full, extract, soft, tan, pleasant with typical shades	Full, extraction, soft, with typical tanning shades	Astringent, plant tones, simple, rough

The data in Table 3 confirms the positive result of the developed technology, according to obtained results, red wines after the removal of a portion of must from the pomace (optimally 10-20%), contribute to a significant increase of BAC, including phenolic substances (2750 and 3000 m /L in the optimal variants), colorants (540 and 560 mg / dm³ respectively) and proanthocyanidins (780 and 830 mg/L) in comparison with the control sample (phenolic substances 2300 mg/L, colorants 510 mg/L and proanthocyanidins 680 mg /L).

Conclusions

Elimination of the part of the must from obtained crushed grapes contributes to the production of dry red wines with advanced content of biologically active compounds. The optimal amount of must removed varies from 10 to 20%, which is confirmed by the content of studied chemical compounds: high levels of phenolic substances, anthocyanins, proanthocyanidins, resveratrol, routine and quarcitine.

The organolpethical properties of the red wines obtained using the elaborated technology of elimination of must from pomace in quantity of 10-20% have been appreciated with notes 8.00 and 8.10 compared to control sample -7.8 points.

Bibliography

1. Кордер Роджерб Все о красном вине. Москва, Рипол классик, 2009, 336 с.

2. Cozub G., Rusu E., Producerea vinurilor în Moldova, Chișinău, 1996, 191 p.

3. SU, B.I. N150462, Cl. C12 G¹/00;

4. MD, BI N563, Cl. C12 G¹/02, BOPI N11/2012;

5. MD, B.I. N2499, CL. C12 G¹/00, ¹/022, BOPI N7/2004;

6. Țîrdea C., Chimia Vinului și analiza vinului. Iași, Ed.: Ion Ionescu de la Brad, 2007, 1398 p.