International Journal of Agriculture Innovations and Research
Volume 8, Issue 6, ISSN (Online) 2319-1473
Manuscript Processing Details (dd/mm/yyyy):
Received: 30/05/2020 | Accepted on: 22/06/2020 | Published: 05/07/2020

Study of the Index of Phenolic Maturity in Georgian Red Grapes at Different Ripeness Stages

Tea Khositashvili* **and Mariam Khositashvili**
Iakob Gogebashvili Telavi State University, N1, Kartuli Universiteti Str., Telavi, Georgia.
*Corresponding author email id: teee87@gmail.com

Abstract **– The main role in red wine assessment is the biologically active substance - phenolic compounds and their transformation products that actively participate in wine formation at all stages of its production and storage and directly influence the taste, bouquet, color and transparency of wine. These substances are formed in the grape and wine is transferred into the alcoholic fermentation process. The first stage of wine making - to determine the exact period of vintage, the technical maturity of the grapes is determined mainly by the sugar-acidity (Glucose asymmetric rate) index and the grapes are given direction. The study of changes in phenolic compounds is an extremely topical problem of modern scientific research to improve the quality of red wines. The purpose of our research was to determine the phenol maturity index, total anthocyanin, tannins and phenol compoundsin the Aboriginal and introducing red grapes and in the grape juice; Determine the optimal date of vintage and study their influence on the red wine quality. The index of the phenolic maturity was first determined in a vineyard to determine the time for harvesting the red grape varieties in Georgia. Dynamics of changes in common phenolic compounds for different red grape (Vitisvinifera L.) varieties (Saperavi, Cabernet, Tavvervi, Okhanuri Saper, Odjaleshi, Aleksandruuli, Asureti Shavi, Mujuretuli) was studied at different stages of ripeness of grapes over three years (2015-2017) in Georgia. Glories method was used to monitor phenolic maturity. After processing the grapes, quantitative changes in common anthocyanin's and tannins in wine and must and their effect on high-quality red wine were studied. The content and structure of tannins in grapes highly depend on the grape variety and agro technical conditions. The astringency of tannins declines when the ripeness of grapes occurs, which causes a softening of the taste of tannins. Organoleptic properties, colour, and quality of the future wine are determined by the phenolic maturity of grapes.**

Keywords **– Harvest, Anthocyanin's, Tannins, Polyphenols, Glories Method, Tothal Phenol Index, Red Grape Varieties.**

I. INTRODUCTION

When the grapes begin to ripen, its green berries lose chlorophyll and change colour, which becomes more intense during the ripening period. Anthocyanins accumulate in the cells of the skin of red grapes, and the skin is deeply coloured [10]. The content of anthocyanins in the berries increases during the ripeness of grapes, that are continuously increasing, reaches a certain maximum and begins to decline [12]. At this time, the phase of phenolic maturity of grapes is occurs [2], [3]. The beginning of the harvest date is recommended after a decrease in the number of anthocyanins. The exact date depends on the grape variety and the rhythm of the reduction in the total number of phenolic compounds, including the anthocyanins and tannins [1], [7].

The purpose of our study was to establish the optimal harvest date, the index of phenolic maturity in the indigenous red grape varieties; to determine the total anthocyanins and polyphenols in the wine and the must, and to study their effect on high-quality red wine production. Eight varieties of red wine grapes (Saperavi, Cabernet, Tavkveri, Otskhanuri Saper, Ojaleshi, Aleksandrouli, Asureti Shavi, Mujuretuli) were taken as an object for analysis from the microzone of Kartli viticulture (Saguramo-Bitsmendi) in 2015-2017. The accumulation dynamics of the total amount of phenolic compounds in berries was determined by on Hach Dr/ 2500 Spectrophotometer using Glories methodduring different growth periods of red grape clusters [5], [11].

II. MAINE HEADING

The determination of the index of the phenolic maturity (Abs 280) quantitatively represents the total phenolic compounds in grapes, including the average content of the anthocyanins and tannins and allows to control the phenolic maturity during the ripening period of grapes [4], [8].

Accordingly, the quantitative and qualitative determination of phenolic compounds and the establishment of the phenolic index for regulating the oxidation of chemical compounds and increasing the intensity of colour and their quality in red wines are very important issues in modern wine-making countries [6]; [9].

Average results of the dynamics of the change of total amount phenolic compounds (total anthocyanin's, tannins, and polyphenols) of Georgian red grapes at the different stages of ripeness of grape berries in 2015-2017 (Table 1). Table 1 shows that the phenolic maturity index and the phenol maturity can be determined by studying the dynamics of the change of the total number of phenols. According to the same table, the phenolic compounds for technical maturity are found in reduced amount compared to the period of fruit set. Therefore, our goal was to maintain the maximum amount of phenolic compounds, anthocyanins, and tannins in grape berries and use them in high-quality production of red wine.

Therefore, monitoring the dynamics of accumulation of phenolic compounds is a very important issue for ensuring the timely compatibility of phenolic maturity with the technical ripening. This was implemented by studying the determinative parameters of the phenolic index of red grapes.

In the period of phenolic maturity, the maximum amount of anthocyanins is transferred from the grape to the must. This one is the percentage of the phenolic compounds from the grape to the must, namely, the amount of the extraction of maximum anthocyanins (EA%).

The determination of the percentage of extraction of anthocyanins from the red grapes into the must is one of the most common methods in Europe and is used to determine the optimal time for ripening of red grapes, which in turn determines the optimal vharvest date together with the sugar-acidity index.

The results of the analysis of anthocyanins of local red grapes and the percentage of pip tannins, the quantitative index of sugar-acidity and phenol index of the must are presented in Table 2. Summarizing the chemical data of grape must of red grape varieties, we found that the grape variety of Saperavi was distinguished by a high amount of anthocyanins and phenolic compounds, which was presented by calculating the phenol index of Saperavi and that was 59.7%.

The grape variety of Mujuretuli had the lowest index, characterized by the low content of anthocyanins and polyphenols and accordingly, the phenol index was 28.5%. The index of the phenolic compounds of the remaining indigenous red grapes was between the data of Saperavi and Mujuretuli.

Table 1. Dynamics of Changes in the Number of Phenolic Copmounds of Indigenous Varieties of Red Grapes at Different Ripness Stages, MG/L (2015-2017 YEAR).

Names of samples	**The total amount of phenolic compounds in different periods of ripening, mg / l**		
	Fruit set	**Veraison**	**Ripening**
Saperavi	37.1	32.2	17.1

Names of samples	The total amount of phenolic compounds in different periods of ripening, mg / l		
	Fruit set	Veraison	Ripening
Cabernet	33.0	28.5	15.2
Asureti Shavi	35.4	27.4	14.8
Tavkveri	30.4	25.9	13.5
Otskhanuri Saper	32.1	29.0	16.0
Ojaleshi	29.4	27.3	12.8
Aleksandrouli	25.5	24.8	14.0
Mujuretuli	26.3	25.1	13.7

Table 2. The Determination of the Phenolic Indes if the Ripening of the Indigenous Red Grape Varieties.

Grape Varieties	pH of buffer solutions		The number of anthocyanin in the must (EA), %	The total number of tannins in grape pip, (MP), %	Absorption of the total phenols at 280 nm	Sugar-Acidity Index	Phenolic compound index (TPI), %
	3.2	1.0					
Saperavi	1663	2962	178.1	93.0	0.5974	30.0	59.7
Cabernet	1473	2518	58.5	24.8	0.4011	31.9	40.1
Asureti Shavi	1130	2368	47.7	23.9	0.4402	34.2	44.0
Tavkveri	1133	2375	47.7	20.5	0.4731	29.8	47.3
Otskhanuri Saper	1210	2585	46.8	20.4	0.3870	27.9	38.7
Ojaleshi	1224	2666	45.90	24.5	0.3524	26.1	35.2
Aleksandrouli	1086	2108	51.5	18.9	0.2643	48.0	26.4
Mujuretuli	983	2388	41.1	27.4	0.2854	41.1	28.5

III. CONCLUSION

The paper presents the results of a three-year study on the dynamics of change of phenolic compounds (anthocyanins, tannins, and polyphenols) of eight indigenous varieties of red grapes (Saperavi, Cabernet, Tavkervi, Okhanuri Saper, Oyaleshi, Aleksandruuli, Asureti Shavi, Mujuretuli).

The phenolic compounds, anthocyanins, and tannins were determined by spectrophotometric analysis at 520 and 280 nm using Glories method.

The study found the dynamics of the changes in phenolic compounds in different periods of grape ripening, and the polyphenol index of grapes was calculated.

It was found that the maximum amount of anthocyanins coincided with the maximum amount of sugar in red grapes (the optimal date of the harvest).

The start of the harvest is recommended after a decrease in the number of anthocyanins, which is determined by calculating the indices of phenolic maturity and sugar-acidity.

REFERENCES

[1] Aleixandre-Tudo JL, Buica A, Nieuwoudt H, Aleixandre JL, du Toit W. (2017): Spectrophotometric analysis of Phenolic Compounds in Grapes and Wines. https://doi.org/10.1021/acs.jafc.7b01724.
[2] Artem V., Geana E., Antoce A., (2014): Study of Phenolic Compounds in Red Grapes and Wines from Murfatlar Wine Center. https://doi.org/10.2478/auoc-2014-0009.
[3] Bautista-Ortín A.B., Martínez-Cutillas A., Ros-Garcia J.M., Lopez-Roca J.M., Gomez-Plaza E. (2005): Improving colour extraction and stability in red wines: The use of maceration enzymes and enological tannins https://doi.org/10.1111/j.1365-2621.2005.01014.x.
[4] Ceto X., Gutiérrezb J.M., Gutierrezb M., Cespedes F., Capdevila J., Mínguez S., Jimenez-Jorquera C., Valle M.D. (2012): Determination of total polyphenol index in wines employing a voltammetric electronic tongue. https://doi.org/10.1016/j.aca.2012.02.026.
[5] Cristea E. (2014): determination of the optimal phenolic extraction yield in red wine using the glories method. Available at: https://repositorio.ucp.pt/bitstream/10400.14/16237/1/thesis_Elena_Cristea_MSc_SEFOTECH_final.pdf
[6] Ferrer-Gallego R., Hernandez-Hierro JM., Rivas-Gonzalo JC., Escribano-Bailon MT. (2012): Influence of climatic conditions on the phenolic composition of Vitisvinifera L. cv. Graciano. https. //DOI:10.1016/j.aca.2011.12.072.
[7] Heras-Roger J., Alonso-Alonso O., Gallo-Montesdeoca A., Díaz-Romero C., Darias-Martin J. (2016): Influence of copigmentation and phenolic composition on wine color. https://doi.10.1007/s13197-016-2210-3.
[8] Jensen JS., Demiray S., Egebo M, Meyer AS. (2008): Prediction of wine color attributes from the phenolic profiles of red grapes (Vitisvinifera). https://doi.org/10.1021/jf072541e.
[9] Kontoudakis N., Esteruelas M., Fort F., Canals J.M., Zamora F. (2010): Comparison of methods for estimating phenolic maturity in grapes: Correlation between predicted and obtained parameters. https://doi.org/10.1016/j.aca.2009.10.067.
[10] Pereira de Freitas V. A., Fernandes A., Oliveira J., Teixeira N., Mateus N. (2017): A review of the current knowledge of red wine colour. https://doi.org/10.20870/oeno-one.2017.51.1.1604.
[11] Ribéreau-gayon, P., Dubourdieu D., Doneche B., Lonvaud A. (2006): Handbook of Enology - Vol. 2: The chemistry of wine stabilization and treatments. http://dx.doi. org/10.1002/0470010398
[12] Sommer S., Cohen S.D. (2018): Comparison of Different Extraction Methods to Predict Anthocyanin Concentration and Color Characteristics of Red Wines. https://doi.org/10.3390/fermentation4020039.

AUTHOR'S PROFILE

First Author

Tea Khositashvili was born on December 24, 1987 she is 32 years old, unmarried. Graduated from Tbilisi State university, faculty of Chemistry and got BA degree of chemist. In parallel of Tbilisi State University she was studying at the institute of Horticulture, Viticulture and Wine-making got my BA degree of food technology. In 2011 she got MA degree from Telavi State University in beverage technology. In 2018 she became Doctor Food of Technologies. Adress: VilDigomi, Baratashvili str. 38 Georgia, Tbilisi. From 2011 to 2015 years she was working some of Georgian Wine companies as Wine maker and chemist. In this day Tea's working as Main technology in Coca-Cola Bottlers Georgia, in the parallel she have teaching course in Telavi state university of Brand production technologies. She had working experience during 10years in the alcoholic and non-alkoholic products technologies filed. She had more than 30 international and locally certified trainings in this field. Published 26 publications in the field. She is international teaching program Erasmus+ staff participant. Other Skills: Computer Programs Microsoft Office Word, Excel, PowerPoint, Outlook, Internet, eDocument (Telavi, Georgia).

Second Author

Mariam Khositashvili, was born on September 09, 1946 she is 74 years old, unmarried. In 1971 he graduated from the Agricultural Institute of Georgia, qualification as an engineer-technologist, specialty - winemaker. 1981-1986 Faculty of Technology of the Georgian Agricultural Institute; Institute of Grape, Fruit and Vegetable Production, Processing, Commodity Science and Specialist Training of Specialists since 1997; 5 candidate and 2 doctoral dissertations have been defended since 2002; 2 candidate dissertations have been submitted. The expert's and opponent's findings were published in 12 dissertations. Scientific rank Senior Research Fellow Proceedings and Publications: Has published 90 s--cientific papers, including 2 monographs, 6 copyright certificates, and has received the priority of 8 copyright certificates. Production introduction 3 (Telavi, Georgia). email id: marina_khositashvili@yahoo.com