Scientific Papers. Series B, Horticulture. Vol. LVIII, 2014
Print ISSN 2285-5653, CD-ROM ISSN 2285-5661, Online ISSN 2286-1580, ISSN-L 2285-5653

EVALUATION OF THE QUALITY OF ORGANICALLY GROWN GRAPES IN THE VITICULTURAL CENTER OF MURFATLAR

Victoria ARTEM[1], Arina Oana ANTOCE[1], Ioan NĂMOLOȘANU[1], Aurora RANCA[2], Anamaria PETRESCU[2]

[1]University of Agronomic Sciences and Veterinary Medicine of Bucharest, Faculty of Horticulture, Department of Bioengineering of Horti-Viticultural Systems, 59 Mărăşti, District 1, 011464 Bucharest, Romania.
[2]Research Station for Viticulture and Oenology Murfatlar, 2 Calea Bucuresti, 905100, Murfatlar, Constanta

Corresponding author email: aantoce@yahoo.com

Abstract

The trend for organic grapevine cultivation has increased recently due to a higher demand for organic products in general, but also due to the fact that new legislation for organic wine has been passed in 2012. In order to produce quality and cost-effective wines the quality of the grapes is of utmost importance. The studies were performed during 2012 and 2013 on grapes for red wines of 'Feteasca neagra' and 'Cabernet Sauvignon' cultivars. The parameters followed were those specific for grape maturation (weight of 100 berries, sugar content, total acidity, anthocyanins accumulation and total polyphenolic index) along with the yield and sanitary quality of the grapes. These two years of organic cultivation proved to have been optimal for this type of technology, the grapes harvested being of the required quality for the production of wine with controlled denomination of origin.

Key words: *organic growing, resilience, pest and diseases resistance*

INTRODUCTION

As a result of health problems and environmental degradation effect due to the extended use of pesticides and synthetic chemical fertilizers applied to control diseases, pests and weeds, in many countries the concept of organic viticulture was promoted (Antoce et al., 2008).

In recent years the academic world and the staff involved in wine production showed increased interest in organic viticulture ideas, which are based on the concept of the harmonious combination of traditional culture methods and scientific research progress in such a way that the harmful impact on the environment to be minimized.

In the European Union, about 85 000 hectares of vineyards are organically grown (2,5%), the largest producers being Italy (5,5%), Greece (4,3%), Austria (3,5%) and France (2,2%). In Romania about 0,6% of the total of existing vineyards (180 000 ha) are grown organically. Although the percentage is very low compared to other countries with longer tradition, in Romania there is a steady increase in the number of wine farms practicing organic viticulture. At the Research Station for Viticulture and Oenology Murfatlar vines are grown organically since 2007. Currently, there are 45 hectares of vineyards registered for organic production, of which 15 ha are certified and 30 ha are in conversion to organic production. The varieties grown organically are 'Columna' and 'Chardonnay' - for white varieties and 'Fetească neagra', 'Cabernet Sauvignon' and 'Pinot noir' for red varieties (Ranca et l., 2013).

Organic farming systems rely on respecting a complex of rules contained in the Regulation (CCE) No 2092/91 of the Council, which Romania assumed once it jointed the EU on 27 June 2007. The new regulation enforced in 2007 (EEC 834/2007) and replaced the 1991 one was much clearer for both farmers and consumers, establishing a complete series of objectives, principles and basic rules for organic production (Ranca and Toncea, 2011).

It is well known that the quality of grapes and wine is influenced mostly by the varietal characteristics that imprint its own traits. Climate has significant influence too, on both the quality and the yield. Typically, the temperature influences the ripening period of various cultivars, allowing for a zone distribution of vine varieties in the regions of the country (Cotea, 1985).

Without any doubt, the ripeness of the grapes has a crucial importance in the production of quality wines. The maturation process has a great influence on the phenolic composition of grapes too, not only in the concentration of sugars and acids, which are usually the parameters mostly followed before harvesting.

MATERIALS AND METHODS

The research was conducted in Murfatlar wine center within the Research Station for Viticulture and Oenology Murfatlar, during two viticultural years, 2012 and 2013. The observations were performed on two organically cultivated vine varieties, 'Feteasca neagră' and 'Cabernet Sauvignon', focusing on fruit quality and adaptability to organic cultivation in the conditions of Murfatlar area.

The total certified organic surface of the studied varieties is 12.39 ha, of which 5.25 ha is planted with 'Feteasca neagra' and 7.14 ha with 'Cabernet Sauvignon'. The varieties under study were grafted on the rootstock Berlandieri X Riparia Teleki 4 - Oppenheim selection 4-4 and the training system used is Guyot with bilateral cordons, the planting distance being 2.2 m between rows and 1.1 m between vines. The row orientation is N-S.

The evaluation of resistance to pathogens was performed twice during the active growing season (June and July), using the descriptors of IPGRI (International Plant Genetic Resources Institute).

The descriptors 9.2.3. and 9.2.4. were used to establish the susceptibility to vine mildew (*Plasmopara viticola*) for grapes and leaves, respectively. For downy mildew evaluation (*Uncinula necator*) descriptors 9.2.5. (leaves) and 9.2.6. (grapes) were used and for the evaluation of gray mold (*Botrytis cinerea*) on grapes the descriptor 9.2.2. was used. The numerical evaluation scale used has values between 1 (resistant) to 9 (high sensitivity).

Due to the fact that in Murfatlar vineyard the most important pest is the grape moth (*Lobesia botrana*), for the population surveillance and control AtraBot pheromone traps were installed.

For the follow-up of the ripening dynamics weekly determinations of technological maturation parameters were performed. We measured the weight of 100 berries (g), the glucoacidimetric index (the ratio of sugar content and total acidity expressed as H_2SO_4) and for the phenolic maturation the anthocyanins content (mg/l) and total polyphenol index. The evolution of these parametes was easilly followed in the subsequently drawn maturation graphs.

The sugar content was determined using the electonic Smart refractometer produced by Atago, Japan; the total acidity - by titration with 0.1 N NaOH; the weight of 100 berries by weighing with the laboratory balance. The content of total anthocyans and polyphenol index were determined using the method ITV developed by the Institut Français de la Vigne et du Vin. This method is based on the extraction of phenolic compounds in an acid medium (15 ml of 95% ethanol, 85 ml HCl 0.1 % v/v) during 2 h, followed by the measurement of the absorbance at 520 nm of the extract previously diluted 1:20 with 1% HCl solution, for the anthocyanin content determination, and by the measurement of the absorbance at 280 nm in a 1 cm quartz cuvette of the same extract previously diluted 1:100 with distilled water for the total polyphenols index (IPT) estimation (Cayla et al., 2002).

Climatic data were provided by the weather station Weather Master 2000 produced by Environdata, Australia and includes daily observations for maximum and minimum temperature, insolation and precipitations.

RESULTS AND DISCUSSION

The climatic conditions of the viticultural years 2012 and 2013 can be judged as favorable for the organic cultivation of winegrapes, the vegetation period of the varieties studied being characterized by average temperatures with 2.0 – 2.7°C higher than the average calculated for the past 20 years. The viticultural year 2012 was a dry one, with higher values of air temperature during the growing season and also with an insolation that exceeded by 275 hours the multiannual average used as reference.

The amount of precipitation was significant in 2013, almost double as compared to the previous year, totaling 554.4 mm as compared to only 296.3 mm in 2012. In the same time, the sunshine hours in 2013 were with 626.9 hours less than in 2012 .

A summary of the climatic parameters can be found in Table 1.

Table 1. The annual average air temperature, the amount af precipitations and the insolation during the viticultural years 2012 and 2013

Climatic parameter	Viticultural year	2012	2013	Multiannual average 1991-2010
The air temperature (^{o}C)	The average temperature, ºC	13.5	14.6	12.6
	The average temperature during the growing season, ºC	21	21.7	19
Precipitation (mm)	∑ annual precipitations ,(mm)	450.8	727.1	513.6
	∑ precipitation during the growing season, (mm)	296.3	554.4	330
Insolation (hours)	∑ real annual insolation, (hours)	2791.2	2164.3	2203
	∑ real insolation during the growing season, (hours)	1973.1	1710.9	1698

The climatic conditions of 2012 and 2013 required an adaptation of the used methods to control and combat pathogens and pests in order to ensure a homogeneous profitable production. Pest control success was ensured by applying specific treatment schemes, considering the microclimate conditions, biological reserve of pathogens, the varietal susceptibility to attacks and last but not least, choosing eficient plant protection products form the list of the aproved ones for organic culture.

In 2012, five treatments were necessary for vine protection, while in 2013 six treatments were neccesary. Plant protection products used in the organic vineyards from the viticultural center Murfatlar are Kocide 2000 (copper hydroxide 53,8%) and Kumulus DF (sulfur 80%) obtained from DuPont International and BASF. The amount of copper/ha/year has not exceeded the 6 kg limit imposed by the Regulation (EC) no. 889/2008 of the European Commission.

Table 2. The resistance evaluation of the studied varieties to the vine pathogens

Variety	Year	Pathogenic agent				
		Plasmopara viticola		*Uncinula necator*		*Botritis cinerea*
		Leaf (9.2.3)	Grape (9.2.4)	Leaf (9.2.5)	Grape (9.2.6)	Grape (9.2.2)
Feteasca neagra	2012	5	3	3	1	3
	2013	5	5	3	1	7
Cabernet Sauvignon	2012	3	1	3	1	3
	2013	5	3	1	1	5

The evaluation of the two varieties resistance to pathogen attack showed that the downy mildew (*Plasmopara viticola*) and gray mold (*Botrytis cinerea*) occurred with greater

intensity in 2013 as compared to the previous year (Table 2). Of the two varieties studied 'Feteasca neagra' showed greater sensitivity to these diseases, the control plan including a complex of cultural and environmental measures preventively applied during the incubation period of pathogens.

The attack of powdery mildew (*Uncinula necator*) recorded a moderate intensity in the studied years and it was manifested only at the foliar level, not affecting the grape yield. Manual works as bounding and tipping of shoots, nipping and partial defoliation were used to create optimal conditions for a good ventilation of the vine stock, which also improved the efficiency of the applied treatments .

Preventive control of the grape moth (*Lobesia botrana*) was achieved by performing correct canopy control and by using pheromone traps. With the help of pheromone traps the population density was determined. During the ongoing of the study the economic damage threshold of 100 butterflies/trap/week was not achieved in any of the two parcels.

The qualitative indices of production as the weight of 100 berries and glucoacidimetric index, on one hand, and the content of extractable anthocyanins and polyphenols index, on the other hand, reveals different levels of accumulation depending on variety and year.

The year of 2013 was the viticultural year in which both studied varieties expressed a higher acumulation in sugars, thus the glucoacidimetric index at harvest had values of 52.2 and 62.8 as compared to the previous year when the values were lower 33.4 and 38.3, respectively (Figure 1).

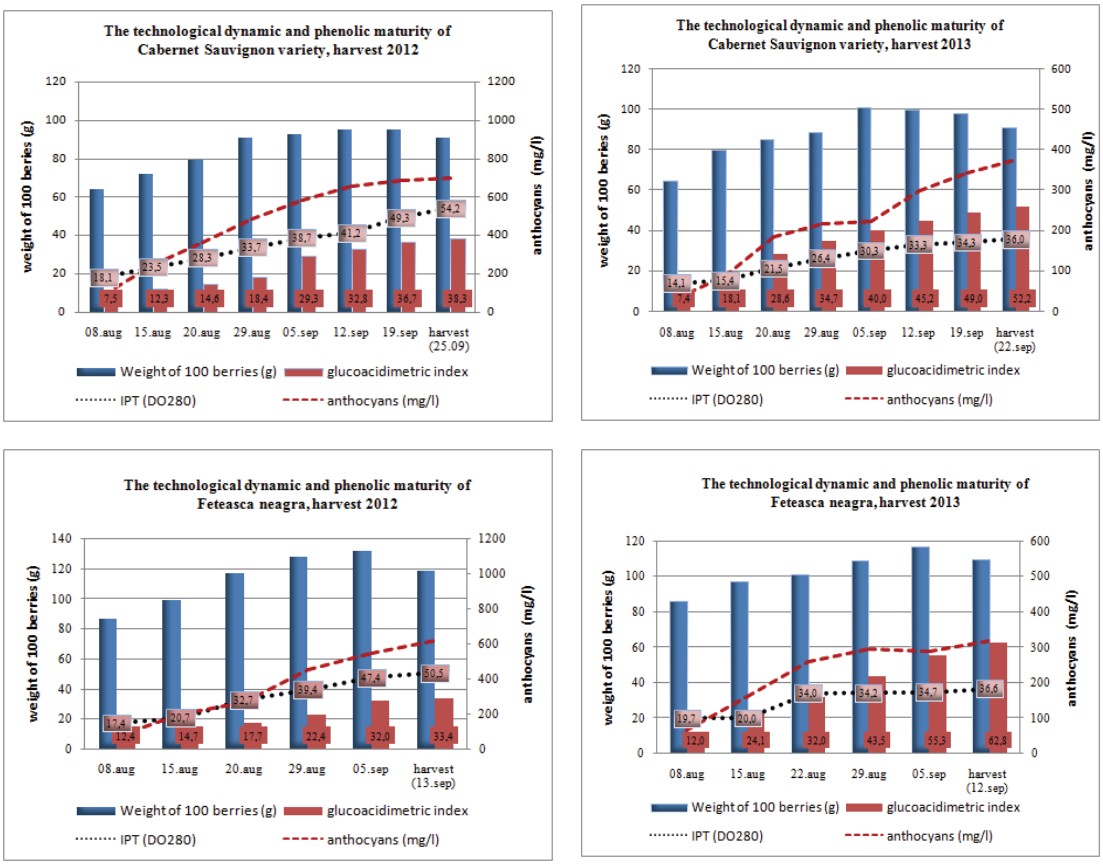

Figure 1. The evolution of qualitative parameters of the studied varieties, 2012-2013

In 2012, due to weather conditions with slightly lower temperatures during the growing season and with a quantity of precipitation similar to the average of the last 20 years, the accumulation of color compounds was superior, thus the total anthocyanins recorded a value of 621.11 mg/l for 'Feteasca neagra' and 699.26 mg/l for 'Cabernet Sauvignon', as compared to 2013, when the content of anthocyanins was only 317.44 mg/l for 'Fetească neagra' and 374.16 mg/l for 'Cabernet Sauvignon'. Regarding the polyphenols, the situation was similar, but with a less variation. The total polyphenol index in 2012 was 36.00 for 'Feteasca neagra' and 36.6 for 'Cabernet Sauvignon', increasing in 2013 to 50.4 and 54.2, respectively.

This indicates a slower phenolic ripening in 2013, coupled with the higher level of precipitations. However, in 2013 the harvest could not be delayed until a better phenolic maturity was reached because the glucoacidimetric index at harvest has already exceeded the previous year values. The option was to attempt the correction of polyphenols during winemaking processes. The evaluation of phenolic grapes ripening makes it possible to forecast the red wines quality and to model the technologies towards improving the wines phenolic structure. During the studied period, the yield was influenced by the action of the climatic factors in connection with the specific characteristics of each variety.

Table 3. The paramters and indices determined for the studied varieties organically grown during 2012 and 2013

Year	Variety	The weight of a bunch (g)	The volume of a bunch (ml)	100 berries weight (g)	No. of berries	Rachis Weight (g)	Yield (t/ha)	Maximum yield allowed for DOC wine (t/ha)
2012	Cabernet Sauvignon	140.86	116.67	135.2	144	5.66	9.0	12.9
	Feteasca neagra	234.44	203.33	229.32	200	5.12	8.8	15.0
2013	Cabernet Sauvignon	184.23	163.33	179.75	186	4.63	10.0	12.9
	Feteasca neagra	236.38	211.67	227.78	166	8.60	9.5	15.0

Under the same ecosystem conditions and technology, grape yield was variable, the most productive year proving to be 2013, when 'Cabernet Sauvignon' had an yield of 10 t/ha and 'Feteasca Neagra' 9.5 t/ha. Although close to the upper legal limit, the obtained values did not exceed the maximum allowed for production of wines with denomination of origin in Murfatlar vineyard and the quality of the raw material was not negativelly affected in any way.

CONCLUSIONS

The climatic conditions of winegrowing region Murfatlar in the years 2012-2013 proved to be favorable for organic growing of 'Cabernet Sauvignon' and 'Feteasca neagra'.

By adapting the pest control methods, especially by applying specific preventive and efficient schemes, the obtainment of a homogeneous and cost effective production was ensured. The selection of plant protection products depends on the microclimate and on the biological reserves of pathogens, but also on the crop sensitivity their attack.

Although the accumulation of glucides and anthocyanins in grapes depends on genetic traits of each variety, the decisive influence of the climatic conditions in specific production years was also observed. By monitoring the phenolic maturity each year it is possible to harvest at an optimal moment, to achieve a better phenolic structure in wines.

The grape harvest quantitatively evaluated by the average weight of the cluster and technological indices prove the good potential of these varieties and their adaptability in the Murfatlar climate. As regard to the quality, sugar content of both varieties showed values between 208 g/l and 245 g/l, allowing the classification of the resulted wines in the category of wines with denomination of controlled origin DOC.

REFERENCES

Antoce A., Cazacu S., Năməloşanu I., Ivaşcu M., Dumitru D., Voiculescu I., Ficiu L., Dumitrascu L., Damian D., 2008. The Organic Viticulture Guide - the Application of the principles and the methodology of organic viticulture in Romania, Ed. Alpha MDN.

Cayla L., Cottereau P., Renard R., 2002. Estimation de la maturité phénolique des raisins rouges par la méthode I.T.V. standard. Revue Française d'Oenologie 193, p. 10-16.

Cotea D.V., 1985. Treaty of Oenology, vol I, Ed. Ceres, Bucuresti.

Ranca A, Antoce A, Artem V, Petrescu A, Stanciu C, Colic-Sova, 2013. C-Principles of organic viticulture applied in Murfatlar vineyard, Romania, Fourth International Scientific Simposium „Agrosim 2013" 3-6 oct 2013, Jahorina, Bosnia and Herzegovina.

Ranca A, Toncea I., 2011. The vine growing organically, Editura Total Publishing, Bucureşti.

IPGRI, 1997. Descripteurs de la Vigne (Vitis spp.), Roma.

www.onvpv.ro - Technical Specifications DOC Murfatlar.

Council Regulation (EEC) N° 834/2007 of 28 June 2007 on organic production and labelling of organic products and repealing Regulation (EEC) No 2092/91.