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THE INFLUENCE OF CLIMATIC CONDITIONS ON THE GRAPE QUALITY IN THE WINE CENTER OF MURFATLAR IN 2012

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Abstract

The overall climatic conditions, through the main three factors (temperature, sunlight and humidity), exert a major influence on the quality and quantity of the grapes produced during a particular year. For this work, studies were performed on several white and black grape varieties authorized for culture in the vineyards of Murfatlar, by following the parameters that define the grape maturation (evolution of sugar accumulation, decrease of acids concentration and evolution of berry weight) and the grape quality at the harvest time. The studies showed that the year 2012 was a hot one, with a period of sunshine recorded during the grapevine vegetation exceeding normal value (average of 50 years) by 173.4 hours. The quantity of precipitations was similar to the level recorded as the multiannual average, but the rain distribution was not uniform during the vegetation period. These particularities led to an unsatisfactory development of the berries and lower yield. Due to the longer period with higher temperatures the ripening was premature, with a certain benefit in favour of sugar accumulation, while the must acidity was insufficient, due to a more intense catabolism at these temperatures. The harvest time started earlier for all the varieties, the recorded yields were much lower, but the grapes were not affected by rot or other diseases. Due to the fact that the grape ripening depends on the climate parameters of the year and on the region, in order to decide the optimum harvest period for a certain type of wine the evolution of the grape maturity parameters should be determined each year and the change in climatic influences should be systematically recorded.

Key words: *climatic, grape, Murfatlar.*

INTRODUCTION

The influence of climate on agriculture and especially on viticulture and wine production has never been more obvious than today. What remains to be argued is the critical aspect regarding the optimal maturation time of grapes, so that the wine obtained could acquire the characteristics of a quality wine (Tate, 2001; Bisson *et al*., 2002; Schultz and Jones, 2010).

History has shown that winegrape growing regions developed when the climate was most conducive and that shifts in viable wine-producing regions have occurred due to climate changes in the past (Le Roy Ladurie, 1971; Pfister, 1988; Jones, 2006).

For example, in any viticultural region, the accumulation of sugars in grapes in optimal concentrations now happens in a shorter time than before. Same is true about total acidity and the aromatic profile optimal for winemaking. In a warmer-than-normal environment, the grapevine passes through the various phenological phases faster, reaching technological maturity sooner and accumulating higher concentrations of sugars in the berries. While the grower or the winemaker awaits for the grapes to gather aroma compounds, the acidity is lost by respiration and the resulted wines lack balance and need corrections in the cellar. As a result of the warming of climate, in various regions a higher concentration of alcohol in wines was observed (Jones, 2007).

MATERIALS AND METHODS

The study was carried out in the Murfatlar viticultural center and was aimed at both renowned grape varieties for white and red wines (Chardonnay, Riesling Italian, Sauvignon blanc, Feteasca regala, Cabernet Sauvignon, Pinot noir, Merlot, Feteasca neagra) as well as varieties obtained by researchers

from SCDVV Murfatlar (Columna and Mamaia) from the 2012 harvest.
The data regarding climate were recorded using the weather station of the research station, model Weather Master 2000.
The dynamics of grape maturation for the studied varieties was monitored by following the accumulation of sugars and the decrease of acidity. At the same time, the evolution of the weight of the berries was also monitored.
The determinations were made every 7 days, on dates established in advance. A number of 5 berries were harvested from each grape, as follows: one berry from the left side, one from the right side, one from center-front, one from center-back and one from the basis of the grape. The 5 berries each were harvested from 60 grapes (thus giving a total of 300 berries to analyze). The 60 grapes were made of 10 grapes chosen from each of the 6 rows selected at random, and the location of each grape on the rows was chosen in zig-zag. The harvested berries were put in labeled plastic bags and transported to the laboratory in a cooler box, avoiding their crushing and heating.
The determination of sugars was done using a Smart electronic refractometer, on the basis of the percentage of dry matter in the grapes. The read values were adjusted for temperature and the value of the sugar content of the must was derived using data tables.
The acidity of the must was measured by titrimetry by neutralizing the acids in a determined amount of must using a solution of NaOH of known factor. Based on the amount of base solution used during the titration, the total acidity of the must can be calculated.
The total acidity was expressed in g/l H_2SO_4.
The determination of the weight of the berries was done using a laboratory technical scale, taking data on the weight of 100 berries.

RESULTS AND DISCUSSIONS

The climatic conditions of the year, namely the main three factors (heat, light, humidity) exercise an important influence on the process of grape maturation. This influence can actually decide the yield and the quality of that year′s crop. In Table 1, the data on the three climate factors of 2012 are compared to the multi-year averages recorded during the last 50 years in the viticultural center of Murfatlar, which are considered ″normal″.
The sum of temperature degrees in the period of vegetation of 2012 was 4100.8°C, compared to the average value of 3449°C. That is 651.8°C more than what is considered the normal value.
The maximum temperature recorded in this period was 39.8ºC (in August), and the lowest temperature recorded was-2ºC (in April).
Regarding the precipitations, the sum of rainfall was 246.4 mm, compared to the average value of 245.7 mm. So the difference was very small, but the distribution in time of the rainfall was not uniform.
The total sunshine time was 1780.6 hours, compared to the average of 1587.2 hours (see Table 1).

Table 1. Evolution of air temperature, precipitations and sunshine time during the growth season 2012, compared to the multi-year averages

Month	Air temperature				Precipitations		Duration of sunshine	
	T avg (50 years average)	T avg (°C)	Average T min (°C)	Average T max (°C)	Multi-year average	(mm)	Multi-year average	hours
April	10.2	14.5	-2.0	28.6	33.5	44.5	160.7	210.1
May	16.2	19.8	8.4	31.0	50.2	145	261.8	281.1
June	20.4	21.2	12.6	37.2	53.2	7.4	314.5	314.0
July	22.6	28.0	13.1	38.2	35.6	33.2	323.7	341.6
August	22.6	26.1	10.7	39.8	31.6	8.8	305.5	345.6
September	17.6	20.7	7.8	36.0	41.6	5.6	221.0	288.2

The accumulation of sugars in the berries, between the beginning of ripening and full maturity, happens quickly and in large concentrations. The increase is faster in the first 2-4 weeks at the beginning of the process, and later slows down and even stagnates for a period of 3-5 days (Cotea, 1985).
The concentration of accumulated sugars in the white varieties at full maturity (Figure 1) was

between 182-212 g/l, the lowest value being measured for the variety Feteasca regala and the highest value been seen in Italian Riesling.

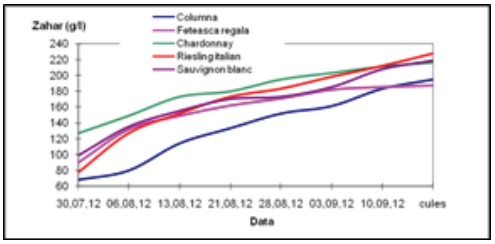

Figure 1. Evolution of the concentration of sugar for the varieties for white wines

In case of the red varieties (Figure 2) the concentration of sugars at full maturity varied between 192 and 219 g/l, the lowest value being seen in Cabernet Sauvignon and the highest value measured for Merlot and Pinot noir.

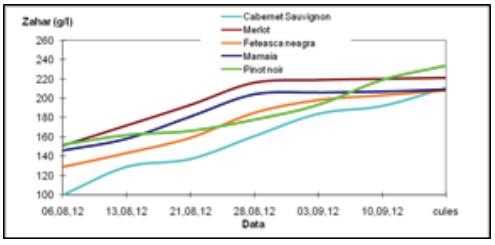

Figure 2. Evolution of the concentration of sugar in the varieties for red wines

The maximum weight of 100 berries of white varieties (Figure 3) was attained in grapes of Columna variety (163 g on September 10). That means that from the beginning of ripening to full maturity the weight of 100 berries increased with 94 g. Afterwards, until harvesting, the grapes lost some weight so that 100 berries weighed 7 g less than at full maturity.

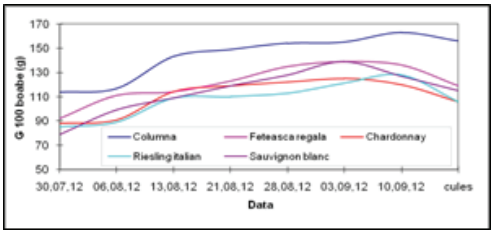

Figure 3. Evolution of the weight of 100 berries for the varieties for white wines

In case of the varieties for red wines the maximum weight of 100 berries was reached by the grapes of Mamaia variety, which weighed 220 g at September 10 (Figure 4). From the beginning of ripening to full maturity the 100 berries gained 64 g, and after that, until the harvesting date (September 18) they lost a mere 2 g.

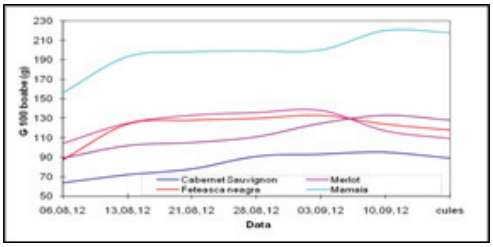

Figure 4. Evolution of the weight of 100 berries for the varieties for red wines

Under the conditions of the Murfatlar viticultural center the fastest decrease of acidity (the steepest slope on the graph) was observed at the white varieties for the variety Italian Riesling – from 23.7 g/l to 5.2 g/l (Figure 5). The mildest slope (the slowest decrease) was recorded for the variety Feteasca regala, from 14.0 g/l to 5.0 g/l.

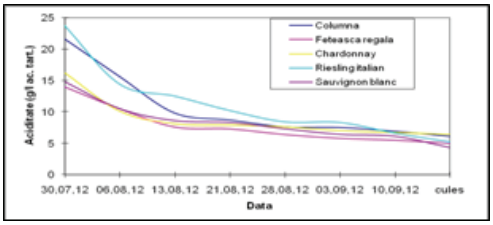

Figure 5. Evolution of total acidity for the varieties for white wines

In case of the varieties for red wines (Figure 6), the steeps slope of the graph of acidity was observed for Cabernet Sauvignon, from 20.3 g/l to 5.5 g/l, and the mildest slope was recorded for the Mamaia variety, from 8.5 g/l to 5.6 g/l.

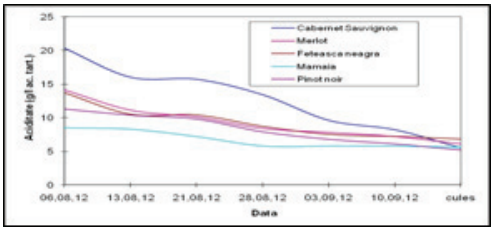

Figure 6. Evolution of total acidity for the varieties for red wines

The rate of accumulation of sugar in the varieties for white wines was between 1.96 and 3.12 g/day, with the lowest value in case of Chardonnay and the highest value for Italian Riesling. As for the varieties for red wines, the rate of accumulation of sugars was between 2.13 g/day (Cabernet Sauvignon) and 1.42 g/day (Mamaia) (see Table 2).

Table 2. Rate of accumulation of sugars

Variety	Sugar (g/day)
-for white wines	
Chardonnay	1.96
Columna	2.66
Feteasca regala	2.22
Italian Riesling	3.12
Sauvignon blanc	2.53
-for red wines	
Cabernet Sauvignon	2.13
Merlot	1.60
Feteasca neagra	1.72
Mamaia	1.42
Pinot noir	1.56

The rate of decrease of total acidity for the varieties for white wines was between 0.83 and 1.03 g/day, with the lowest value observed for Columna variety and the highest rate in Italian Riesling. As regards the varieties for red wines, the highest rate of decrease in total acidity was observed for the variety Pinot noir (0.80 g/day) and the lowest rate of decrease was seen in Cabernet Sauvignon and Mamaia (0.66 g/day, Table 3).

Table 3. Rate of decrease in total acidity

Variety	Metabolisation of acids (g/l/day)
-for white wines	
Chardonnay	0.84
Columna	0.83
Feteasca regala	0.97
Riesling Italian	1.03
Sauvignon blanc	0.97
-for red wines	
Cabernet Sauvignon	0.66
Merlot	0.71
Feteasca neagra	0.67
Mamaia	0.66
Pinot noir	0.80

All the grape varieties registered sugar concentrations between 195 and 234 g/l which alows them to be used for the production of wines with controlled denomination of origin, with the exception of the variety Feteasca regala which met the conditions for the Geographical Indication "Colinele Dobrogei" (Table 4.)

Table 4. Physico-chemical characteristics of the grapes obtained in the Murfatlar viticultural center, 2012 harvest

Variety	Date	Physico-chemical characteristics			Quality level*		
		Sugar (g/l)	Acidity (g/l ac. tartric)	Weight 100 grains (g)	Table wines	Wines with Geographical Indication	Wines with Controlled Denomination of Origin
					144.6-178.5	178.6-187.0	> 187.1
Varieties for white wines							
Chardonnay	14.09.2012	216	6.12	106			x
Columna	19.09.2012	195	5.05	156			x
Feteasca regala	15.09.2012	187	6.43	119		x	
Riesling Italian	20.09.2012	228	5.20	106			x
Sauvignon blanc	21.09.2012	219	4.28	139			x
Varieties for red wines							
Cabernet Sauvignon	25.09.2012	211	5.51	95			x
Merlot	17.09.2012	221	6.12	109			x
Feteasca neagra	13.09.2012	208	6.89	118			x
Mamaia	18.09.2012	209	5.66	218			x
Pinot noir	24.09.2012	234	5.20	133			x

CONCLUSIONS

This study showed that 2012 was a hot year, with a total sunshine duration in the vegetation period that was 173.4 hours longer than normal. The level of precipitations in the same period remained similar to the multi-year average, but rainfall was not distributed uniformly. These factors led to an early development of the grape berries, the rise in temperature having a positive impact on the accumulation of sugars in the grapes. The acidity of must at harvest time showed lower than optimal values, due to the early arrival of the ripening phase and to a highest rate of metabolisation of organic acids at higher temperatures.

The unusual aspect of the 2012 harvest was that some of the varieties for red wines reached full maturity at the same time with certain varieties for white wines. This phenomenon occurs only in dry years with hot summers, when the maturation of grapes is forced and most varieties mature at the same time.

The ripening of grapes differs from one year to another and from one vineyard to another, according to climate conditions, and therefore every year every grower must carefully monitor the ripening of each variety.

The harvesting of the grapes is a very important operation which must be done at the right time, since it has a major influence on the yield and quality of the harvest.

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