

ASPECTS REGARDING THE MATURATION DYNAMICS OF TABLE GRAPES GROWN IN VIILE AREA OF BUJORU WINE CENTRE

ASPECTE PRIVIND DINAMICA MATURĂRII UNOR STRUGURI DE MASĂ CULTIVATE PE PLAIUL VIILE DIN CENTRUL VITICOL BUJORU

**ODĂGERIU G.¹, ZAMFIR C.I.¹, LEFTER B.²,
COLIBABA Lucia Cintia³, DONICI Alina⁴**
e-mail:odageriu@yahoo.com

Abstract: This article presents data regarding the oenological potential of some table grape varieties cultivated in Viile viticultural area of Bujoru Wine Centre from Dealu Bujorului vineyard by analysing the evolution of the maturation process. The main purpose of this article is to present data regarding the maturation dynamics of six table grape varieties (Victoria, Italia, Chasselas doré, Muscat of Hamburg, Tamina, Alphonse Lavallée), in the new climatic conditions of the last 5-10 years, as a result of global warming, specifically concerning the raise of the sum of active temperatures during the vegetation period, especially in the grape maturation period. The results obtained emphasise the beginning of the optimum time of grape consumption, when the grape harvest should start, the grape full maturity, and the post-maturation period, respectively. The data reflect the influence of climatic conditions of 2014, generally favourable.

Key words: table grapes, maturation, total sugars, titratable acidity.

Rezumat: Lucrarea de față prezintă date referitoare la potențialul oenologic al unor soiuri de struguri de masă cultivate în plaiul viticol Viile din centrul viticol Bujoru al podgoriei Dealu Bujorului prin urmărirea în principal, a evoluției procesului de maturare a acestora. Scopul principal al lucrării constă în prezentarea unor date referitoare la dinamica maturării a 6 soiuri de struguri de masă (Victoria, Italia, Chasseleas doré, Muscat de Hamburg, Tamina, Alphonse Lavallée), în noile condiții climatice ale ultimilor 5-10 ani, ca urmare a încălzirii globale, respectiv a creșterii sumei temperaturilor utile în perioada de vegetație, în special în cea de maturare a strugurilor. Rezultatele obținute reliefează începutul momentului optim de consum al strugurilor, maturitatea deplină a acestora, respectiv perioada postmaturare. Acestea reflectă în general influențele condițiilor climatice, în general favorabile, ale anului 2014.

Cuvinte cheie: struguri, maturare, zaharuri totale, aciditate titrabilă.

¹ Research Centre for Oenology- Iași branch of Romanian Academy, Romania

² S.C. EUROFRUCT S.R.L., Romania

³ University of Agricultural Sciences and Veterinary Medicine of Iași, Romania

⁴ Vine and Wine Research and Development Station of Bujoru, Romania

INTRODUCTION

The rich content of sugars, mineral salts, organic acids and vitamins in grapes and wine, as well as the assimilable form in which they can be found, constitute a valuable characteristic, adding also to people's food intake (Cotea, 1985). Table grapes are harvested at commercial maturity, *i.e.* at the moment when they fulfil the characteristics of composition and quality, which make them good for consumption. The evaluation of the harvesting time is made based on physical-chemical and organoleptic tests. Consequently, grapes are considered to reach the consumption maturity when they have a pleasant, balanced taste, the ratio between sugars and acidity (the glucose-acidic indicator) being higher than 10, and when the grape berries have the colour specific to the variety, with intact skins. In general, the total sugar content is between 130-180 g/L, and the total acidity is 5-8 g/L $C_4H_6O_6$ (Cotea, 1985; Țârdea and Rotaru, 2003; Rotaru *et al.*, 2011). In order to establish the optimum time of grape consumption, we followed the evolution of the maturation process, from the beginning of ripening to their full maturity, and part of post-maturation period, respectively.

MATERIAL AND METHOD

For the experiments, we studied six varieties cultivated in Viile viticulturale area, originated from the plantations of S.C. EUROFRUCT S.R.L., of which three white ones (Victoria, Italia, Chasselas doré), and three red ones (Muscat of Hamburg, Tamina, Alphonse Lavallée). The grape samples (1-2 kg) were harvested periodically, at intervals of 5 days, between the 5th of August and the 24th of October, 2014. After determining the mass of 100 berries, the grapes were crushed, and the juice obtained was tested from a physical and a chemical point of view. The main characteristics of grape composition concerning total content of sugars, titratable and real acidity (pH), tartaric acid, malic acid and conductivity (X) were determined on the day of sample harvesting at S.C. EUROFRUCT S.R.L., and at the Oenology Laboratory of the University of Agricultural Sciences and Veterinary Medicine of Iași. Along with the absolute values obtained, we also present the relative deviations (δr) in (%), which modified the mass of 100 berries, total sugars, alcohol, titratable acidity, real acidity (pH), tartaric and malic acids of the grape juice samples analysed. The physical and chemical tests were performed using the methods indicated in the national and international standards in force (***2012) or in the literature (Țârdea, 2007; Cotea *et al.*, 2009).

RESULTS AND DISCUSSIONS

The data referring to the grape production of the varieties studied are presented in Table 1. Consequently, on the 24th of October, which was the last day of the study, the values were between 3.55 ÷ 5.69 kg/vine, and 11.7 ÷ 20.8 tons per hectare, respectively. The grape health was very good.

Table 1

Data referring to the grape production of the tested varieties

No.	Variety	Number of vines/ha	Production	
			Kg/vine	tons/ha
1.	Victoria	3300	5.69	18.8
2.	Italia	3300	3.81	12.6
3.	Chasselasdoré	3780	5.49	20.8
4.	Muscat of Hamburg	3780	3.56	13.5
5.	Tamina	3300	4.70	15.5
6.	Alphonse Lavallée	3300	3.55	11.7

The results of the tests performed on the 2014 grape crop are presented in tables 2÷4.

The total sugar content (g/L) increased from values between 56 (Tamina) and 96 (Muscat of Hamburg) on the 5th of August, to values between 145 (Alphonse Lavallée) and 216 (Muscat of Hamburg) on the 24th of October. At full maturity, its values were the following: 170 on the 29th of September for Chasselas doré variety; 210 on the 9th of October for Muscat of Hamburg variety; 193 on the 14th of October for Italia variety; 144, 154, and 172 on the 19th of October for Alphonse Lavallée, Tamina, and Victoria varieties.

Titrateable acidity (g/L $C_4H_6O_6$) decreased from values between 8.51 (Alphonse Lavallée) and 13.81 (Victoria) on the 5th of August, to values between 3.42 (Victoria and Alphonse Lavallée), and 4.67 (Tamina) on the 24th of October. At full maturity, it had the following values: 3.98 on the 29th of September for Chasselas doré variety; 4.48 on the 9th of October for Muscat of Hamburg variety; 4.37 on the 14th of October for Italia variety; 3.40, 3.41, and 4.65 on the 19th of October for Victoria, Alphonse Lavallée, and Tamina varieties.

Real acidity (pH) increased from values between 2.864 (Tamina) and 3.135 (Chasselas doré) on the 5th of August, to values between 3.476 (Tamina) and 3.695 (Victoria) on the 24th of October.

Tartaric acid (g/L) decreased from values between 5.16 (Alphonse Lavallée) and 8.38 (Victoria) on the 5th of August, to values between 2.28 (Victoria) and 4.32 (Italia) on the 24th of October.

Malic acid (in g/L) decreased from values between 4.10 (Tamina) and 7.85 (Victoria) on the 5th of August, to values between 1.49 (Victoria and Alphonse Lavallée) and 2.90 (Tamina) on the 24th of October.

The glucose-acidic or maturation indicator (IM) increased from values between 4.4 (Tamina) and 9.3 (Chasselas doré) on the 5th of August, to values between 33.8 (Tamina) and 50.9 (Victoria) on the 24th of October. At full maturity this indicator had the following values: 42.7 on the 29th of September for Chasselas doré variety; 46.9 on the 9th of October for Muscat of Hamburg variety; 44.2 on the 14th of October for Italia variety; 33.1, 42.2, and 50.6 on the 19th of October for Tamina, Alphonse Lavallée and Victoria varieties.

Table 2

Grape maturation dynamics at *Victoria* and *Italia* varieties from Viile area of Bujoru Wine Centre, from Dealu Bujorului vineyard, in the harvesting year 2014 (age of plantation = 7 years)

No.	Test date	Mass of 100 berries		Total sugars		Titratable acidity		Real Acidity (pH)		Tartaric acid		Malic acid		Gluco- -acidic indic. (I _M)	Conduc tivity (X) (mS/ cm)
		g/L	δ _r (%)	g/L	δ _r (%)	g/L C ₄ H ₆ O ₆	δ _r (%)		δ _r (%)	g/L	δ _r (%)	g/L	δ _r (%)		
Victoria															
1.	Aug. 5 th	271	0.0	66	0.0	13.81	0.0	2.994	0.00	8.38	0.0	7.85	0.0	4.8	7.5
2.	Aug. 15 th	335	23.6	76	15.2	12.32	-10.8	2.963	-1.04	8.38	0.0	7.56	-3.7	6.2	7.1
3.	Aug. 25 th	398	46.9	86	30.3	9.65	-30.1	3.099	3.51	6.79	-19.0	6.01	-23.4	8.9	6.7
4.	Sep. 4 th	527	94.5	115	74.2	6.98	-49.5	3.244	8.35	4.95	-40.9	4.12	-47.5	16.5	6.3
5.	Sep. 14 th	574	111.8	128	93.9	5.10	-63.1	3.394	13.36	3.59	-57.2	2.65	-66.2	25.1	5.9
6.	Sep. 24 th	626	131.0	145	119.7	4.25	-69.2	3.441	14.93	2.82	-66.3	1.92	-75.5	34.1	5.5
7.	Oct. 4 th	673	148.3	160	142.4	3.63	-73.7	3.522	17.64	2.41	-71.2	1.62	-79.4	44.1	5.1
8.	Oct. 14 th	695	156.5	169	156.1	3.42	-75.2	3.647	21.81	2.31	-72.4	1.51	-80.8	49.4	4.6
9.	Oct. 24 th	702	159.0	174	163.6	3.42	-75.2	3.695	23.41	2.28	-72.8	1.49	-81.0	50.9	4.2
Italia															
1.	Aug. 5 th	274	0.0	62	0.0	13.76	0.0	2.954	0.0	7.00	0.0	7.58	0.0	4.5	7.5
2.	Aug. 15 th	329	20.1	80	29.0	12.56	-8.7	2.986	1.1	6.78	-3.1	6.99	-7.8	6.4	6.5
3.	Aug. 25 th	374	36.5	112	80.6	9.53	-30.7	3.074	4.1	5.96	-14.9	5.22	-31.1	11.8	5.7
4.	Sep. 4 th	458	67.2	138	122.6	6.72	-51.2	3.141	6.3	5.11	-27.0	3.88	-48.8	20.5	5.1
5.	Sep. 14 th	484	76.6	158	154.8	5.23	-62.0	3.342	13.1	4.65	-33.6	3.06	-59.6	30.2	4.5
6.	Sep. 24 th	562	105.1	175	182.3	5.00	-63.7	3.410	15.4	4.55	-35.0	2.75	-63.7	35.0	4.2
7.	Oct. 4 th	602	119.7	185	198.4	4.54	-67.0	3.459	17.1	4.35	-37.9	2.63	-65.3	40.7	3.9
8.	Oct. 14 th	620	126.3	193	211.3	4.37	-68.2	3.504	18.6	4.27	-39.0	2.56	-66.2	44.2	3.8
9.	Oct. 24 th	615	124.5	197	217.7	4.42	-67.9	3.610	22.2	4.32	-38.3	2.60	-65.7	44.6	3.7

Table 3

Grape maturation dynamics at *Chasselas doré* and *Muscat de Hamburg* varieties from Viile area of Bujoru Wine Centre, from Dealu Bujorului vineyard, in the harvesting year 2014 (age of plantation = 8years)

No.	Test date	Mass of 100 berries		Total sugars		Titratableacidity		Real Acidity (pH)		Tartaric acid		Malic acid		Gluco- acidic indic. (I _M)	Condu ctivity (X) (mS/ cm)
		g/L	δ _r (%)	g/L	δ _r (%)	g/L C ₄ H ₆ O ₆	δ _r (%)		δ _r (%)	g/L	δ _r (%)	g/L	δ _r (%)		
Chasselasdoré															
1.	Aug. 5 th	188	0.0	88	0.0	9.44	0.0	3.135	0.0	7.31	0.0	7.04	0.0	9.3	6.7
2.	Aug. 15 th	195	3.7	98	11.4	8.34	-11.7	3.166	1.0	6.59	-9.8	6.12	-13.1	11.8	6.4
3.	Aug. 25 th	206	9.6	112	27.3	7.21	-23.6	3.222	2.8	5.83	-20.2	4.63	-34.2	15.5	6.2
4.	Sep. 4 th	220	17.0	131	48.9	5.92	-37.3	3.294	5.1	4.78	-34.6	3.35	-52.4	22.1	5.9
5.	Sep. 14 th	228	21.3	151	71.6	4.67	-50.5	3.379	7.8	4.01	-45.1	2.32	-67.0	32.3	5.7
6.	Sep. 24 th	232	23.4	164	86.4	4.02	-57.4	3.433	9.5	3.62	-50.5	2.02	-71.3	40.8	5.5
7.	Oct. 4 th	232	23.4	176	100.0	3.94	-58.3	3.490	11.3	3.50	-52.1	1.96	-72.2	44.7	5.4
8.	Oct. 14 th	228	21.3	182	106.8	3.94	-58.3	3.550	13.2	3.54	-51.6	1.96	-72.2	46.2	5.2
9.	Oct. 24 th	222	15.6	186	100.0	3.98	-54.9	3.622	15.1	3.57	-48.2	1.99	-69.1	46.7	5.2
Muscat de Hamburg															
1.	Aug. 5 th	256	0.0	96	0.0	11.02	0.0	3.057	0.0	6.01	0.0	5.48	0.0	8.7	8.0
2.	Aug. 15 th	267	4.3	113	17.7	10.53	-4.4	3.097	1.3	5.93	-1.3	5.22	-4.7	10.7	8.9
3.	Aug. 25 th	304	18.8	132	37.5	9.39	-14.8	3.148	3.0	5.75	-4.3	4.45	-18.8	14.1	8.1
4.	Sep. 4 th	335	30.9	160	66.7	7.34	-33.4	3.321	8.6	5.24	-12.8	3.53	-35.6	21.8	7.4
5.	Sep. 14 th	340	32.8	186	93.8	6.02	-45.4	3.396	11.1	4.52	-24.8	2.78	-49.3	30.9	6.8
6.	Sep. 24 th	346	35.2	202	110.4	4.91	-55.4	3.492	14.2	3.93	-34.6	2.30	-58.0	41.1	6.1
7.	Oct. 4 th	363	41.8	208	116.7	4.45	-59.6	3.547	16.0	3.63	-39.6	2.15	-60.8	46.7	5.6
8.	Oct. 14 th	365	42.6	212	120.8	4.46	-59.5	3.568	16.7	3.52	-41.4	2.12	-61.3	47.5	5.0
9.	Oct. 24 th	362	40.3	216	111.8	4.50	-58.7	3.581	16.5	3.60	-39.5	2.15	-59.9	48.0	4.7

Table 4

Grape maturation dynamics at *Tamina* and *Alphonse Lavallée* varieties from Viile area of Bujoru Wine Centre, from Dealu Bujorului vineyard, in the harvesting year 2014 (age of plantation = 7 years)

No.	Test date	Mass of 100 berries		Total sugars		Titratableacidity		Real Acidity (pH)		Tartaric acid		Malic acid		Gluco- -acidic indic. (l _M)	Condu ctivity (X) (mS/ cm)
		g/L	δ _r (%)	g/L	δ _r (%)	g/L C ₄ H ₆ O ₆	δ _r (%)		δ _r (%)	g/L	δ _r (%)	g/L	δ _r (%)		
Tamina															
1.	Aug. 5 th	273	0.0	56	0.0	12.76	0.0	2.864	0.0	6.68	0.0	4.10	0.0	4.4	7.7
2.	Aug. 15 th	306	12.1	62	10.7	12.84	0.6	2.891	0.9	6.73	0.7	4.16	1.5	4.8	7.2
3.	Aug. 25 th	359	31.5	70	25.0	11.96	-6.3	2.883	0.7	6.18	-7.5	3.94	-3.9	5.9	6.7
4.	Sep. 4 th	405	48.4	93	66.1	9.78	-23.4	3.049	6.5	5.25	-21.4	3.61	-12.0	9.5	6.3
5.	Sep. 14 th	439	60.8	114	103.6	6.83	-46.5	3.180	11.0	4.21	-37.0	3.22	-21.5	16.7	5.9
6.	Sep. 24 th	487	78.4	128	128.6	5.66	-55.6	3.239	13.1	3.83	-42.7	3.13	-23.7	22.6	5.7
7.	Oct. 4 th	537	96.7	139	148.2	5.05	-60.4	3.294	15.0	3.53	-47.2	3.00	-26.8	27.5	5.4
8.	Oct. 14 th	551	101.8	149	166.1	4.69	-63.2	3.425	19.6	3.42	-48.8	2.90	-29.3	31.8	5.2
9.	Oct. 24 th	550	101.5	158	182.1	4.67	-63.4	3.476	21.4	3.45	-48.4	2.90	-29.3	33.8	5.1
Alphonse Lavallée															
1.	Aug. 5 th	535	0.0	65	0.0	8.51	0.0	3.044	0.0	5.16	0.0	4.85	0.0	7.6	7.5
2.	Aug. 15 th	573	7.1	77	18.5	8.05	-5.4	3.076	1.1	5.01	-2.9	4.61	-4.9	9.6	7.2
3.	Aug. 25 th	612	14.4	98	50.8	6.83	-19.7	3.132	2.9	4.61	-10.7	3.79	-21.9	14.3	7.0
4.	Sep. 4 th	672	25.6	109	67.7	5.14	-39.6	3.332	9.5	3.85	-25.4	2.72	-43.9	21.2	6.8
5.	Sep. 14 th	752	40.6	115	76.9	4.12	-51.6	3.552	16.7	3.24	-37.2	2.09	-56.9	27.9	6.7
6.	Sep. 24 th	815	52.3	124	90.8	3.80	-55.3	3.597	18.2	3.04	-41.1	1.70	-64.9	32.6	6.7
7.	Oct. 4 th	831	55.3	136	109.2	3.60	-57.7	3.612	18.7	2.90	-43.8	1.58	-67.4	37.8	6.7
8.	Oct. 14 th	840	57.0	142	118.5	3.45	-59.5	3.632	19.3	2.83	-45.2	1.50	-69.1	41.2	6.8
9.	Oct. 24 th	843	57.8	145	123.1	3.42	-59.8	3.652	20.0	2.82	-45.3	1.49	-69.3	42.4	6.9

Electrical conductivity (X) expressed in mS/cm decreased from values between 6.7 (Chasselas doré) and 8.8 (Muscat of Hamburg) on the 5th of August, to values between 3.7 (Italia) and 6.9 (Alphonse Lavallée) on the 24th of October.

Based on the data presented in Tables 2-4, Fig. 1 illustrates the graphical evolution of the mass of 100 berries during grape maturation. We can see that the grape varieties studied reached full maturity on the following days: 29th of September (Chasselas doré); 9th of October, (Muscat of Hamburg); 14th of October (Italia); 19th of October (Victoria, Tamina; Alphonse Lavallée).

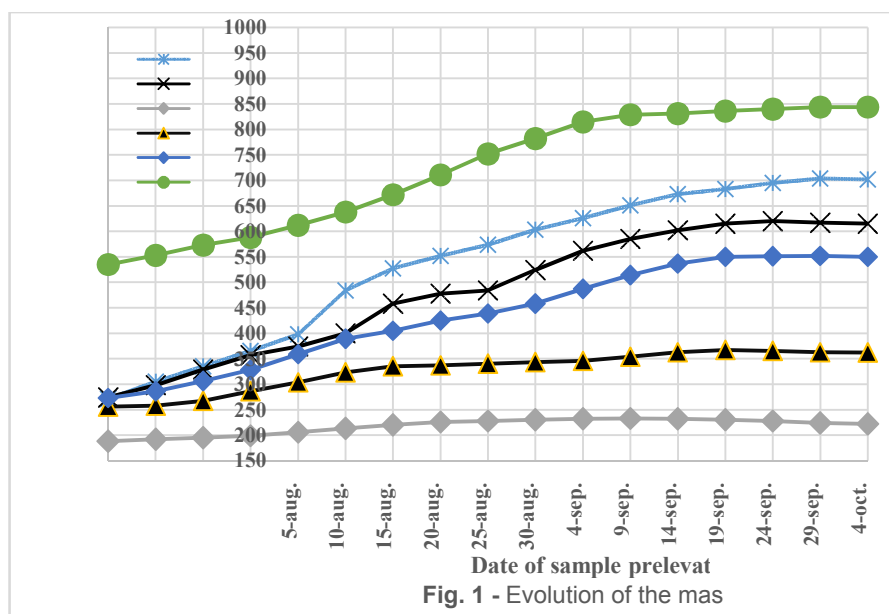


Fig. 1 - Evolution of the mas

The data referring to the beginning of consumption time for fresh grapes from the varieties studied are presented in Table 5. Consequently, the grapes were good to be harvested for consumption as follows: those from Muscat of Hamburg variety on the 25th of August, when the total sugar content was 132 g/L, the titratable acidity was 9.39 g/L $C_4H_6O_6$, and the value of glucose-acidic indicator was 14.1; those from Chasselas doré and Italia varieties on the 4th of September, when the total sugar content was 131 g/L, and 138 g/L, respectively, the titratable acidities were 5.92 and 6.72 g/L $C_4H_6O_6$, and the values of glucose-acidic indicator were 22.1 and 20.5; those from Victoria variety on the 19th of September, when the total sugar content was 132 g/L, the titratable acidity was 4.57 g/L $C_4H_6O_6$, and the value of glucose-acidic indicator was 25.1; those from Alphonse Lavallée and Tamina varieties on the 29th of September, when the total sugar content was 130 g/L and 133 g/L, respectively, the titratable acidities were 3.73 and 5.32 g/L $C_4H_6O_6$, and the values of glucose-acidic indicator were 34.9 and 25.0.

Most of the data presented above do not agree completely with the literature (Țârdea and Rotaru, 2003, Rotaru *et al.*, 2011), which defines the maturation time (II-VI)

as follows: II (August 1st–15th for Victoria variety); III (August 16th–31st for Chasselas doré variety); IV (September 1st–15th for Muscat of Hamburg and Alphonse Lavallée varieties); V (September 16th–31st for Tamina variety); VI (October 1st–15th for Italia variety).

Table 5

Data referring to the beginning of consumption time at the varieties studied

No	Variety	Test date	Total sugars (g/L)	Titratable acidity (g/L C ₄ H ₆ O ₆)	Glucose acidific. (I _M)	Maturation time	
						fore-seen	real
1.	Victoria	Sep. 19 th	132	4.57	25.1	II	V
2.	Italia	Sep. 4 th	138	6.72	20.5	VI	IV
3.	Chasselasdoré	Sep. 4 th	131	5.92	22.1	III	IV
4.	Muscat of Hamburg	Aug. 25 th	132	9.39	14.1	IV	III
5.	Tamina	Sep. 29 th	133	5.32	25.0	V	V
6.	Alphonse Lavallée	Sep. 29 th	130	3.73	34.9	IV	V

This disagreement can be mainly due to greater productions of grapes for the varieties analysed, and also to the climatic conditions of the year we studied.

CONCLUSIONS

The results obtained, both from the quantitative aspect of grape production, and from the qualitative aspect of their composition characteristics, reflect the influences of the climatic conditions, generally favourable, of the year we studied.

The temperature increase during both vine vegetation period and grape maturation period was favourable to the accumulation of sugars for fresh consumption.

The aspects mentioned above, corroborated with the technological ones, proved insufficient for making most of the varieties studied fit to the maturation time specified in the literature.

This imperiously requires to conduct new studies regarding the evaluation of the maturation time, and to mark the limits of the areas with table grape varieties.

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