STUDIES OF THE INFLUENCE OF CLIMATIC CHANGES ON SOME GRAPE VARIETIES FOR WHITE WINES IN MOLDAVIAN VINEYARDS

CERCETĂRI PRIVIND INFLUENȚA MODIFICĂRILOR CLIMATICE ASUPRA UNOR SOIURI PENTRU VINURI ALBE CULTIVATE ÎN PODGORIILE MOLDOVEI

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Abstract: *Global warming has multiple effects and represents an important stress on the vine plant. Small amounts of rain, extreme negative and positive temperatures at a too short time intervals, all increase the bad influence of the ever-changing climate, leading to shortening the phenophses period, hastening grape maturation, with positive and negative implications. This article presents, in a comparative manner, the compositional characteristics of wines obtained from grapes harvested from Moldovian vineyards (Iasi, Contari and Targu Bujor) from three consecutive years 2010, 2011 and 2012.*
Key words*: climatic changes, white wines, viticultural regions*

Rezumat: *Incălzirea globală, din ce în ce mai vizibilă datorită efectelor sale multiple, reprezintă un stress important asupra viței de vie. Precipitațiile reduse, temperaturile negative şi pozitive extreme ce se succed la intervale reduse de timp, toate sporesc influenta nefastă a climatului în continuă schimbare şi conduc la scurtarea fenofazelor de vegetatie, precipitând maturarea strugurilor, cu implicații semnificative, în sens pozitiv, dar şi negativ. În lucrare sunt prezentate comparativ caracteristicile de compozitie ale vinurilor obtinute din struguri recoltati din podgoriile Moldovei (Iasi, Cotnari, Dealurile Bujorului), sub influența modificărilor climatice din ultimii trei ani, 2010, 2011 si 2012.*
Cuvinte cheie *: modificari climatice, vinuri albe, regiuni viticole*

INTRODUCTION

Climate generally constrains a given variety's optimum ripening conditions to a narrow geographic zone, putting the grapevines at a greater potential risk from climatic variations and change than crops with a broader geographic range (Jones, 2005). Furthermore, wine has developed as a key economic sector with broad historical, social, and cultural identity (Tate, 2001) derived from grape growing and production (e.g., the Moldavian Hills region, Romania). Based on the cultural and economic importance of viticulture, extensive evidence of historical responsiveness to climate change and the

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potential impacts that may come from future climate change, this research studies the nature and trends of climate (Rotaru et al., 2013) and wine quality for the three most important vineyards in the North-Eastern part of Romania.

MATERIAL AND METHOD

Three North-Moldavian vineyards (Iasi, Cotnari and Targu Bujor) and wines obtained from four grape varieties (Frâncuşă, Fetească regală, Grasă de Cotnari and Tamaioasa romaneasca) were taken into study during 2010-2012 viticultural years.

RESULTS AND DISCUSSIONS

A comparative evaluation of the wines obtained during the three study years was done in order to underline the influence of the *terroir* on the final viticultural product: wine.

The Feteasca regala wines (table 1) have high alcoholic concentrations, ranging between 11,02% (Feteasca regala Tg. Bujor 2012) and 14,98% vol. (Feteasca regala Tg. Bujor 2011), thus classifying as quality wines. The values of reductive substances are as follows: 1,05 g/L Feteasca regala Tg. Bujor 2012 – 46,59 g/L Feteasca regala Iasi 2010; except the wines obtained from Feteasca regala in Iasi vineyard, harvest of 2010 and 2011, all other wines are dry. The values of the non-reductive extract vary between 11,31 g/L (Feteasca regala Iasi 2010) and 20,92 (Feteasca regala Tg. Bujor 2012); all, except Feteasca regala Iasi 2010 wines, are wines of superior quality.

Table 2 presents the values of the compositional characteristics of Francusa wines from Iasi and Cotnari vineyards, during 2010-2012. The total acidity of Francusa wines is equilibrated, with values between 6,03 (Francusa Cotnari 2012) and 10,56 g/L $C_4H_6O_6$ (Francusa Cotnari 2011).

The alcoholic concentration has values ranging from 9,71% (Francusa Cotnari 2012) and 12,92 (Francusa Iasi 2011); the lower alcoholic concentrations than those of the previous samples are a results of the early harvesting because of unfavourable climatic conditions. Francusa wines are also dry, ranging between 0,72 (Francusa Iasi 2011) – 1,26 g/L (Francusa Iasi 2012) reductive substances, except the sample Francusa Iasi 2010, with 18,21 g/L fermentiscible sugars. The values of the non-reductive extract of Francusa wines has values between 18,79 (Francusa Iasi 2010) and 23,79 g/L (Francusa Cotnari 2010); this serves as proof for classifying the variants as quality wines, according to the Romanian legislation.

Table 3 presents the main compositional characteristics of the wines obtained from Grasa de Cotnari variety during 2010 -2012 in Iasi and Cotnari vineyards.

Table 4 registers the values of the main physical-chemical characteristics of Tamaioasa romaneasca wines during 2010 -2012 in Iasi and Cotnari vineyards.

The values of the alcoholic concentration are specific to this type of wines, describing the oenological potential of this grape variety, ranging between

10,96% (Grasa de Cotnari, Cotnari 2010) and 14,44% vol. alcohol (Grasa de Cotnari, Iasi 2011).The Grasa de Cotnari wines have concentrations of the reductive substances lower than 4 g/L, except the ones obtained in Iasi vineyard in 2010 and 2011; in these two years, demidry wines were obtained with values of remanent sugars between 4,23 and 8,34 g/L. The values of the non-reductive extract is similar to the other wines, ranging between 18,67 (Grasa de Cotnari, Iasi 2011) – 28,73 g/L (Grasa de Cotnari, Cotnari 2012), while the other results are close to 22 g/L, the normal values for this type of wine.

Table 1

Main compositional parameters of Fetească regala wines

Vineyard	Vol. acidity (g/L $C_2H_4O_2$)	Total acidity (g/L $C_4H_6O_6$)	Alc.conc. (% vol.)	Relative density	Reductive subst. (g/L)	N.E. g/L	T.D.E. g/L	Free SO_2 (mg/L)	Total SO_2 (mg/L)
Iasi 2010	0,33	7,39	11,08	1,0076	46,59	11,31	57,9	23,69	94,12
Tg. Bujor 2010	0,53	7,1	12,7	0,9913	1,42	19,18	20,6	61,27	129,18
Iasi 2011	0,23	7,77	13,79	0,99185	7,02	18,23	25,30	22,24	61,24
Tg. Bujor 2011	0,18	7,05	14,98	0,98925	1,68	20,22	21,90	21,02	65,81
Iasi 2012	0,27	5,78	12,29	0,99293	2,58	20,92	23,50	26,41	195,29
Tg. Bujor 2012	0,31	5,81	11,02	0,99394	1,05	21,15	22,20	24,58	155,32

Table 2

Main compositional parameters of Francusa wines

Vineyard	Vol. acidity (g/L $C_2H_4O_2$)	Total acidity (g/L $C_4H_6O_6$)	Alc.conc. (% vol.)	Relative density	Reductive subst. (g/L)	N.E. g/L	T.D.E. g/L	Free SO_2 (mg/L)	Total SO_2 (mg/L)
Iasi 2010	0,28	7,97	11,21	0,9993	18,21	18,79	37	19,58	85,59
Cotnari 2010	0,25	10,56	8,43	0,998	1,01	23,79	24,8	74,85	129,49
Iasi 2011	0,19	9,34	12,92	0,99148	0,72	20,88	21,60	24,07	57,58
Cotnari 2011	0,19	7,58	11,43	0,99303	0,74	20,36	21,10	27,11	55,14
Iasi 2012	0,22	6,72	11,14	0,99316	1,26	19,46	20,90	25,06	153,18
Cotnari 2012	0,19	6,03	9,71	0,99454	0,94	18,86	19,80	40,68	147,29

Table 3

Main compositional parameters of Grasa de Cotnari wines

Vineyard	Vol. acidity (g/L $C_2H_4O_2$)	Total acidity (g/L $C_4H_6O_6$)	Alc.conc. (% vol.)	Relative density	Reductive subst. (g/L)	N.E. g/L	T.D.E. g/L	Free SO_2 (mg/L)	Total SO_2 (mg/L)
Iasi 2010	0,33	9,17	12,33	0,9958	8,37	22,93	31,3	16,11	96,33
Cotnari 2010	0,4	9,6	10,96	0,9947	2,08	22,12	24,2	38,22	134,23
Iasi 2011	0,25	7,24	14,44	0,99029	4,23	18,67	22,90	7,92	42,04
Cotnari 2011	0,26	8,73	12,57	0,99236	0,77	22,13	22,90	34,73	73,42
Iasi 2012	0,31	5,75	13,45	0,99301	3,96	23,14	27,10	14,49	183,22
Cotnari 2012	0,27	7,23	12,47	0,99513	0,97	28,73	29,70	33,58	163,38

Analysing the data in table 4, the total acidity of Tamaioasa romaneasca wine samples registers values between 5,72 (Tamaioasa romaneasca Cotnari 2012) and 10,32 g/L $C_4H_6O_6$ (Tamaioasa romaneasca Iasi 2010). 2010 was

characterised by colder climatic parameters, so the wines obtained have higher total acidities. Except the Tamaioasa romaneasca sample from 2010 from Cotnari vineyard, with only 9,13% vol., all the other wines with over 12,5% vol. The Tamaioasa romaneasca Iasi 2012 sample has 14,12% vol. alcohol, close to liqueur wines. As with the other wine samples from this study, the Tamaioasa romaneasca variants are mostly dry [0,69 (Tamaioasa romaneasca Cotnari 2011) – 3,91 g/L reductive sugars (Tamaioasa romaneasca Iasi 2012)] except one wine obtained in Iasi in 2010, with 5,14 g/L non-fermented sugars. The values for the non-reductive extract are higher compared to the other analysed samples, ranging between 20,61 (Tamaioasa romaneasca Cotnari 2010) – 26,86 g/L (Tamaioasa romaneasca Iasi 2010).

Table 4

Main compositional parameters of Tamaioasa romaneasca wines

Vineyard	Vol. acidity (g/L $C_2H_4O_2$)	Total acidity (g/L $C_4H_6O_6$)	Alc.conc. (% vol.)	Relative density	Reductive subst. (g/L)	N.E. g/L	T.D.E. g/L	Free SO_2 (mg/L)	Total SO_2 (mg/L)
Iasi 2010	0,41	10,32	12,67	0,9958	5,14	26,86	32	30,64	129,18
Cotnari 2010	0,47	10,08	9,13	0,9963	2,09	20,61	22,7	107,7	255,51
Iasi 2011	0,23	7,81	12,97	0,99180	1,96	20,74	22,7	14,93	73,42
Cotnari 2011	0,42	8,81	12,75	0,99248	0,69	23,16	23,85	41,02	78,15
Iasi 2012	0,31	5,95	14,12	0,99294	3,91	24,99	28,90	8,36	189,57
Cotnari 2012	0,40	5,72	13,27	0,99389	2,52	26,38	28,90	28,70	175,84

CONCLUSIONS

High-quality wine regions create unique physical and cultural landscapes that, through production, processing, trade, and tourism industries, are a vibrant component of local economies. While the exact magnitude and rate of future climate change is uncertain, any change can greatly impact the narrow geographical limits of high-quality production viability and will likely bring about related changes in suitable grape varieties, regional wine styles, and regional cultures. To prepare for the future, the wine industry should integrate planning and adaptation strategies to adjust accordingly.

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