

STUDIES ON THE ADAPTABILITY OF LOCAL GENOTYPES VINE TO CLIMATE CHANGE IN COPOU-IAȘI VINEYARD ECOSYSTEM

STUDII PRIVIND ADAPTABILITATEA UNOR GENOTIPURI AUTOHTONE DE VIȚĂ DE VIE LA SCHIMBĂRILE CLIMATICE DIN ECOSISTEMUL VITICOL COPOU- IAȘI

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Abstract. *The promote of domestic production of vine varieties less vulnerable to climate change is a role to the scientific research that may help to improve the wine assortment by creating new genotypes. In the year 2012, characterized by severe frosts and by very dry and hot weather, six new genotypes were studied, Gelu, Mara, Fetească Regala cl.1Is, Sauvignon 12.9.5., Cabernet Sauvignon 16.6.9. and Golia, or pending the approval in terms of resistance to the cumulative effects of stressful environmental factors, of production and quality. The results obtained revealed that most of them were affected by the climatic factors, droughts leading to yellowing the leaves, the partial drying of the vines, a slow vegetative growth and ultimately, in obtaining lower production than the potential of every known variety. There have proven less vulnerable genotypes: Golia, clonal elites Sauvignon 12.9.5. and Cabernet Sauvignon 16.6.9., which are pending omologation.*

Key words: *genotype, adaptability, climate, resistance*

Rezumat. *Promovarea în producție a unor soiuri autohtone de viță de vie mai puțin vulnerabile la schimbările climatice constituie o preocupare a cercetării științifice, care poate contribui, prin crearea de noi genotipuri la îmbunătățirea sortimentului viticol. În anul 2012, caracterizat prin geruri aspre, foarte secetos și vreme caniculară, au fost studiate șase genotipuri noi, Gelu, Mara, Fetească regală cl.1 Iș, Sauvignon 12.9.5., Cabernet Sauvignon 16.6.9. și Golia, sau în curs de omologare sub aspectul rezistenței la efectul cumulativ al factorilor de mediu stresanți, ai producției și calității acesteia. Rezultatele obținute au scos în evidență faptul că majoritatea acestora au fost afectate de îngheț iar seceta a condus la îngălbenirea frunzelor, uscarea parțială a butucilor și la obținerea unor producții mici sub potențialul cunoscut al fiecărui soi. S-au dovedit mai puțin vulnerabile genotipurile: soiul Golia, elitele clonale Sauvignon 12.9.5. și Cabernet Sauvignon 16.6.9., ce sunt în curs de omologare.*

Cuvinte cheie: *genotip, adaptabilitate, climat, rezistență*

INTRODUCTION

The climatic factors level influence the main biological processes,

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conditioning the grape production and the behavior at biotic and abiotic factors, diminishing the quality and quantity of crops and damaging the vine trunks in vineyards as a result of harsh winter frosts and the destructive effect of spring frosts causing significant losses to viticultural patrimony. (Calistru et. al., 1998; Doina Damian et al., 1995; Gagea et. al., 1991). The damages can be increase when these phenomena are followed by prolonged drought and lack of irrigation possibilities. In Copou vineyard ecosystem, the climate changes which are manifested throughout the world, have led to a heating of the weather, a visible decrease in rainfall and a higher frequency of occurrence of winter frosts. In 2012, in the presence of those factors, was possible to study the genotypes vine, new varieties, clones and elites in the process of homologation due to the cumulative action of climatic factors risk in terms of winter hardiness, production and quality, in order to determined the adaptability to the specific conditions of the ecosystem.

MATERIAL AND METHOD

The research was conducted in Iasi SCDVV biological fields on the table grape genotypes, Gelu and Mara, which were compared to selected variety Coarnă neagră and on the white and red wine varieties Golia, Fetească regală 1 Iș clone, Sauvignon 12.9.5. elite clone, Cabernet Sauvignon 16.6.9. elite clone which all were compared to Fetească regală variety. Experimental plantations, under full capacity of production are located on a chernozem plateau with southeastern exhibition. Planting distances used were 2.2 m / 1.2 m, ensuring a density of 3787 vines / ha. Was performed the culture system on stems of 70-80 cm height, vines were led to the bilateral cordon and the cutting system performed was the short cane of 2-3 eyes, ensuring a load of fruit of 25-35 buds / vine for table varieties and 45-50 buds / vine for wine varieties. At the basis of the vine were preserved safety buds with the aim to regenerate the vine trunk in case of a freeze, protected by the mound in winter time.

To establish the vulnerability of studied genotypes on unfavorable climatic factors and their degree of adaptability on the ecosystem condition, the research focused on the following elements: monitoring the climatic factors by meteorological station AGROEXPERT and determining their level, wintering resistance, phenological spectrum covering in direct correlation with climatic factors, fertility and productivity, production and quality.

RESULTS AND DISCUSSIONS

The climate monitoring of viticultural ecosystem Copou-Iasi, in 2012, shows the presence of stress climatic factors which have conditioned the biological processes of the vine. From their analysis, it is found that the minimum and maximum average temperatures in winter were very low, resulting frosty periods (Table 1). In February, temperatures have decreased below the minimum resistance of grapevine, respectively -26.7°C in air and -33.0°C at the surface of the soil, and temperatures below -20°C were maintained 5 days consecutively.

The average diurnal temperatures were lower (-9.3°C compared to -1.9°C the normal of February) and the daily maximum values between -10.4°C and -14.9°C were emphasized the phenomenon of frost. Spring was cold, with negative temperatures at the beginning of March and then increased towards the end of

April. During May, the values approached to the normal years. Accumulated rainfall in April-May were plentiful, totaling 147.2 mm at which were added about 61 mm from solid precipitation.

Table 1

**Values of the main climatic elements registered in 2012
In Iași-Copou Vineyard Center**

Month	Temperatures °C, air			Temperatures °C, soil			Amount degrees of temperature, °C			Hygros-copcity %	Precip itation mm	Heat stroke, hours
	aver age	max	min	aver age	max	min	global	activ	useful			
I	-2,8	11,8	-17,9	-3,2	10,7	-21,8				81	12,3	99,8
II	-9,3	7,2	-26,7	-11,1	1,5	-33,0				80	61,0	150,1
III	3,8	20,4	-9,5	3,4	33,8	-8,6				65	15,8	157,6
IV	12,9	30,0	-1,5	14,2	51,5	-1,9	387,3	340,1	120,1	62	66,2	187,2
V	17,7	31,0	6,3	22,5	56,4	6,1	548,4	548,4	238,4	63	85,0	217,9
VI	22,3	36,0	11,6	29,5	66,8	7,5	670,2	670,2	370,2	56	26,2	314,7
VII	25,4	38,0	14,0	33,3	68,0	10,5	788,7	788,7	478,7	49	29,5	334,4
VIII	22,6	40,1	10,6	26,3	61,2	6,8	700,8	700,8	390,8	53	33,9	227,3
IX	18,6	30,5	8,4	21,3	49,7	4,2	557,4	548,1	258,1	57	46,4	217,6
X	11,7	28,0	0,4	12,1	39,5	-1,8				75	55,2	121,7
XI	6,0	18,6	-2,5	5,8	25,5	-3,8				84	26,8	76,1
XII	-3,8	9,4	-13,7	-4,6	8,9	-21,0				88	77,6	65,1
Total	10,4			11,6			3652,8	3596,3	1856,3	68	535,9	2169,8

The summer of 2012 was estimated to be very warm, extreme hot and very dry. Daily average temperatures of summer months had high values of 22.3°C in June, 25.4°C in July and 22.6°C in August, with 2-4°C over specific multiannual average of this season. Absolute maximum temperature was 40.1°C in August and in July for 25 days exceeded 30°C, of which 13 days with temperatures above 35°C.

The drought has been settled at the beginning of June, the rainfall were very low in all summer months accumulating just 89.6 liters and the total number of days of rain was 29 of which only two were useful rains above 10 mm, the lack of rainfall leading to atmospheric and pedologic drought installation. Autumn season, also starts with the same warm weather, with average daily temperatures of 18.6°C and absolute maximum of 30.5°C. Analyzing the vineyard climate during the growing season, it can be concluded that in terms of average monthly temperatures, average, minimum and maximum absolute values was a normal and warm springtime, while the summer was very hot and dry. It was a warm autumn, favorable to a good maturation of the grapes. Active and useful global heat balance showed high values, respectively 3652.8°C, 3592.3°C to 1856.3°C. The amount of precipitation during the growing season of 287.6 mm was below the consumption needs of grapevine, during this period the number of days with useful rains (> 10 mm) was 5. Real heatstroke, expressed in number of hours of sun shine was 1449.1.

Under the influence of cumulative stress climatic factors, the studied genotypes were manifested differently depending on each specific genetics. Obtained results regarding the genotypes vulnerability at low (extreme)

temperatures action, assessed by winter bud viability analysis showed a good and very good resistance at Golia variety created at SCDVV Iași, where the losses were within with the ones of a normal thermal year, respectively 17% on the 12 buds length cane (Table 2) it can be an alternative to avoid crop losses caused by frost.

Table 2

**Winter buds viability of studied genotypes
In Iași-Copou Vineyard Center**

No.	Variety	No. examined eyes	% viable buds – poztion on the cane								
			1 - 3			1 - 6			1 - 12		
			P	S	P + S	P	S	P + S	P	S	P + S
1	Golia	72	83	100	100	83	100	100	83	100	100
2	Gelu	65	31	94	94	18	94	94	19	94	94
3	Cabernet Sauvignon 16.6.9	62	61	100	100	64	100	100	50	100	100
4	Mara	60	6	72	72	6	61	61	7	62	62
5	Sauvignon 12.9.5	58	72	100	100	78	100	100	86	100	100
6	Fetească regală cl 1Iș	64	67	100	100	64	100	100	53	100	100

A good behavior had clonal elites Sauvignon 12.9.5., Cabernet Sauvignon 16.6.9. and royal Fetească 1 Is, at which the main buds losses were 23-39% on the cane position 1-3, being assessed as favorable for Copou - Iasi vineyard ecosystem conditions. On the opposite side, grape varieties for table Mara and Gelu had significant losses which ranged between 61și 94% primary frozen buds.

Regarding the dynamic of phenological spectrum, was found that analyzed genotypes have completed the vegetation phenophases differently according to each hereditary specificity, being conditioned by the evolution and the level of climatic factors (Table 3).

As a phenophase that mark the beginning of active vegetation, budbursting took place from 26th April to 2th May, within a interval of 6 days, with small difference between varieties, starting with Gelu and Fetească regală 1 Iș varieties (26th April) and ending with Mara variety (2th May) in terms of active thermal balance between 233.2°C - 364.3°C. Under the action of high temperatures in late May, the flowering has been exceeded with three weeks, from 25th May (Fetească regală) until 8th June (Cabernet Sauvignon 16.6.9.), when were accumulated between 459.0°C - 711.1°C active temperatures and between 199.0°C - 321.1°C useful temeratures. Grapes véraison was marked by Gelu variety (15th July) with 10 days earlier than witness variety Selected Coarnă neagră (25th July) due the active temperatures between 986.9°C -1438°C and useful temperatures between 576.9°C - 808°C which rushed grapes véraison with about 10 days earlier than the normal climatic years. Grapes ripening was advanced with two weeks under the action of high temperatures and took place between 23th August - 13th September for table grape varieties and from 5th - 13th September for wine varierties. The leaf fall occurred during 31th October to 5th November.

Active and useful thermal balance values calculated for each phenological stage show that all genotypes studied received a warm climate favorable for grapes ripening and for achieving the quality parameters.

Table 3

**Phenological cycle of the grapevines - 2012
in Iași-Copou Vineyard Center**

Variety	Phenological stages											
	Budburst			Flowering			Veraison			Grape maturity		
	Data	Ta, °C	Tu, °C	Data	Ta, °C	Tu, °C	Data	Ta, °C	Tu, °C	Data	Ta, °C	Tu, °C
Gelu	26.04	233,2	63,2	04.06	711,1	321,1	15.07	986,9	576,9	23.08	936,5	519,9
Mara	02.05	364,3	134,3	28.05	459,0	199,0	27.07	1389,4	789,4	13.09	1068,8	588,7
Coarnă neagră select (ct*)	02.05	364,3	134,3	01.06	524,2	199,0	25.07	268,6	728,6	13.09	1124,4	624,3
Golia	29.04	292,1	92,1	06.06	700,2	320,2	31.07	1331,9	781,9	05.09	810,2	450,5
Fetească regală cl 1Is	26.04	233,2	93,2	25.05	541,5	251,5	24.07	1358,4	758,4	12.09	1130,6	630,5
Sauvignon cl 12.9.5	30.04	316,1	106,0	06.06	572,5	306,3	28.07	1117,6	714,3	06.09	917,8	517,7
Cabernet Sauvignon cl 16.6.9.	30.04	316,1	106,0	08.06	572,5	306,3	01.08	1322,9	795,1	13.09	934,1	504,0
Fetească regală (ct)	26.04	233,2	62,1	25.05	541,5	251,5	27.07	1438,0	808,0	12.09	1210,2	581,0

*ct - control

Grape production achieved by studied genotypes show that Golia variety with increased resistance to frost produced over 10 t/ha, almost double against the witness (5.25 t/ha) followed by Sauvignon 12.9.5. elite with 2.82 kg/vine, respectively 10.68 t/ha and Cabernet Sauvignon 16.6.9. elite with 2.50 kg/vine and 9.50 t/ha, qualities which are recommended for approval and culture expansion. New table grape variety Mara achieved 3.24 kg/vine, respectively 12.3 t/ha, statistically ensured very significant, and Gelu variety achieved 2.4 kg / vine and 9.1 t/ha with an increase of harvest significantly distinct from the control (table 4).

Harvest quality assessed by the average mass of grapes, mass and volume of 100 berries, sugar content and total acidity, reflects the influence of climatic factors on the value of these items. All studied genotypes realized smaller grape, smaller berry weight and volume. Gelu variety had higher values (200 g/grape) then the witness. With Cabernet Sauvignon 16.6.9 elite exception (142 g/grape), the other grape genotypes made grapes far below from each own specific. The high level of temperatures and the low amount of precipitation during the grapes ripening have positively affected the sugar accumulation in must, all varieties achieved high concentrations of sugars ranging between 168 and 230 g/L for table varieties and between 182 and 230 g/L for wine varieties.

Under the action of the same factors, total acidity of must was reduced for table varieties (2.1 to 3.2 g/L H₂SO₄) as well for wine varieties (3.3 to 3.9 g/L H₂SO₄).

Corroborating the values of quality and production elements with the climatic conditions of the reference year, can be considered as being more tolerable at cumulative action of stress climatic factors the following genotypes: Mara, Golia, Fetească regală 1 Iș and Cabernet Sauvignon 16.6.9.

Table 4

Grapes production and quality, in Iași-Copou Vineyard Center

Variety	Production		Commodity production	Average weight grape	100 berries weight	100 berries volume	Sugars	Total acidity
	kg/vine	t/ha	%	g	g	cm ³	g/L	g/L H ₂ SO ₄
Gelu	2,4 ^{***}	9,1	80	200	318	300	168	2,1
Mara	3,24 ^{***}	12,3	85	130	202	160	230	3,2
Coarnă neagră select. (control)	1,15	4,35	78	180	280	260	160	3,9
Golia	2,84	10,75	-	47	70	35	197	4,2
Fetească regală 1 Iș	1,8	6,82	-	78	110	102	238	3,4
Sauvignon 12.9.5.	2,82	10,68	-	63	87	80	182	3,3
Cabernet Sauvign. 16.6.9.	2,5	9,46	-	142	87	80	209	3,9
Fetească regală (control)	2,10	7,95	-	66	102	98	212	3,6

DL – grapes table production

5% - 0,84;

1% - 1,20;

0,1%- 1,76

DL – wine variety production

5% - 0,91

1% - 1,25

0,1%- 1,72

CONCLUSIONS

1. The year 2012 was characterized by very cold winter, cold and rainy spring and hot and dry summer.

2. Very low temperatures caused loss of fruit buds in a large percentage 61-94% for table grapes and 23-39% for wine varieties.

3. Phenophases of vegetation were brought forward with 10-15 days depending on the specific hereditary of varieties.

4. Showed a greater adaptability at ecosystem conditions the following genotypes: Golia, Fetească regala 1 Iș and Cabernet Sauvignon 16.6.9.

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