

ECOPHYSIOLOGICAL RESEARCHES ON SOME GRAPEVINE CVS. CULTIVATED IN IASSY AND COTNARI VINEYARDS IN 2011 YEAR

CERCETĂRI ECOFIZIOLOGICE LA UNELE SOIURI DE VIȚĂ DE VIE CULTIVATE ÎN PODGORIILE IAȘI ȘI COTNARI ÎN ANUL 2011

*MARTA Alina Elena¹, JITĂREANU Carmen Doina¹,
SLABU Cristina¹, TOMA Liana Doina¹*
e-mail: martaalinaelena@yahoo.com

Abstract. *In the context of climatic changes that take place on the planet and that are felt more and more in our country, the vines in areas of Moldova have to deal with two major problems: drought and excessive temperatures. Although vine has a great capacity to adapt to extreme conditions of hydrophily or xerophily, the water deficit during the dry years disturbs the main plant physiological processes, having negative effect on vine stock vegetation and their production capacity. In the Iasi and Cotnari vineyards, the growing season of 2011 was characterized by drought conditions caused by strong water deficit in May and July to September. This study analyzed the effect of climatic conditions on quantitative and qualitative parameters of grape production and the dynamics of chlorophyll content in leaves of Frâncușă, Fetească albă, Grasă de Cotnari and Tămâioasă românească vine cvs.*

Key words: vineyard, eco-physiology, photosynthetic pigments

Rezumat. *În contextul schimbărilor climatice care au loc la nivel planetar și care se fac simțite tot mai pregnant și în țara noastră, cultura viței de vie în arealele din Moldova se confruntă cu două probleme majore: seceta și temperaturile excesive. Deși vița de vie are o mare capacitate de adaptare la condiții extreme de hidrofilie sau xerofilie, deficitul de apă din anii secetoși dăunează principalelor procese fiziologice ale plantei, având efecte negative asupra vegetației butucului și a capacității de producție. În podgoriile Iași și Cotnari sezonul de vegetație a anului 2011 s-a caracterizat prin condiții de secetă, provocate de un deficit hidric pronunțat în lunile mai și iulie - septembrie. În lucrare a fost analizat efectul acestor condiții climatice asupra unor parametri cantitativi și calitativi ai producției de struguri, precum și asupra dinamicii conținutului de clorofilă în frunzele soiurilor de viță de vie Frâncușă, Fetească albă, Grasă de Cotnari și Tămâioasă românească.*

Cuvinte cheie: viță de vie, eco-fiziologie, pigmenți fotosintetici

INTRODUCTION

Several research studies have pointed out the importance of photosynthesis in the quantitative and qualitative production of grapevine (Cifre et al., 2005; Lebon et

¹ University of Agricultural Sciences and Veterinary Medicine Iasi, Romania

al., 2008). Photosynthesis is the most sensitive process to the summer drought (Palliotti et al., 2009; Zulini et al., 2005). The stress caused by the lack of water and the water deficit that is closely related to it have severe effects especially when they appear suddenly, when they are extremely intense and accompanied by high temperatures (Cifre et al., 2005; Jităreanu et al., 2011).

The present study focuses on the ecophysiological reaction of certain grapevine varieties, which was determined on the basis of the chlorophyll content in the leaves and in relation to the drought conditions present in the north of Moldavia.

MATERIAL AND METHODS

The researches were conducted in the vegetation season of 2011 on the following grapevine varieties Fetească albă, Grasă de Cotnari, Tămâioasă românească and Frâncușă that were cultivated in Iasi and Cotnari vineyards. The evolution of climatic conditions in January - October was estimated taking into consideration the average value of the temperatures recorded, the monthly minimum and maximum values (°C) as well as the monthly sum of precipitations (mm). These data were related to the normal values registered in Iasi and Cotnari vineyards. The grape production values (kg/stock) and the sugar content in the must (g/l) were used as production indicators.

The ecophysiological reaction was estimated using a photosynthesis parameter, more precisely, the chlorophyll content index in the leaves (CCI), the field method was used and a CCM 200 plus device. These values were recorded in dynamics, during the blooming phenophases, the grapes' growth and maturation.

RESULTS AND DISCUSSIONS

The evolution of climatic conditions in Iasi and Cotnari vineyards

In 2011 the climatic conditions in Iasi vineyard recorded average monthly temperatures higher than the normal, with deviations ranging between 0.1°C in April and 2.3°C in September; the maximum temperatures recorded varied between 31.6 °C in May and 35.5 °C in July. The precipitation quantity showed a monthly sum characterized by a very high hydric deficit in May and July-September. In April and June, the values recorded were very close to normal, the hydric deficit being of only 4.6 mm.

In Cotnari vineyard, the average monthly temperatures recorded were also higher than the normal, with values raging between 0.8°C in April – May and 3.2°C in September. The maximum temperatures ranged between 22.6°C in April and 33.6°C in July. A severe rainfall deficit was recorded in May and August. On the other hand, in June it was registered a precipitation excess of 35.8 mm higher than the normal. Just like in Iasi vineyard, in Cotnari, the months May – August – September 2011 were characterized by severe drought, while in June the rainfall excess from Cotnari vineyard diminished the effects of the drought in July when the hydric deficit was also lower (tab. 1).

The effect of climatic conditions on some production indicators

The climatic conditions of the vegetation season in 2011 have lead to the production of a higher quantity of grapes in Cotnari vineyard than in Iasi vineyard

for all the grape varieties that were analyzed; it was expressed in grape production (kg/stock), the average number of grapes/stock and the average weight of one grape (tab. 2). The quality of the production, expressed by the sugar content in the grapes (g/l) and the glucoacidimetric index was higher especially at the following varieties - Grasă de Cotnari and Tămâioasă românească. At the same time, the mass of 1000 berries (g) was superior in the case of Grasă de Cotnari (tab. 2).

Table 1

Humidity and temperature climatic conditions in Iasi and Cotnari vineyards in 2011

	I	II	III	IV	V	VI	VII	VIII	IX	X
Iasi vineyard										
Temperature °C										
Monthly average	-2,4	-2,3	3,5	10,3	16,7	20,7	22,9	21,6	18,1	8,8
Deviation from normal	-0,7	-1,1	0,1	0,1	0,4	1,0	1,7	1,1	2,3	-1,3
Maximum	10,3	15,3	21,6	24,7	31,6	34,6	35,5	33,1	31,9	28,5
Monthly sum of precipitations (mm)										
Monthly sum	13,2	13,7	8,4	82,2	32,3	84,1	37,8	32,1	18,7	40,2
Deviation from normal	-17,3	-14,7	-24,4	33,1	-26,8	-4,6	-45,0	-24,8	-33,3	7,4
Cotnari vineyard										
Monthly average	-1,3	-2,6	3,5	10,4	16,3	20,0	22,0	21,2	18,7	9,3
Deviation from normal	1,3	-1,3	0,5	0,8	0,8	1,2	1,6	1,2	3,2	+0,8
Maximum	11,2	15,9	19,9	22,6	28,8	32,2	33,6	31,0	29,9	27,1
Monthly sum of precipitations (mm)										
Monthly sum	8,7	28,0	14,0	58,2	12,8	114,4	70,8	13,4	18,0	31,0
Deviation from normal	-12,6	6,6	13,4	8,5	-46,2	35,8	-13,8	-46,3	-26,0	1,8

It can be seen that the thermal factor from the two vineyards taken into consideration respected the optimum ecological requirements for grapevine. The amount of precipitations registered in June diminished the effects of the drought in July for Cotnari vineyard, it being responsible for the production values that are net higher than those registered in Iasi vineyard.

Lebon et al. (2008) point out the role of sugars in the blossoming phase of the grapevine; the decrease of sugars' disponibility disturbs the formation of flowers and their abortion. At the same time, sugars can be seen as signal molecules involved in the stress reaction. The source of sugars is represented by photosynthesis; drought reduces the photosynthetic capacity during summer (Palliotti et al., 2009). Reducing the drought conditions in the flowering phenophase and at the beginning of the growth stage in Cotnari vineyard it was stimulated the apparition of inflorescences and fruits,

reducing the risk of flower abortion; this led to the appearance of a higher number of grapes/stock and implicitly to the growth of grapes production.

At the same time, the temperature and rainfall values from September and October have had a positive effect on the maturation and the quality of the grapes from Cotnari, increasing the sugar content, the glucoacidimetric index and the mass of 100 berries. The highest values were recorded at Grasă de Cotnari variety.

The extreme climatic conditions favored the over-maturation of grapes, bringing about a slow process of sugar and flavor accumulation.

Table 2

Grape production for the grapevine varieties studied in 2011

Variety	Vineyard	Grape production (kg / plant)	Calculated production per hectare (t / ha)	Grapes on the plant (average)	The average-weight of a grape (g)
Fetească albă	Iași	2,77	10,5	26,4	105
	Cotnari	3,02	8,4	30,5	99
Frâncușă	Iași	2,69	10,2	25,8	104
	Cotnari	4,86	13,5	42,2	115
Grasă de Cotnari	Iași	1,19	4,5	8,21	145
	Cotnari	2,98	8,3	13,9	213
Tămâioasă românească	Iași	2,13	8,1	19,0	112
	Cotnari	3,56	9,9	21,8	163
Mean values	Iași	2,19	8,32	19,8	11,6
	Cotnari	2,58	7,02	27,1	14,7

Table 3

Production's quality for the grapevine varieties studied in 2011

Variety	Vineyard	Sugars (g/L)	Weight of 100 grains (g)	Gluco-acidimetric index
Fetească albă	Iași	195	177	48,75
	Cotnari	205	173	48,23
Frâncușă	Iași	211	171	45,37
	Cotnari	220	169	51,40
Grasă de Cotnari	Iași	238	327	58,04
	Cotnari	298	339	71,12
Tămâioasă românească	Iași	181	199	40,67
	Cotnari	231	204	56,47
Mean values	Iași	206,2	218,5	48,21
	Cotnari	238,5	221,2	56,80

The dynamic of chlorophyll content in the leaves of grapevine varieties

The dynamic of chlorophyll content in the leaves of grapevine varieties cultivated at Iasi vineyard during the vegetation period of 2011 can be represented by a uniapical curve for all the varieties studied, with maximum values during the growth phenophase of berries. The chlorophyll content reaches its maximum level at Tămâioasă românească variety and its minimum at Fetească albă (fig.1).

The resulted data confirm the varieties mentioned in the specialized literature referring to the color of the leaves, that is light green for Fetească albă variety (Rotaru, 2009). At the same time, they can be used to point out the high efficiency of photosynthesis during blooming and maturation phenophase of fruits that is characteristic for grapevine. The peak registered in the period July – August can be related to the low photosynthetic activity due to drought. Pigments can also play a part in absorbing and dissipating the excess solar radiant energy.

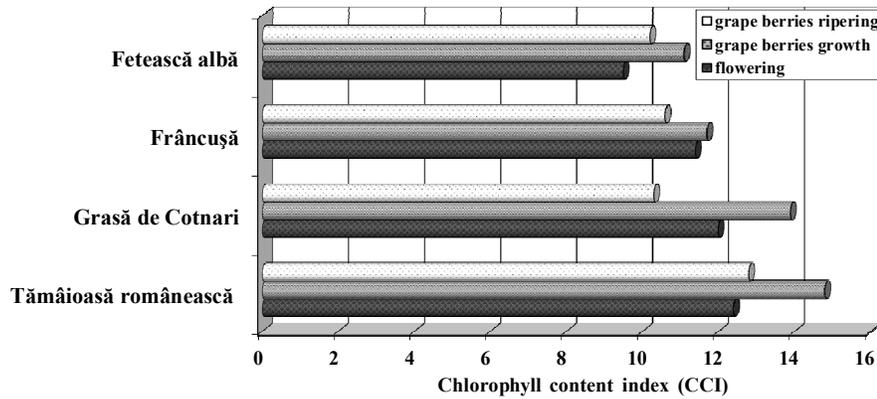


Fig. 1 - The dynamic of chlorophyll content in the leaves of the grape varieties cultivated at Iasi vineyard

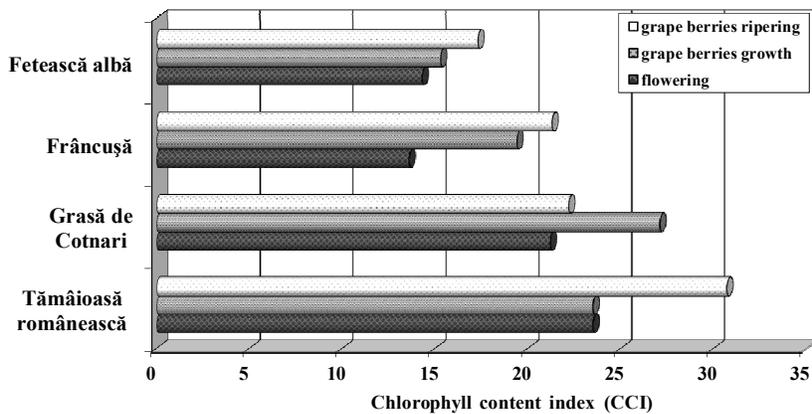


Fig. 2 - The dynamic of chlorophyll content in the leaves of the grape varieties cultivated at Cotnari vineyard

In Cotnari vineyard, the dynamic of CCI values maintains its shape of unipical curve at only one variety of grape – Grasă de Cotnari; this variety is sensitive to drought during berry growth, while for the other varieties, an ascendant curve is registered. The same minimum values were recorded by Fetească albă variety and the highest values were recorded by Tămâioasă românească (fig. 2).

The comparative analysis of the average value of the CCI in the leaves for the varieties analyzed in Iasi and Cotnari during vegetation reveals a much higher

content of chlorophyll in the leaves of the varieties cultivated in Cotnari. In both vineyards, the chlorophyll content is minimum at Fetească albă and maximum at Tămâioasă românească varieties.

Relating these data to the grape production, it results the ecophysiological reaction of different varieties of grapes to the climatic conditions of 2011, pointing out the role of the photosynthetic pigments in controlling the hydric stress that diminishes the normal quantity produced in both vineyards, but also their different effect on the production of the two vineyards (t/ha) and the sugar content of grapes (g/l). It is noticed the action of some photosynthetic parameters – foliar pigments in the formation and the supramaturation of grapes, in the accumulation of sugars and flavored compounds, that are more intense at the autochthonous varieties from Cotnari vineyard.

CONCLUSIONS

1. The climatic conditions in 2011 from Iasi and Cotnari vineyards are generally characterized by pronounced in May and July-September; in June, the effect of the drought is considerably reduced by the excess rainfall recorded in Cotnari vineyard.

2. The qualitative and quantitative grape production was greater in Cotnari than in Iasi vineyard.

3. The dynamics of the chlorophyll content in the leaves shows the participation of photosynthesis in the formation and the maturation of grapes in the given ecological conditions.

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