

## ECOPHYSIOLOGICAL RESEARCH AT SOME GRAPEVINE VARIETIES CULTIVATED IN IASI AND TÂRGU BUJOR VINEYARDS IN 2011

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### Abstract

Climate changes and their impact on vineyards represent an extremely important issue for the researchers in various fields. These changes are interesting for the specialists in the vine industry as the vineyards producing quality wines are extremely sensitive to any pedoclimatic changes. The general warming of the climate disturbed the evolution of the natural factors in the grapevine ecosystems: summers have become warmer and drier every year autumns have become longer, winters shorter and rarely excessive, the drought periods more frequent and the damp ones excessively rainy. Global warming has severely disrupted the grapevine ecosystems, grape varieties being forced to modify their annual vegetation cycle, the consequences on the quality and the quantity of grape production and wine being most often negative. In Iasi and Târgu Bujor vineyards the vegetation season of 2011 was characterized by drought caused by the high hydric deficit from July – September. The present paper consists in the analysis of the effect of these climatic conditions on the quantitative and qualitative parameters of grape production, as well as on the dynamics of the chlorophyll content in the leaves of the following varieties of grapevines *Fetească albă*, *Fetească regală*, *Riesling italian* și *Băbească gri*.

**Key words:** *grapevine, eco-physiology, photo synthetic pigments*

Numerous researches point out the importance of photosynthesis in the quantitative and qualitative formation of grapevine production (Flexas J., 2009; Lebon G., 2008). Photosynthesis is the most drought sensitive process (Palliotti A., 2009; Zulini L., 2005). The stress caused by the lack of water and related to it the water deficit has severe effects mostly when they appear suddenly, are highly intense and are accompanied by high temperatures (Cifre J., 2005; Jițăreanu Carmenica Doina, 2011). The present paper studies the eco-physiological reaction of some grapevine varieties and it is assessed on the base of the chlorophyll content in the leaves, confronted by the drought conditions in Northern Moldova.

### MATERIAL AND METHOD

The research was conducted in the vegetation season of 2011 on the following grapevine varieties *Fetească albă*, *Fetească regală*, *Riesling italian* and *Băbească gri*, cultivated in Iasi and Târgu Bujor vineyards. The evolution of the climate between January – October was assessed by recording the average temperatures and the minimum and maximum monthly values (°C) as well as the monthly rain fall (mm). These data were related to the normal values in Iasi and Târgu Bujor vineyards. As production indicators, we considered the grape production values (kg/vine) and the sugar content in the unfermented wine (g/l). The eco-physiological reaction was estimated using a parameter of the photosynthesis process, represented the chlorophyll content index in the

leaves (CCI) using the field method and a CCM 200 plus device. The results were obtained in dynamics, during the blooming, grape growth and maturation phenophase.

### RESULTS AND DISCUSSION

#### Evolution of climatic conditions in Iasi and Târgu Bujor vineyards

In 2011, the climatic conditions from Iasi vineyard recorded average monthly temperatures higher than normal, with deviations ranging between 0.1°C in April and 2.3°C in September and maximum temperatures of 31.6°C in May and 35.5°C in July. From the analysis of the amount of rain it resulted an intense hydric deficit in May and July – September. The values recorded in April and June were very close to normal, the hydric deficit being of only 4.6 mm.

In Târgu Bujor vineyard, the average monthly temperatures recorded were higher than normal, with values ranging between 0.4°C in April – May and 3.2°C in September. The maximum temperatures recorded ranged between 22.2°C in April and 32.9°C in September. The precipitation level registered high deficit in July, August and September, while in April – June slight precipitations excess was noted; their values being with 10.8 – 16.1 mm higher than normal. Just like in Iasi, in Târgu Bujor vineyard the months of July – August – September 2011 were characterized by intense drought, while April – June the precipitation excess from Târgu Bujor

compensated for the effects of the drought in June, when the hydric deficit was lower (*tab. 1*).

#### The effect of climatic conditions on production indicators

Grape production is the result of two grapevine characteristics, fertility and productivity, as a result of complex transformations in their mechanisms that take place in successive phases and in the presence of certain factors. The quantity of the harvest depends of the number and the size of the grapes, so that varieties with the same percent of fertile shoots or with the same fertility coefficient lead to different grape productions. The climatic conditions from the vegetation season of 2011 lead to higher quantities of grapes in Iasi vineyard at the following varieties: *Fetească albă*, *Fetească regală*, *Riesling italian* and in Târgu Bujor

vineyard at *Băbească gri*. The quantitative production of grapes was considered the grape production (kg/vine), the average number of grapes/vine even if the average weight of a grape was higher in Târgu Bujor vineyard (*tab. 2*). The quality of the production, represented by the sugar content in the grapes (g/l) was higher at the following varieties *Fetească albă*, *Riesling italian* and *Băbească gri* from Târgu Bujor vineyard, and the glucoacidmetric index was higher at *Fetească albă* and *Fetească regală* from Iasi vineyard and *Riesling italian* and *Băbească gri* from Târgu Bujor vineyard. At the same time, the mass of 1000 berries (g) was higher at *Fetească albă*, *Fetească regală*, *Riesling italian* from Iasi vineyard and *Băbească gri* from Târgu Bujor vineyard (*tab. 2*).

Table 1

Climatic conditions – temperature and humidity – in Iasi and Cotnari vineyards in 2011										
	I	II	III	IV	V	VI	VII	VIII	IX	X
Iași 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 amount of precipitations (mm)										
Monthly amount	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
Târgu Bujor vineyard										
Monthly average	-2.90	-2.90	3.30	9.70	15.90	19.90	22.60	21.80	19.20	9.40
Deviation from normal	-0.1	-1.9	-0.2	-0.6	-0.1	0.4	1.3	1.1	3.2	-1.0
Maximum	8.9	14	20.7	22.2	28.8	33.9	33.3	32.5	32.9	27.5
Monthly amount of precipitations (mm)										
Monthly amount	28.0	22.6	6.4	55.0	73.2	86.2	14.8	22.0	3.0	32.2
Deviation from normal	3.0	-1.8	-22.0	12.4	16.1	10.8	-54.2	-35.2	-42.7	0.3

It can be considered that the thermic factor from the two vineyards respected the best ecological conditions for the grapevine. The precipitations from April – June diminished the effects of drought in Târgu Bujor, not being responsible for the quantitative production which was higher in Iasi, influencing the quality of the grapes by accumulating higher quantities of sugars.

Lebon et al. (2008) underline the role of sugars in the flowering process; the low availability of sugars disturbs the formation of flowers and their abortion. At the same time, sugars can be signal molecules involved in stress reactions. The source of sugars is photosynthesis, and drought reduces the photosynthetic capacity during summer

(Pallioti A., 2009). At the same time, the temperature values and the amount of rain from September and October favoured the maturation and the quality of the grapes from Târgu Bujor vineyard, increasing the sugar content and the mass of 100 berries.

#### Dynamics of the chlorophyll content from the leaves of the grapevine varieties

The dynamics of the chlorophyll content from the leaves of the grapevine varieties cultivated in Iasi vineyard, assessed using the chlorophyll content index (CCI) during the vegetation period of 2011, presents itself as a unipical curve at all the varieties of grapes studied, except for *Fetească regală*, presenting maximum values during the growing phenophase.

Table 2

**Grape production of the grapevine varieties studied in 2011**

Variety	Vineyard	Grape production (kg/vine)	Production calculated per hectare (t/ha)	Average number of grape son a vine	Average weight of a grape (g)
<i>Fetească albă</i>	Iasi	2.77	10.5	26.4	105
	Bujoru	2.21	9.2	21.3	104
<i>Fetească regală</i>	Iasi	3.77	14.3	32.8	115
	Bujoru	3.02	12.6	22.4	135
<i>Italian Riesling</i>	Iasi	1.98	7.5	21.8	91
	Bujoru	1.92	8.0	20.4	94
<i>Băbească gri</i>	Iasi	4.62	17.5	23.3	198
	Bujoru	4.83	20.1	20.5	235

Table 3

**Grape quality of the grapevine varieties studied in 2011**

Variety	Vineyard	Sugars (g/L)	Total acidity (g/L H <sub>2</sub> SO <sub>4</sub> )	Mass of 100 berries (g)	Glucoacidmetric index
<i>Fetească albă</i>	Iasi	195	4.00	177	48.75
	Bujoru	198	4.36	169	45.41
<i>Fetească regală</i>	Iasi	235	4.50	181	52.22
	Bujoru	216	4.69	177	46.05
<i>Italian Riesling</i>	Iasi	220	5.5	133	40.00
	Bujoru	246	4.95	125	49.69
<i>Băbească gri</i>	Iasi	175	5.65	193	30.97
	Bujoru	198	5.30	209	37.35

The chlorophyll content is maximum at *Băbească gri* and minimum at *Fetească albă* (fig. 1).

The resulting data confirm the information present in the specialized literature refer to the colour of the leaves, light green at *Fetească albă* (Rotaru Liliana, 2009). At the same time, it can confirm the photosynthesis high efficiency during

blooming and fruit maturation phenophases, which is characteristic to the grapevine. The peak recorded in July – August can be correlated with the photosynthetic activity which was reduced by the stress caused by the drought. Pigments can play a part in the absorption and the dissipation of excessive radiant solar energy.

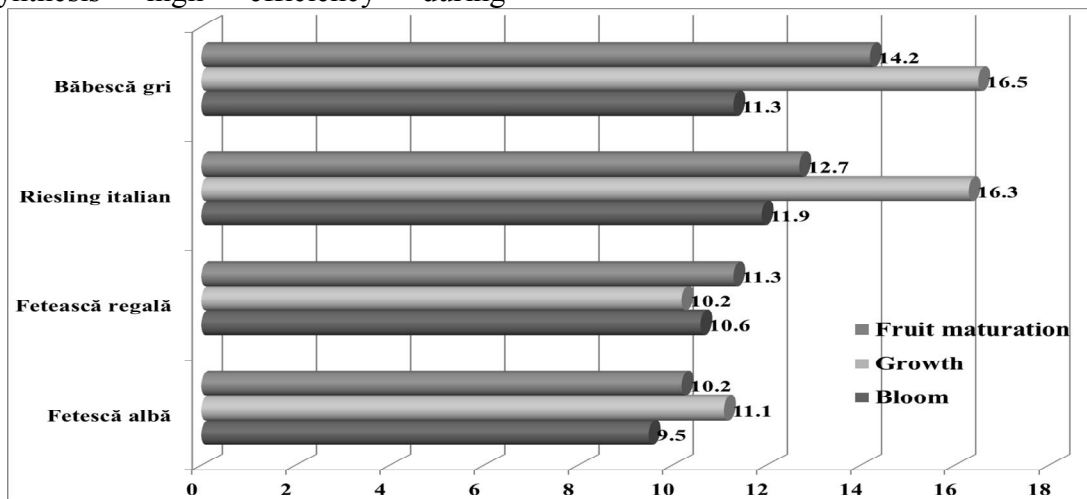


Figure 1. Chlorophyll content dynamics (CCI) in the leaves of the grapevine varieties cultivated in Iasi vineyard

The comparative analysis of the CCI values in the leaves of the grapevine varieties studied in Iasi and Târgu Bujor vineyard during the fruit formation phenophase point out similar values at the following varieties *Fetească regală*, *Riesling italian* and

*Băbească gri*, especially during the development of the berries (fig. 1 and 2).

*Fetească albă* presented a completely different behaviour, having a much higher chlorophyll content in Târgu Bujor vineyard especially during fruit maturation phenophase

(fig. 2). Relating these results to the quantitative and qualitative values of grape production (t/ha), the sugars content and the glucoacidimetric index, higher values are

recorded by *Riesling italian* and *Băbească gri* cultivated in Târgu Bujor vineyard and lower at *Fetească regală* and *Fetească albă* from the same vineyard.

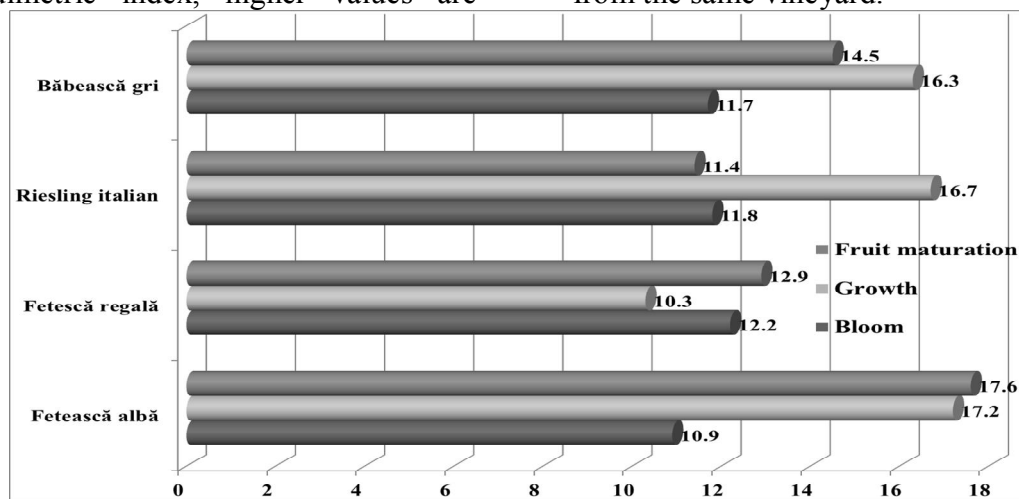


Figure 2. Dynamics of chlorophyll content (CCI) in leaves of varieties cultivated the Targu Bujor vineyard

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#### CONCLUSIONS

1. The climatic conditions from Iasi and Târgu Bujor vineyards in 2011 are characterized by intense drought in July – August – September while in April – June the excess of rain from Târgu Bujor vineyard counteracted the effects of drought from July when the hydric deficit was lower.

2. The climatic conditions of the vegetation season of 2011 lead to higher grape production in Iasi vineyard at *Fetească albă*, *Fetească regală* and *Riesling italian* while the quality of the production, represented by the sugar content in the grapes (g/l) was higher at *Fetească albă*, *Riesling italian* and *Băbească gri* cultivated in Târgu Bujor vineyard.

3. The dynamics of chlorophyll content in the leaves indicate the participation of photosynthesis in the formation and the maturation of grapes in Iasi vineyard and the existence of high sugar levels in the grapes

from Târgu Bujor vineyard in the given ecological conditions.

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