

PHENOLOGICAL CHANGES IN SOME GRAPE VARIETIES FOR WHITE WINES IN THE NORTH-EAST AREA OF MOLDOVA

MODIFICĂRI FENOLOGICE LA UNELE SOIURI PENTRU VINURI ALBE CULTIVATE ÎN ZONA DE NORD EST A MOLDOVEI

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Abstract. *In the last years, the changes of the environmental factors have become more and more visible. The repercussions are registered in the vineyard system as well; the grape varieties alter their annual life cycle. In the northern area of Romania, an increase of the thermal regime and a decrease of rains led to a thermic and hydric stress of plants. The present article presents the behaviour of some grape varieties for white wines, during 2011 and 2012, grown in the Cotnari and Iași vineyards. The vegetation phenophases start much earlier than before, leading to a hastened grape maturity, 2-3 weeks prior to normal years and with a negative influence on the quality of the obtained products.*

Key words: *vine, vegetation phenophases, global warming*

Rezumat. *În ultima vreme asistăm tot mai mult la modificarea unor factori de mediu, ca fapt concret al schimbărilor climatice. Repercusiunea acestora în ecosistemele viticole nu s-a lăsat așteptată, astfel încât soiurile de viță de vie își schimbă ciclul de viață anual. În ultimii ani, în zona de nord a României s-a înregistrat o creștere a regimului termic și un deficit al precipitațiilor, ceea ce a dus la un stres termic și hidric al plantelor. În lucrarea de față este prezentată comportarea unor soiuri pentru vinuri albe, pe parcursul anilor 2011-2012, cultivate în podgoriile Iași și Cotnari. Se constată o devansare a fenofazelor de vegetație, ceea ce duce la o grăbire a maturării strugurilor, cu circa 2-3 săptămâni față de anii normali viticoli și cu implicații negative asupra calității produselor viti-vinicole obținute.*

Cuvinte cheie: *viță de vie, fenofaze de vegetație, încălzire globală*

INTRODUCTION

Starting with the '80s until the present time, global warming has become an issue. Expected changes in temperature and rainfall are likely to lead to changes in the vegetation periods, zoning of grape varieties and many other changes that, at present, are not visible but can escalate over time. Predictions based on global climate models show we can expect a more frequent occurrence of extreme weather events and related risks and damages can be significant (Legave et al., 2008). A qualitative and quantitative decrease in the yield of grapes and damages vines in vineyards due to weather events (early autumn frosts, spring frosts,

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excessive negative temperatures, rainfall, etc..) lead to significant losses for the national vineyards area (Rotaru et al., 2012).

Climatic changes have a high impact on vine culture and implicitly on the phenological spectra. Climate change has a direct impact and lead to disruption of the normal physiological and biochemical processes with implications for the quality and specificity of vine products. Varieties behavior analysis confirms the dependence of the vine on the climate resources over a time period, the relationship is substantiated by studies on a series of unitary and multi criterion climatic indices, duration and intensity of various climatic determinants along phenophases of vegetation (Chmielewski and Rötzer, 2002).

MATERIAL AND METHOD

Three grape varieties were taken into study: Fetească albă, cultivated in all the three studied vineyards, Fetească regală, cultivated in Iași and Dealu Bujorului vineyards, as well as Tămâioasă românească, from Iași and Cotnari vineyard.

The values of the main climatic elements were recorded from the meteorological stations of the above mentioned areas, during 2011 and 2012. The values of some specific viticultural indices were calculated: real heliothermal index, hydrothermal coefficient, viticultural bioclimatic index, oenoclimatic aptitude index and aridity index.

The analysis of the plants aimed at the development of the active biological cycle, registering onset dates of different phenophases as well as calculating number of days from one phenophase to another.

RESULTS AND DISCUSSIONS

Table 1 presents the main climatic elements and specific indicators used for evaluating favourability of vine culture in some areas from Dealu Bujorului, Iași and Cotnari, for 2011-2012.

Table 1

Main climatic indices used for evaluating the vine culture favourability in Dealu Bujorului, Iași and Cotnari vineyards during 2011-2012

Climatic elements	Dealu Bujorului		Iași		Cotnari	
	2011	2012	2011	2012	2011	2012
Global thermal balance, (°t°g)	4287,9	4402,3	3855,2	4287,9	3706,4	4403,6
Active thermal balance, (°t°a)	3093,9	3797,8	3112,5	3567,9	3073,8	3787,5
Useful thermal balance, (°t°u)	1784,2	2037,8	1663,5	2012,6	1603,9	1995,8
Σ annual rainfalls, mm	360,1	445,5	372,0	507,7	368,2	526,1
Σ rainfalls during vegetation period, mm	254,2	223,0	287,2	275,1	287,6	274,1
Σ insolation hours during vegetation period, hours	1487,2	1552,8	1472,5	1499,1	1426,9	1410,2
Mean annual temperature °C	10,1	11,9	10,3	10,8	10,4	10,6
Mean temperature in						
- July °C	22,6	26,2	22,9	26,3	22,0	25,2
- August °C	21,8	23,7	21,6	23,1	21,2	22,7
- September °C	19,2	19,8	18,1	18,9	18,7	18,6
Absolute minimal temperature °C	-16,2	-19,7	-16,5	-26,6	-19,9	-28,4
Date	31.I	9.II	5.I	12.II	5.I	2.II
Absolute maximal temperature °C	35,9	41,5	37,0	41,3	35,7	38,8

Mean temperature of first and second decades of June	19,9	23,2	20,3	22,1	19,2	22,1
Mean speed of wind (km/hour)	3,4	3,2	2,8	3,5	3,5	3,7
Relative air humidity (%)	72	66,6	71,4	67,9	72	68
Cloudiness	5	5	6	5	6	6
No. days with maximal temp. > 30 °C	38	65	31	66	27	52
Bioactive period span, days	193	212	190	206	188	204
Real heliothermal index	2,65	3,16	2,44	3,01	2,28	2,81
Hydrothermal coefficient	0,82	0,58	0,92	0,77	0,93	0,72
Bioclimatic index of vine plants	9,38	12,47	8,39	9,44	8,11	9,55
Oenoclimatic aptitude index	4576,9	5377,6	4547,8	5041,9	4463,1	5173,6
Annual aridity index	17,9	20,3	18,3	24,4	18,04	25,53

From a climatic point of view, the year 2011 can be considered a normal year from the point of view of climatic conditions. 2012 was an exceptional year, from the point of view of winter thermal values that were under the resistance limit of vine as well as a very droughty summer and autumn with thermal values of over 40 °C. Vines were affected by climatic conditions in the viticultural area of Moldovian hills.

In the case of Fetească albă grape variety, cultivated in all of the three vineyards, table 2 registers the manner on which phenophases develop.

Table 2

Phenophases development at Fetească albă grape variety

Vineyard / year	bleeding	Bud break	Flowering	Veraison	Full maturity	Leaf fall
Iasi-2011	08.04.2011	13.04.2011	03.06.2011	04.08.2011	18.09.2011	20.10.2011
Iasi-2012	15.04.2012	22.04.2012	06.06.2012	24.07.2012	23.08.2012	11.11.2012
Cotnari-2011	08.04.2011	17.04.2011	09.06.2011	14.08.2011	15.09.2011	21.10.2011
Cotnari-2012	15.04.2012	18.04.2012	07.06.2012	28.07.2012	28.08.2012	01.11.2012
D. Buj.-2011	23.03.2011	12.04.2011	31.05.2011	07.08.2011	18.09.2011	23.10.2011
D.Buj.-2012	03.04.2012	10.04.2012	30.05.2012	17.07.2012	20.08.2012	14.11.2012

Analysing the biological cycle of Fetească albă grape variety (fig. 1), one registers that the time period between bleeding and full maturity is, in the case of a normal viticultural year, of 157-176 days, while, in the case of a year characterised by thermal and hydric stress, grape maturation was hastened, the time span shortening up to 128-137 days. A prolongation of the vegetation process is registered, until late autumn, the time span between full maturity and leaf fall being of 63-84 days, compared to 32-36 days in a normal year.

In the case of Fetească regală from Iași and Bujoru vineyards, phenophases development is as seen in table 3.

Table 3

Phenophases development at Fetească regală grape variety

Vineyard / year	Bleeding	Bud break	Flowering	Veraison	Full maturity	Leaf fall
Iasi-2011	05.04.2011	15.04.2011	07.06.2011	12.08.2011	24.09.2011	21.10.2011
Iasi-2012	18.04.2012	25.04.2012	06.06.2012	24.07.2012	25.08.2012	15.11.2012
D. Buj.-2011	24.03.2011	14.04.2011	02.06.2011	12.08.2011	21.09.2011	23.10.2011
D.Buj.-2012	04.04.2012	12.04.2012	07.06.2012	24.07.2012	28.08.2012	17.11.2012

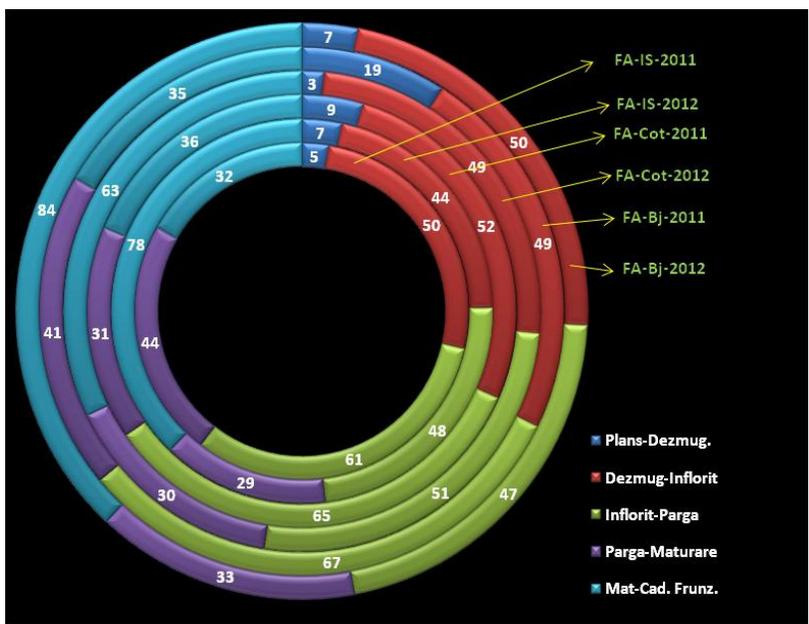


Fig. 1 - Biologic cycle of the active vegetation period for Feteasca alba grape variety in Iași, Cotnari and Dealu Bujorului vineyards during 2011-2012 (no. of days)

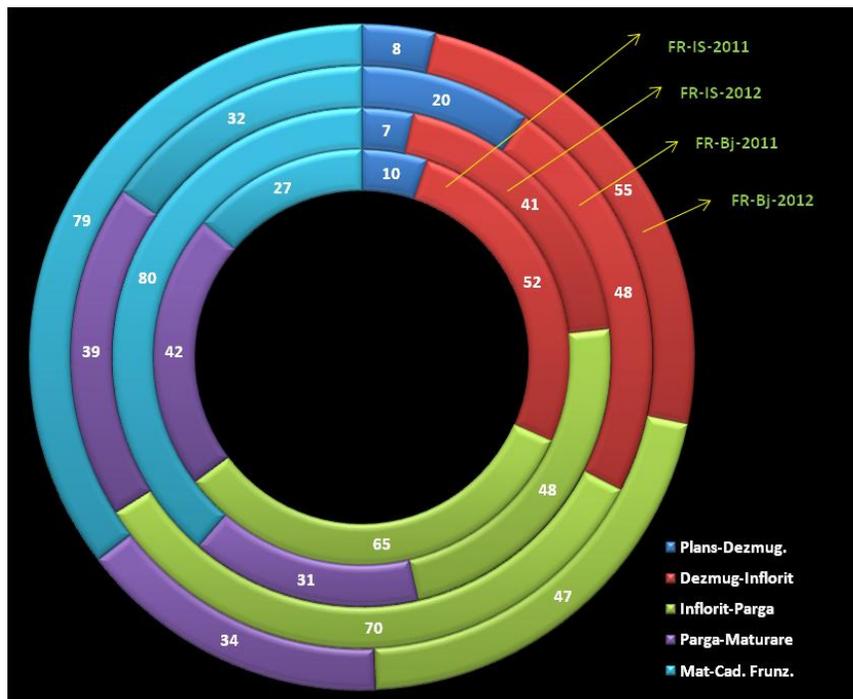


Fig. 2 – Biologic cycle of the active vegetation period for Feteasca regală grape variety in Iași and Dealu Bujorului vineyards, during 2011-2012 (no. of days)

Analysing the biological cycle of Fetească regală grape variety (fig. 2) one registers that the time period between bleeding and full maturity is, in the case of a normal viticultural year of 169-177 days, while, in the case of a year characterised by thermal and hydric stress, grape maturation was hastened, the time span from bleeding to bud break shortening up to 127-144 days. A prolongation of the vegetation process is registered, until late autumn, the time span between full maturity and leaf fall being of 79-80 days, compared to 27-32 days in a normal viticultural year.

In the case of Tămâioasă românească grape variety in Iași and Cotnari vineyards, table 4 registers the phenophases development.

Table 4

Phenophases development at Tămâioasă românească grape variety

Vineyard / year	bleeding	Bud break	Flowering	Veraison	Full maturity	Leaf fall
Iasi-2011	07.04.2011	24.04.2011	14.06.2011	12.08.2011	27.09.2011	27.10.2011
Iasi-2012	21.04.2012	28.04.2012	07.06.2012	27.07.2012	29.08.2012	12.11.2012
Cot.-2011	11.04.2011	21.04.2011	14.06.2011	15.08.2011	25.09.2011	25.10.2011
Cot.-2012	22.04.2012	29.04.2012	14.06.2012	26.07.2012	29.08.2012	03.11.2012

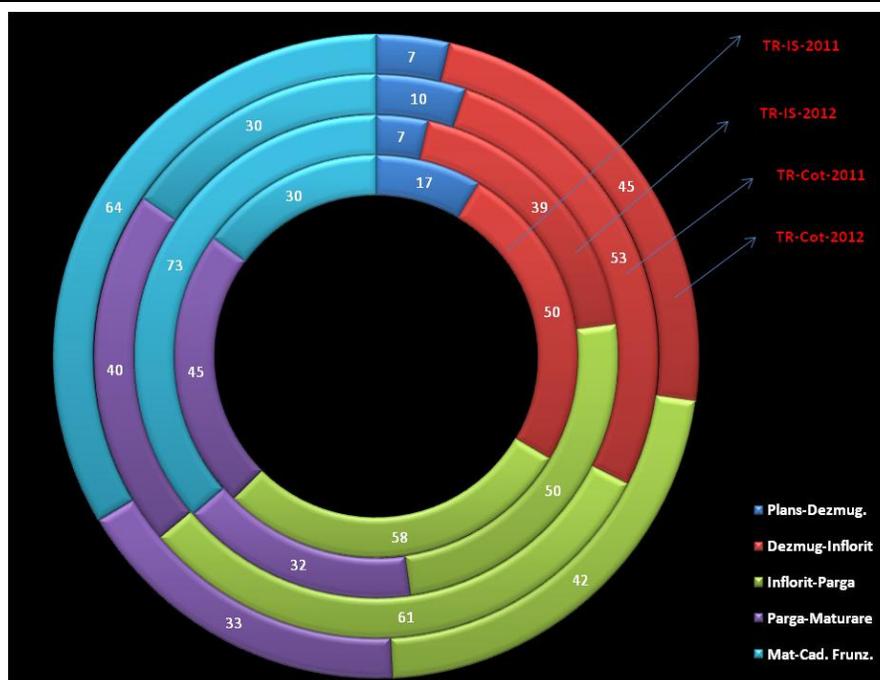


Fig. 3 - Biologic cycle of the active vegetation period for Tămâioasă românească in Iași and Cotnari vineyards during 2011-2012 (no. of days)

The biological cycle of Tămâioasă românească (fig. 3) has changed accordingly, as well: the time period between bleeding and full maturity is, in the case of a normal viticultural year of 164-170 days, while during a thermal and hydric stressed year, grape maturity was forced, the biological cycle registered between bleeding from bud break was of 127-128 days. A prolongation of the

vegetation process is registered, until late autumn, the time span between full maturity and leaf fall being of 63-64 days compared to 30 days in a normal viticultural year.

CONCLUSIONS

1. Regarding the development of the vegetation cycle, the shortest time segment from vine bleeding to bud break was found in Fetească albă variety, from Cotnari in 2012, of only 3 days, while the longest period was identified in Fetească regală, from Dealu Bujorului, of 20 days.

2. The shortest period of time (39 days) from bud break to flowering was recorded in the case of Tămâioasă românească, in Iași in 2012, while the longest (55 days) was identified in the case of Fetească regală in Bujoru in 2012.

3. The duration logged between flowering and veraison was shortest in the case of Tămâioasă românească (42 days) cultivated in Cotnari vineyard in 2011, while the longest was found to be in Fetească regală variety from Bujoru vineyard, in 2011.

4. The time period between veraison and full maturity of grapes was shortest in Fetească albă, grown in Iași vineyard, in 2012 registering a number of only 29 days, while the slowest grape maturation was registered in Tămâioasă românească grape variety, from the same vineyard, in 2011, of 45 days.

5. The interval from full maturity of grapes to leaf fall ranged from 27 days in the case of Fetească regală, in Iași, in 2011 and 84 days in Fetească albă from Dealu Bujorului, in 2012.

6. The long and draughty autumn, with a high thermal regimen, influenced the development of longer intervals from full maturity to leaf fall, the phenomenon being more accentuated in the south part of the region, respectively Dealurile Bujorului vineyard, where vegetation stopped in the last decade of November, with over 35-40 days later than usual.

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REFERENCES

1. **Chmielewski F.M., Rötzer T., 2002** - *Annual and spatial variability of the beginning of growing season in Europe in relation to air temperature changes.* Clim. Res., vol. 19, nr. 1, p. 257-264.
2. **Legave J.M., Farrera I., Alméras T., Calleja M., 2008** - *Selecting models of apple flowering time and understanding how global warming has had an impact on this trait.* Journal of Horticultural Science & Biotechnology, nr. 83:, p. 76-84.
3. **Rotaru Liliana, Amăriucăi M., Colibaba Cintia, Machidon O., 2012** - *The evolution of the main meteorological parameters (year 2011) in the eastern part of wine region Moldova hills.* Lucrări Științifice U.S.A.M.V. Iași, seria Horticultură, vol. 55, nr. 1, p. 341-346.