CLIMATIC REQUIREMENTS FOR OPTIMUM DEVELOPMENT OF GRAPEVINE IN COTNARI VINEYARD

NECESITĂȚI CLIMATICE PENTRU DEZVOLTAREA OPTIMĂ A VIȚEI DE VIE ÎN ZONA PODGORIEI COTNARI

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Abstract. *In this paper some of the favourable climatic elements for the development of grapevine in Cotnari Vineyard (air temperature, the length of sun shining, the relative humidity) will be analysed. Monthly, seasonally and annual evolution of each climatic element will be analysed, taking into account the connection between these climatic elements and the grapevine requirements for this area.*
Key words: air temperature, the length of sun shining, the relative humidity

Rezumat. *În lucrarea de față se vor analiza câteva elemente climatice favorabile dezvoltării viței de vie din zona Podgoriei Cotnari, precum temperatura aerului, durata de strălucire a soarelui, umiditatea relativă. Evoluția lunară, anotimpuală şi anuală a fiecărui element climatic va fi analizată, ținând cont de legătura existentă între aceste elemente climatice şi necesitățile viței de vie din această zonă.*
Cuvinte cheie: temperature aerului, durata de strălucire a soarelui, umiditatea relativă

INTRODUCTION

In many situations, the quality of viti-vinicole production is influenced by climatic elements. For pointing out the conditions of possibility as regards the obtaining of significant oenological performances, very important for us is to know the écart manifestation of climatic elements in Cotnari Vineyard.

MATERIAL AND METHOD

In this paper, some climatic elements will be analysed (air temperature, the length of sun shining, the relative humidity), reckoning on data from Cotnari and Botoşani meteorological stations and a correlation between these climatic elements and grapevine requirements will be realized for Cotnari Vineyard.

RESULTS AND DISCUSSIONS

Air Temperature

The main climatic factor that influences the physiological and biochemical processes of grapevine, restricting at the same time its cultivation, is air temperature. Analysing air temperature values between 1956-2006, we can remark that annual average temperature was 9.2 ºC, both in Cotnari and Botoşani.

As regards the annual regime of monthly average temperature, we can observe that minimum value in January was higher in Cotnari than Botoşani by 0.6ºC while maximum value in July was lower in Cotnari than Botoşani by 0.5ºC (fig. 1).

The highest monthly average temperature between 1956-2006 has been registered in August 1992, both in Cotnari (23.9 ºC) and Botoşani (23.6 ºC). The lowest monthly average temperature for the same period has been produced in January 1963, at both meteorological stations: -11.4 ºC in Cotnari and -12.2 ºC in Botoşani.

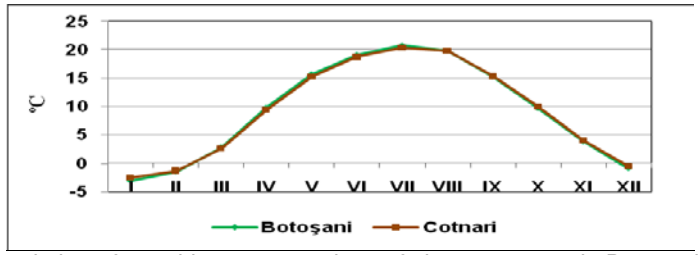

Fig. 1. The evolution of monthly average values of air temperature in Botoşani and Cotnari (1956-2006)

The long-term annual graphical representation of air temperature for the two meteorological stations marks out an evolutive course with clear fluctuations between some years (1956-1957; 1968-1969; 1975-1976; 1988-1989; 1990-1991; 1993-1994). Tropical air masses above our country made possible the producing of the highest annual average temperature between 1990 and 2000 in Cotnari (10.9 ºC) and 1990 in Botoşani (10.9 ºC). The lowest annual average temperature has been registered in 1956 (7.3 ºC in Cotnari and 7.4 ºC in Botoşani), as a result of arctic air masses influence (fig. 2).

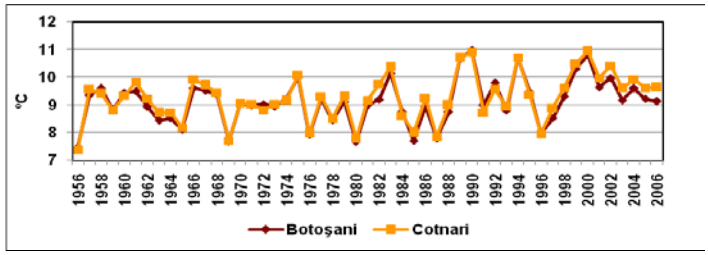

Fig. 2. The long-term evolution of annual average values of air temperature in Botoşani and Cotnari (1956-2006)

Analysing the monthly average temperature between 1956-2006, we observed from calculus that January was the coldest month of the year in 49 % of the cases in Cotnari and in 53 % of the cases in Botoşani. The warmest month of the year was July in 58,8 % of the cases in Cotnari and in 64,7 % of the cases in Botoşani. A certain quality of production needs a certain level of average temperature from the warmest month of the year. For middling productions, the

level of the average temperature from the warmest month of the year must be equal or it could exceed 16 ºC; for good productions, temperature must be 18 ºC and for the best productions, this must be 19-20 ºC (Martin T., 1968). For Cotnari Vineyard region, the average temperature from the warmest month of the year was favorable for obtaining the best vintages (19-20 ºC, sometimes even 21-22ºC) in majority of analysed years, aside from some years (1969, 1974, 1978, 1979, 1984, 1999 in Cotnari and 1962, 1969, 1974, 1978, 1979, 1984 in Botoşani), favourable for obtaining good vintages (17-18 ºC).

In winter, the average temperature was higher in Cotnari (-1.4 ºC) than in Botoşani (-1.8 ºC). More moderate temperature values during winter in Cotnari could be due to foehn influence. Cold winters in some years in Cotnari Vineyard region, such as 1969 in Cotnari (-6.0 ºC) and 1963 in Botoşani (-7.7 ºC), have been caused by an intensive anticyclonic activity, given by Siberian Anticyclone and, less, Greenland and Scandinavian Anticyclones (Topor N., 1965). In other years, winters have been warm: 1989 (2.8 ºC) in Cotnari; 1989 (2.8 ºC) in Botoşani.

In spring, the average temperature in Cotnari was 9.0 ºC, but in Botoşani this was higher by 0.4 ºC. Cold springs, produced by Greenland and Scandinavian Anticyclones, have been in: 1956 (6.7 ºC), 1980 (6.2 ºC) in Cotnari; 1980 (6.3ºC), 1987 (6.4 ºC) in Botoşani. Among the years with warmer springs we can mention: 1983 (11.9 ºC), 1990 (11.5 ºC), 2000 (11.5 ºC) in Cotnari; 1983 (11.9ºC), 1989 (11.2 ºC), 1990 (11.6 ºC), 2000 (11.4 ºC), 2002 (11.1 ºC) in Botoşani.

The average air temperature of summer in Cotnari (19.6 ºC) was easily lower than that in Botoşani (19.9 ºC). Easily lower temperatures during summer in Cotnari in comparison with those in Botoşani, could be explained through foehn influence. Cold summers, due to Greenland and Scandinavian Anticyclones influence, have been remarked in the next years: 1984 (17.6 ºC) in Cotnari; 1976 (17.5 ºC), 1984 (17.6 ºC) in Botoşani. Warm summers have been in: 1963 (21.2 ºC), 1999 (21.4 ºC), 2003 (21.3 ºC) la Cotnari; 1963 (21.4 ºC), 1992 (21.1ºC), 1995 (21.0 ºC) 1999 (21.4 ºC) in Botoşani.

In autumn, the average temperature in Cotnari (9.7 ºC) was easily higher comparing with that in Botoşani (9.5 ºC). Cold autumns, caused by Greenland and Scandinavian Anticyclones influence, have been remarked in: 1956 (7.9 ºC), 1959 (7.6 ºC), 1988 (7.7 º C), 1993 (7.3 ºC) in Cotnari; 1993 (6.9 ºC) in Botoşani. Years with warm autumns were: 1963 (12.6 ºC), 1967 (12.1 ºC) in Cotnari; 1960 (11.0 ºC), 1963 (11.8 ºC), 1967 (11.7 ºC) in Botoşani.

The annual unrolling of grapevine phenological phases is imposed by a certain temperature level (*biological threshold*). Thus, biotermic threshold by 5ºC, registered in Cotnari on 27 March, corresponds to „awakening" grapevine period from latent life; threshold by 10 ºC, considered zero of growing or biological zero, which in Cotnari takes place on 19 April, corresponds with „cry" period; sprouting phenological phase is produced in a 12 ÷ 13 ºC biological threshold; threshold by 15 ºC coincides with blossoming period of grapevine, which in Cotnari takes place on 17 May; threshold by 18 ºC, registered on 15 June in

Cotnari Vineyard, corresponds to growing grapes phenological phase; threshold by 20 ºC corresponds to the beginning of the ripening grapes period, which starts on 10 July; the growing up of the wood phenological phase and the falling of the leaves stage take place in a biological threshold of 25 ºC. Overtaking termic thresholds above mentioned determines stagnation of grapevine development processes, which can be resumed when thresholds come back to normal limits (Cotea Victoria şi colab., 1996).

The length of sun shining

More important for viticulture is knowing of space repartition and time evolution of the length of sun shining because this climatic parameter could influence the quality and the quantity of viti-vinicole vintages from Cotnari Vineyard.

During the year, July was the month with the highest value of the length of sun shining (291.4 hours in Cotnari; 274.5 hours in Botoşani) and December was the month with minimum value of the length of sun shining (76.5 hours in Cotnari; 67.1 hours in Botoşani) (fig. 3).

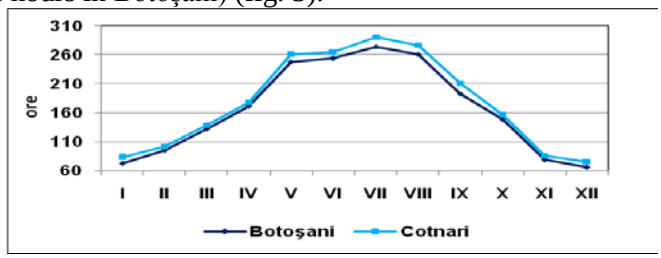

Fig. 3. The evolution of monthly average values of the length of sun shining in Botoşani and Cotnari (1975-2006)

On semesters, the length of sun shining is distributed in warm semester (April-September) in proportion of 69.7 % in Cotnari (1483.3 hours) and of 70 % in Botoşani (1401.5 hours), when grapevine requirements for light are higher. In cold semester (October-March), when grapevine requirements for light are lower, the length of sun shining registers a less percent (30.3 % in Cotnari – 645.9 hours and 30 % in Botoşani – 598.1 hours).

The long-term annual graphical representation of the length of sun shining marks out a maximum value in 2000 in Cotnari (2390 hours) and Botoşani (2347 hours), and a minimum value in 1984 in Cotnari (1754.5 hours) and in 1980 in Botoşani (1608.5 hours) (fig. 4). While in less sunny years, cyclonic activity was frequent, years with high values of the length of sun shining have been dominated by an anticyclonic regime.

In our studied period, the highest monthly average value of the length of sun shining has been registered in May 2000, both in Cotnari (379.8 hours) and Botoşani (355.2 hours). The lowest value of the same climatic parameter has been produced in February 1984, at both meteorological stations: Cotnari (32.2 hours) and Botoşani (34 hours).

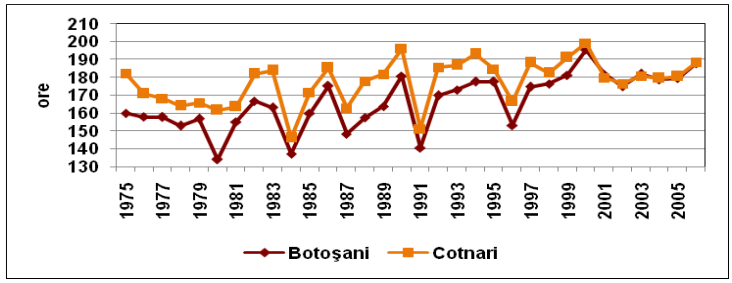

Fig. 4. The long-term evolution of annual average values of the length of sun shining in Botoşani and Cotnari (1975-2006)

The relative humidity

The annual average of the relative humidity has been calculated between 1970-2006, counting on the monthly average values obtained for Cotnari and Botoşani meteorological stations. The relative humidity was higher in Cotnari (78%) than in Botoşani (76.7%) because of higher altitude of Cotnari meteorological station (289 m).

During the year, the relative humidity has a fluctuating evolution, with a maximum value in January (82.6 % in Botoşani; 84 % in Cotnari), respectively in December (84 % in Cotnari) and a minimum value in May (72.4 % in Cotnari; 69.6 % in Botoşani) (fig. 5).

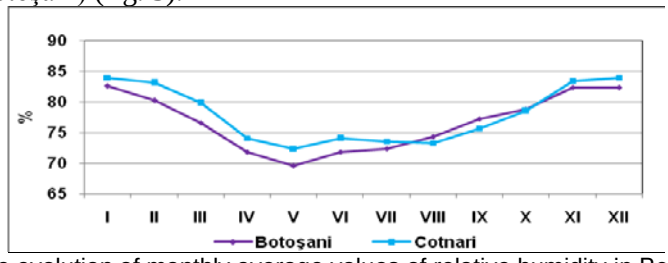

Fig. 5. The evolution of monthly average values of relative humidity in Botoşani and Cotnari (1970-2006)

Owing to a well developed root system and to a high hydrique absorption capacity, grapevine has a high adaptability to drought period. However, grapevine cannot live without water, but its hydric requirements became differentiated in accordance with specific phenological phases of vegetation period (75-80 % in the sprouting phenological phase, over 55 % in the blossoming phenological phase, 50-60% in the ripening grapes period) (Cotea Victoria şi colab, 1996). The hydrique assimilation process will be getting on normal, if grapevine requirements for relative humidity are between 50-80 %, very well satisfied for Cotnari Vineyard region.

On seasons, the highest value of the relative humidity is registered in winter (83.7 % in Cotnari; 81.7 % in Botoşani) and the lowest value of the same parameter is produced in summer (73.6 % in Cotnari), respectively in spring (72.6% in Botoşani).

In the long-term annual profile, the poorest years in humidity were 1986 in Cotnari (72.4 %) and 2004 in Botoşani (68 %) because of continental air masses from

East and the richest years in humidity were 1978 in Cotnari (86.5 %) and 1996 in Botoşani (84.4 %) because of frequent humid air masses from Atlantic Ocean (fig. 6).

The lowest monthly average value of the relative humidity in Cotnari has been registered in May and June of 2003 (59 %), as well as in March of 2002 (59 %), and the highest monthly average value of the same parameter has been registered in February of 1978 and 1984 (98 %). In Botoşani, minimum value of the relative humidity has been produced in June of 2004 (51 %) and maximum value in December of 1996 (96 %).

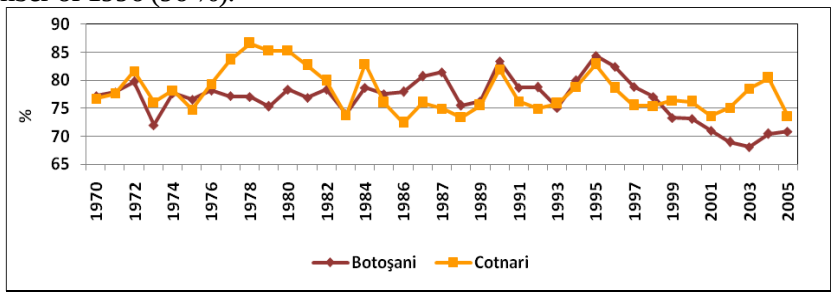

Fig. 6. The long-term evolution of annual average values of relative humidity in Botoşani and Cotnari (1970-2006)

CONCLUSIONS

The evolution of the three climatic parameters (air temperature, the length of sun shining, relative humidity) in our discussion concerning grapevine requirements for Cotnari Vineyard reflects the existence of a tight ecoclimatic interdependence. The average temperature from the warmest month of the year was favorable for obtaining of the best vintages (19-20 ºC, sometimes even 21-22ºC) in majority of the analysed years. The annual average of the length of sun shining between 1975-2006 was highest in Botoşani (1999.7 hours) than in Cotnari (2129.8 hours), because of foehn influence from that area. The length of sun shining is distributed in warm semester (April-September) in proportion of 69.7 % in Cotnari, respectively of 70 % in Botoşani, when grapevine requirements for light are higher, while in cold semester (October-March), the length of sun shining registers a less percent (30.3 % in Cotnari and 30 % in Botoşani).

As regards the relative humidity, this had annual average values of 78 % in Cotnari and of 76.7 % in Botoşani (1970-2006), suitable values for satisfying the hydric requirements of grapevine for Cotnari Vineyard.

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