

THE HIDRIC AND THERMIC STRESS FROM THE AGRICULTURAL YEAR 2006-2007 AND THIS INFLUENCE ABOUT VITICULTURAL PLANTATIONS

STRESUL HIDRIC ȘI TERMIC DIN ANUL AGRICOL 2006 – 2007 ȘI INFLUENȚA ACESTUIA ASUPRA PLANTAȚIILOR VITICOLE

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Abstract: *In the temperate climate area, the pluviometric features registered are regular but certain periods are characterized by high or low atypical stages. (Berbecel O., et al. 1970) The drought period which started in September 2006 and ended in July 2007 triggered the growth of soil water deficit down to the deepest strata (100 – 150). The lack of humidity of soil and the high temperatures of 42,3°C (July 2007) brought about the diminishing of twig growing, photosynthesis reduction and implicitly the decrease of grapes yield.*

Rezumat: *În zona cu climat temperat este specifică înregistrarea unor perioade cu caracteristici pluviometrice normale, dar în anumite intervale se detașează perioade excedentare sau deficitare care se abat de la normal (Berbecel O., ș.a., 1970). Perioada secetoasă care a început din luna septembrie a anului 2006 și pînă în luna iulie 2007 a dus la creșterea deficitului de apă din sol, pînă în straturile profunde (100 -150 cm). Lipsa umidității din sol și înregistrarea unor temperaturi maxime în aer de pînă la 42,3 °C (iulie 2007), a dus la diminuarea creșterii lăstarilor, reducerea fotosintezei și implicit la scăderea producției cantitative de struguri.*

Vine is a big consumer of water. If during certain droughty years it does not bear the consequences due to the fact that it has a very deep root network reaching the extended areas of deep soil stratum where there are large water reserves. During long periods of drought (2 - 3 years) in which water reserves decrease even in the deep soil strata, vine is also affected just like annual plants.

The optimum soil humidity for vineyards is 50-80% from the whole available water capacity (AWC), higher levels favoring the growing of twigs and lower ones supporting seeds maturing (M. Motoc, 1968).

For the temperate climate area of our country the pluviometric features registered are regular but certain periods are characterized by high or low atypical stages. (Berbecel O., et al. 1970)

MATERIAL AND METHOD

For the study of precipitations and temperatures were used the data registered by the stations' weather centre, by the automatic registration station (Agroexpert) and by the Regional Meteorological Centre Moldova from Iasi.

In order to establish the soil humidity, monthly probes were taken during the vegetation period, down to a depth of 150 cm, each 10 cm of strata. The results were previously expressed in percentages of dry soil weight and afterwards in percentages of volume. Resorting to hydrophysical indices it was calculated the available soil water at a certain moment expressed in mm and the deficit in cubic meters/ha and % (Obreja Gr., 1964). To assess the degree of water availability for plants the momentary humidity was reported to the available water capacity (AWC), previously calculated for the viticulture centre Copou Iasi.

RESULTS AND DISCUSSIONS

Copou viticulture centre belongs to the continental climate at the junction between the steppe and the forest area, integrating in the category IIBpS: II - continental steppe climate; B- the centre of the hill climate; S- steppe climate district; p- forest climate district (Geographic monograph of Romanian Republic vol. I, 1960) characterized by low precipitations since the fall and until the beginning of spring.

According to the precipitation survey for a period of 27 years (1980-2006), in the Copou viticulture centre were recorded excessively rainy and very rainy years (1-2 years), excessively droughty and very droughty years (period of 1-2 years) intercalated with standard years. (table1)

Table 1

Precipitation regime and the characterization of years for the interval 1980 – 2006 in the viticulture centre Copou Iasi (according to the system used by N. Topor, 1964)

| Year | Precipitations, L/m ² | | Type of year | Year | Precipitations, L/m ² | | Type of year |
|------|----------------------------------|-------------------|----------------------|------|----------------------------------|-------------------|-------------------|
| | total | period vegetation | | | total | period vegetation | |
| 1980 | 785,5 | 499,0 | Excessively rainy | 1994 | 427,8 | 378,3 | A little droughty |
| 1981 | 624,1 | 423,7 | Very rainy | 1995 | 709,4 | 543,0 | Excessively rainy |
| 1982 | 357,5 | 249,4 | Excessively droughty | 1996 | 818,3 | 563,0 | Excessively rainy |
| 1983 | 423,4 | 353,8 | Very droughty | 1997 | 619,7 | 428,2 | Very rainy |
| 1984 | 715,0 | 542,4 | Excessively rainy | 1998 | 653,5 | 358,8 | Very rainy |
| 1985 | 583,6 | 460,2 | Rainy | 1999 | 518,8 | 334,1 | normal |
| 1986 | 397,6 | 274,0 | Very droughty | 2000 | 399,7 | 269,2 | Very droughty |
| 1987 | 528,4 | 347,9 | normal | 2001 | 748,0 | 533,2 | Excessively rainy |
| 1988 | 628,5 | 462,2 | Very rainy | 2002 | 602,3 | 432,0 | Rainy |
| 1989 | 649,7 | 586,9 | Very rainy | 2003 | 485,4 | 293,5 | A little droughty |
| 1990 | 378,6 | 249,7 | Excessively droughty | 2004 | 593,5 | 386,1 | Rainy |
| 1991 | 829,5 | 693,3 | Excessively rainy | 2005 | 646,1 | 433,9 | Very rainy |
| 1992 | 488,0 | 348,8 | A little droughty | 2006 | 500,2 | 464,6 | normal |
| 1993 | 603,8 | 395,6 | Rainy | | | | |

It was also observed that after long periods of rain 1-2 years, will follow 1-2 years of excessive drought or droughty. In the years when drought brought about significant damage, the lack of precipitations started in the previous year (in summer or autumn) and continued during the cold season and during the spring and summer of following year. Such was the case for the summer and winter of 2006 and continued for the spring and summer of 2007, the precipitation shortage being of 226,5 mm (table 2)

Table 2

Precipitations registered in the Copou viticulture centre from Iasi during the period September 2006 – July 2007

| Precipitation, mm | Month | | | | | | | | | | | Sum, mm |
|----------------------------|-------|------|------|------|------|------|------|------|------|------|------|--------------|
| | IX | X | XI | XII | I | II | III | IV | V | VI | VII | |
| Multiannual average | 40,8 | 34,4 | 34,6 | 28,9 | 28,9 | 27,4 | 28,1 | 40,3 | 52,5 | 75,1 | 69,2 | 460,2 |
| 2006 - 2007 | 14,8 | 22,7 | 10,5 | 2,4 | 21,5 | 30,1 | 25,6 | 25,1 | 28,0 | 15,4 | 40,3 | 236,4 |
| Deficit | 26,0 | 11,7 | 24,1 | 26,5 | 7,4 | - | 2,5 | 15,2 | 24,5 | 59,7 | 28,9 | 226,5 |

In this context, the situation worsened, the water deficit increasing each month reaching in July 2007 70 % at a depth of 50-100 cm respectively 62 % at 100-150 cm (table 3).

Table 3

Water deficit during the vegetation period- year 2007

| Depth, cm | Month | | | | | | | | | | | |
|------------------|--------------------|----|--------------------|----|--------------------|----|--------------------|----|--------------------|----|--------------------|----|
| | IV | | V | | VI | | VII | | VIII | | IX | |
| | m ³ /ha | % |
| 0 – 20 | 311 | 65 | 324 | 68 | 458 | 96 | 335 | 71 | 164 | 35 | 305 | 64 |
| 20 – 50 | 233 | 31 | 287 | 39 | 420 | 57 | 550 | 74 | 327 | 44 | 338 | 46 |
| 50 - 100 | 449 | 42 | 498 | 46 | 642 | 60 | 745 | 70 | 717 | 67 | 513 | 48 |
| 100 - 150 | 182 | 28 | 214 | 33 | 285 | 44 | 398 | 62 | 409 | 63 | 292 | 45 |

The values of humidity between 29-38 % characterized the hardly accessible water corresponding to the depth of 0-150cm, taking into consideration that the easily available level of water is 50-80% (fig.1).

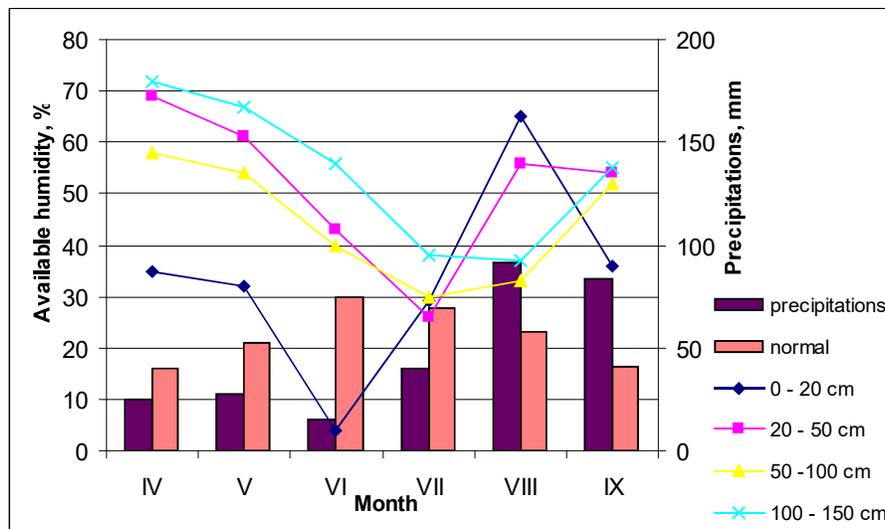


Fig. 1 – The evolution of precipitations and the degree of available soil water during the period of vegetation of 2007

Therefore we can say that the drought of 2007 affected not only annual plants but also vine (fig.2).



Fig. 1 – The evolution of precipitations and the degree of available soil water during the period of vegetation of 2007

In the following months (August, September) the humidity level improved due to the precipitations of 91,3 mm and respectively 83,5 mm, double values in comparison with the standards for these months.

By analyzing the temperatures of the studied period of time it can be stated that the winter of 2007 was warmer, the average temperatures of January and February were of 4,1°C and respectively 0,8°C compared to the multiannual values of these months which are of -3,6°C and -1,9°C, and the maximal ones of 16,9°C and 16,6°C (table 4).

Table 4

The values of temperatures for the agriculture year 2006 – 2007

| Valori termice | Month | | | | | | | | | | | |
|--|-------|------|------|-------|-------|------|------|------|------|------|------|------|
| | X | XI | XII | I | II | III | IV | V | VI | VII | VIII | IX |
| Average temperature multiannual values, °C | 10,1 | 4,1 | -0,8 | -3,6 | -1,9 | 3,3 | 10,1 | 16,1 | 19,4 | 21,3 | 20,6 | 16,3 |
| Average temperature 2006 -2007, °C | 11,4 | 6,4 | 2,5 | 4,1 | 0,8 | 7,3 | 10,2 | 18,9 | 22,8 | 25,0 | 22,0 | 15,3 |
| Maximal temperatures 2006 -2007, °C | 31,2 | 18,4 | 14,5 | 16,9 | 16,6 | 20,2 | 22,6 | 34,5 | 37,0 | 42,3 | 38,8 | 26,7 |
| Minimal temperatures 2006 -2007, °C | -3,8 | -4,5 | -7,8 | -10,5 | -19,6 | -0,8 | 1,6 | 0,5 | 11,6 | 11,0 | 11,6 | 4,8 |

Spring was also warmer than usual with monthly average temperatures of 7,3°C, 10,2°C and 18,9°C during the months of March, April, May and maximal

air temperatures of 20,2°C, 22,6°C and 34,5°C.

The elevated heat continued during the summer months when were registered for many days temperatures of 37°C, even 41,6°C and 42,3°C in July and an august peak of 38,8°C.

High temperature values corroborated with water shortage triggered the accentuation of air and pedologic drought with negative effects on the vegetation state of vine stocks by outrunning the phenophases of vegetation, diminishing the growing of shoots, the reduction of foliar area, of photosynthesis and the decrease of grapes yield.

Thus, the root system of vine stocks could not absorb in the spring of 2007 the water necessary for xylem sap, the phenophases being reduced.

Debudding was forwarded, taking place during the period April 24 – 28 with slight differences between varieties. Blossom took place almost simultaneously, in the first decade of June, 10 days earlier, and grapes ripening started in July.

Technological maturation took place three weeks earlier, namely during the period August 30- September 8. The drop of leaves occurred during the last decade of October, being a standard physiological fall.

As a consequence of the climatic conditions registered, grapes yield of 2007 was very low recording an average of 1893 kg/ha for the variety Fetească albă, and 7500 kg/ha for the variety Chardonnay (table 5). On the other hand large quantities of sugars were found in must- 200 g/L for Aligoté and 240 g/L for Fetească albă.

Table 5

Quantitative and Qualitative Yield for the main varieties cultivated, in 2007

| Variety | Yield, kg/ha | Sugars, g/L | Acidity, g/L H ₂ SO ₄ | Weight 100 grapes, g |
|-----------------|--------------|-------------|---|----------------------|
| Aligoté | 2080 | 200 | 5,0 | 136 |
| Fetească regală | 2564 | 220 | 3,3 | 128 |
| Fetească albă | 1893 | 240 | 3,1 | 130 |
| Muscat Ottonel | 3247 | 215 | 2,4 | 147 |
| Sauvignon blanc | 5081 | 210 | 4,0 | 90 |
| Chardonnay | 7500 | 230 | 3,8 | 130 |

CONCLUSIONS

1. Vine is a relatively drought resistant plant but when this phenomenon occurs for longer periods of time (1-2 years) it influences the repose period and continues for the vegetation months of the following year and significant damages may be recorded. The consequences are borne for 2-3 years.

2. The permanent rehabilitation of vine stocks after being affected by drought has to be a significant stage in the technology of vine cultivation.

3. The droughty period of 2006 – 2007 was the longest one of the last

years, starting in September 2006 and ending in July 2007 when a precipitation deficit occurred each month.

4. Water deficit for the stratum of 50 – 100 cm at the end of July 2007 was of 70 %, the highest for the last years.

5. Grapes yield, as a result of water and temperature stress was reduced with 36 % reaching a level of 81 %, according to the variety.

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