THE „TERROIR VITICOLE” CONCEPT APPLIED IN COTNARI VINEYARD

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Key words: terroir viticole, ecoviticole identity, vegetation period.
Cuvinte cheie: terroir viticole, identitate ecoviticolă, perioada de vegetaţie.

ABSTRACT:

The present paper intends to turn to account the descriptive features of „terroir viticole” concept for characterizing Cotnari Vineyard, in order to underline the way in which the components of geographic environment emphasized by this concept (geological component, topographical component, climatic component, pedological component) interact one to the others, so that to contribute in establishing an intimate relation with other two components of „terroir viticole” concept (humane factor and agronomical factor). We tried in this way to outline the ecoviticole identity of Cotnari Vineyard, which makes it a unique viticole area in Romania.

1. Introduction

The „terroir viticole” concept is known in French Geography of Viticulture as an interactive ecosystem made of the components of geographic environment (geological component, topographical component, climatic component, pedological component), humane factor (local history, socio-economic system) and agronomical factor (viticole and oenological techniques) (Seguin G., 1986, 1988). There is another acceptance of „terroir viticole” concept, more restrictive: that of Lebon (1993) or that of Carbonneau (1997). These authors understand through *terroir* the interaction between soil and climate.

For van Leeuwen C. (2006), the best expression of terroir is achieved when the precocity of the grapevine variety is suited to the local climatic conditions in such a way that full ripeness is reached by the end of the growing season. As regards our position, we think that it is necessary to pay special attention not only to climatic conditions, but also to pedological conditions, soil being an essential factor in the process of obtaining high qualitative viticole productions.

The essence of *„terroir viticole”* concept, represented by geological-topographical-soil-climate components, is reflected in the best way in the central area of Cotnari Vineyard, as these components interact intimately among themselves in this region, so that to result a high qualitative viticole production. In the peripheral areas of Cotnari Vineyard, the components of „terroir viticole” concept mentioned above could not be found in the perfect combination as in the central area, because of the excessive extending of Cotnari Vineyard in socialist period. As a consequence,

grapevine did not meet any more the environmental conditions favorable for developing in the same qualitative parameters.

2. Environmental factors

Geographical position

Being located at the North limit of the grapevine growing (45-50 º North latitude) as other vineyards like *Tokay* (Hungary), *Rheingau* (Germany), *Champagn*e (France), ***Cotnari Vineyard*** includes in its area a viticole ecosystem, world-wide recognized for its high quality wine products.

Being one of the oldest and famous vineyards in Romania, Cotnari Vineyard is situated at the contact among Suceava Plateau (West) and Moldova Plain (East; fig. 1). From a geo-mathematical point of view, Cotnari Vineyard is displaying between the latitude of 47° 12' 23" and 47° 35' 17" North and between the longitude of 26° 49' 43" and 27° 01' 20" East**.**

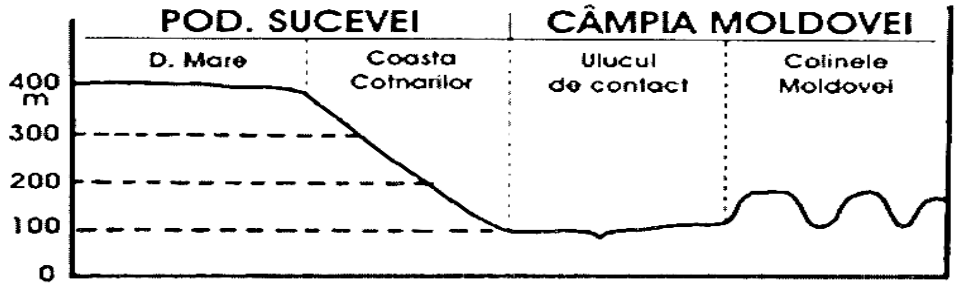

Fig. 1. Physico-geographical units in Cotnari Vineyard (after N. Barbu, 2006).

Geology

Sarmatian sediments on Cotnari Vineyard (marls, clays, sands, calcareous burrs, oolitical limestone) form a pedological support for the grapevine on small areas, especially in slopes areas, where these sediments are brought to light by erosion (Cotea D. V.– co-ord., Barbu N., 2006).

The majority of viticole plantations in Cotnari Vineyard region are located on quaternary sediments (pebbles, loessoide sands and clays, clays), especially on the deluvio-coluvial ones of Cotnari Coast and very little on the alluvial ones of flood plains (Cotea D. V. – co-ord., Barbu N., 2006).

Marls and calcareous burrs sediments are the most fitted for the developing of the grapevine in Cotnari Vineyard region because of high content in calcium, magnesium, iron ions etc.

Topography

Bohmrich R. (1996) says that „topography is the bridge between soil and climate in the *terroir* equation".

Viticole plantations from Cotnari Vineyard region can be met beginning from 110 m altitude (on South-West slope of Baban Hill and near the confluence of Sărat Brook with Măgura Brook) and until 305 m altitude (in *La Nuci* area, in Osoi-Stroeşti Hill).

The slopes cultivated with grapevine from Cotnari Vineyard region have, generally, an South-East, South and, rarely, East exposition.

Little inclined terrains, with slopes under 3º, correspond to the flood plain areas (Bahlui, Cârjoaia, Buhalnița), to the fluvial terraces and western structural plateaus.

Moderate inclined terrains, with slopes between 3-15º, are characteristic for the majority of slopes, especially for that of Cotnari Coast. These terrains are the best capitalized ones in terms of viticulture.

Very inclined terrains (15-20º and over 20º) correspond to the cuestas slopes in the North of Cătălina and Stroeşti Hills.

I. Gugiuman (1978) mentions that the front of Cotnari Coast has been intensely broken up through erosion by the right effluents of Bahlui River (at South of Hârlău Town – Buhalnița, Cârjoaia), as also by the right effluents of Miletin River (at North of Hârlău Town - Varnița), creating a succession of small morpho-hydrographical basins, well sheltered by the West, South-West and North coasts against the dominant winds from the region. After the same author, also other morpho-hydrographical basins, carved by some brooks, effluents of Bahlui River (Ceplenița şi Hodora), presents a sheltered character.

Climate

For characterizing the climate of Cotnari viticole region, the data registered in Cotnari Meteorological Station were used, even if it is situated to the upper limit of the vineyard (289 m). But for realizing such a climatic comparison, the data from Botoşani Meteorological Station (161 m) has been also used. Climatic elements selected for characterizing viticole region above mentioned in the vegetation period (April-September) are: the air temperature, the atmospheric precipitation, the relative humidity, the length of sun shining, the frequency and velocity of wind. Jianu L. (1973) mentions that the length of vegetation period increases from 179-182 days on the bottom of valleys, until 186-197 days in relative altitudes of 50-70 m; in higher altitudes, the length of this interval decreases gradually, reaching on Cătălina Hill 174 days.

Favorable temperatures for starting the vegetation appear in spring, the earliest in 18 April on slopes, at 50-70 m relative altitudes, and in more and more later data at higher altitudes and also lower than this. The latest (24 April) temperature exceeds 10 ºC at 260 m relative altitude (Cătălina Hill). On the inferior part of the slopes and on the bottom of valleys, the date of exceeding temperatures over 10 ºC is later than on the middle slopes, especially on the bottom of narrow secondary valleys. The temperatures descend the latest (22-23 October) at 50-70 m relative altitudes when the vegetation stops in autumn. Higher but also lower than this altitude, temperatures descend under 10 ºC in more and more later data – Cătălina Hill, 16 October (Jianu L., 1973).

The graphic of the air temperature in the vegetation period (April-September), between 1956 and 2006 indicates a uniform evolution of this climatic parameter.

Thus, thermal values increase beginning with April (9.8 ºC in Botoşani; 9.4 ºC in Cotnari) and until July (20.8 ºC in Botoşani; 20.3 ºC in Cotnari). The air temperature decreases easily (19.8 ºC in both meteorological stations) in August, getting in September about 15 ºC (15.2 ºC in Botoşani; 15.3 ºC in Cotnari; fig. 2). Average value of the air temperature was easily more decreased in Cotnari (16.4 ºC) than in Botoşani (16.7 ºC). As regards the highest value, respectively the smallest value in the vegetation period (April-September), one can remark that the first was produced in 1994, both in Cotnari (18.1 ºC) and in Botoşani (18.0 ºC), and the second was registered in 1999 in Cotnari (14.5 ºC) and in 1980 in Botoşani (14.8 ºC).

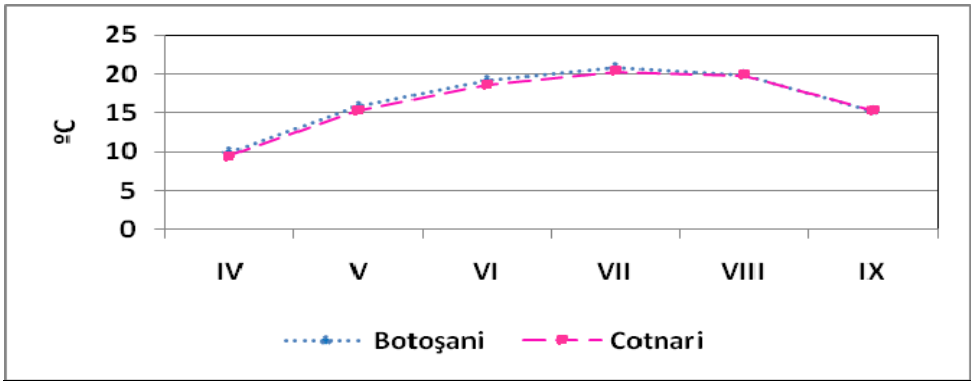

Fig. 2 Distribution of the air temperature in the vegetation period (April-September) in Botoşani and Cotnari (1956-2006)

The sum of precipitations in the vegetation period (1956-2006) was more decreased in Cotnari (361.7 mm) than in Botoşani (401.7 mm). Atmospheric precipitations during this period had an ascending evolutionary course from April (48.8 mm in Cotnari; 50.1 mm in Botoşani) until July (76.3 mm in Cotnari; 87.8 mm in Botoşani), when pluviometric maximum is registered. Starting with August, the quantity of atmospheric precipitations is diminished easily (61.4 mm in Cotnari; 64.2 mm in Botoşani), getting in September under 50 mm (43.0 mm in Cotnari; 44.6 mm in Botoşani; fig. 3). Maximum value in the same period was registered in 1991, both in Cotnari (697.8 mm) and in Botoşani (575.9 mm), and minimum value was produced in 1966 in Cotnari (209 mm) and in 1963 in Botoşani (196.1 mm).

The years with little precipitations in the ripening period of the grapes are the most favorable for the grapevine culture. Excessive droughty years, as excessive rainy years are not favorable for normal ripening and obtaining of a qualitative vintage. The surplus of precipitations determines the growing of the berry volume, getting thinner of the peel and even cracking of this (Şt. C. Teodorescu, V. Stoian, 1987).

The graphic of the relative humidity in the vegetation period (1970-2006) marks out higher values in April-July in Cotnari than in Botoşani and lower values in August-September (fig. 4). The average of the relative humidity in this period was easily higher in Cotnari (73.8 %) than in Botoşani (72.8 %). Maximum value was produced in 1978 in Cotnari (84.1 %) and in 1991 in Botoşani (83 %). Minimum value was registered in 1986 in Cotnari (66.1 %) and in 2003 in Botoşani (60.5 %).

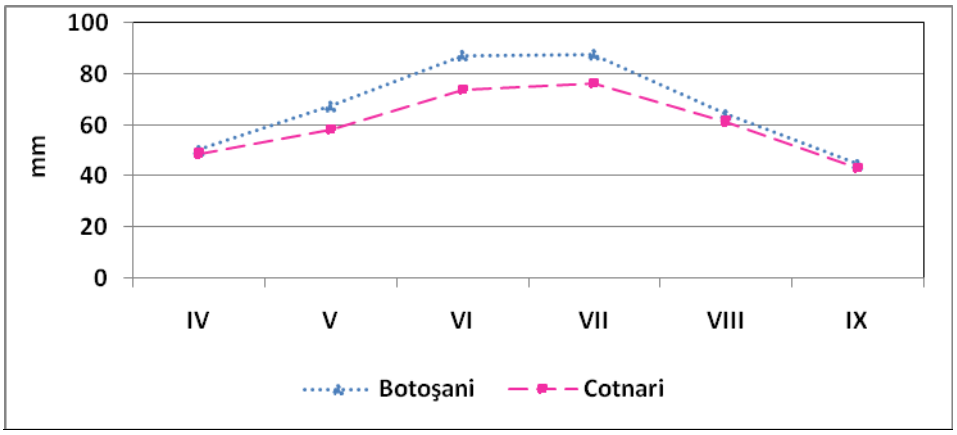

Fig. 3 Distribution of the atmospheric precipitation in the vegetation period (April-September) in Botoşani and Cotnari (1956-2006).

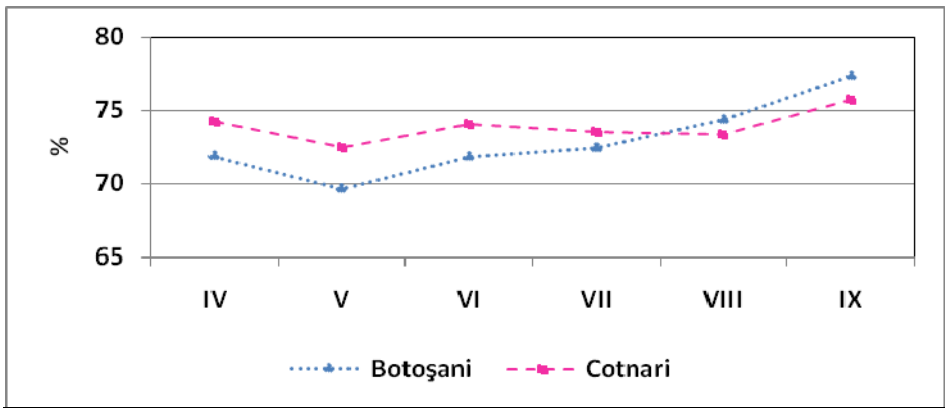

Fig. 4. Distribution of the relative humidity in the vegetation period (April-September) in Botoşani and Cotnari (1970-2006).

The sum of the sun shining hours in the vegetation period (1975-2006) was higher in Cotnari (1483.6 hours) than in Botoşani (1437.9 hours) because of the influence of foehn phenomenon, specific for Cotnari Vineyard (fig. 5). The highest value has been registered in 2000, both in Cotnari (1717.5 hours) and in Botoşani (1657.7 hours). The smallest value has been produced in 1991 in Cotnari (1251.6 hours) and in 1980 in Botoşani (1162.2 hours).

The greatest frequency of wind in the vegetation period (1970-2006) has been registered on NV direction, both in Cotnari (34.7 %) and in Botoşani (31.4 %). Also, the highest velocity of wind in the same period (1970-2006) has been remarked on NV direction: 4.9 m^3/s in Cotnari and 4.7 m^3/s in Botoşani (fig. 6).

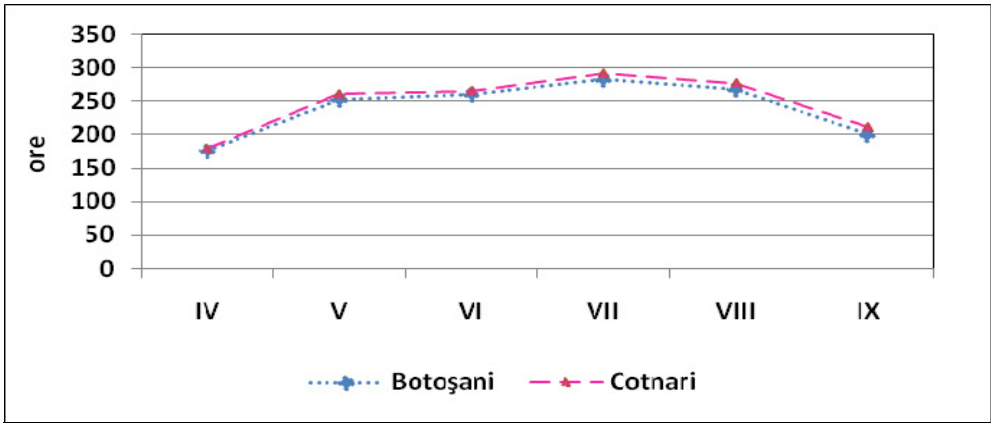

Fig. 5 Distribution of the length of sun shining in the vegetation period (April-September) in Botoşani and Cotnari (1975-2006).

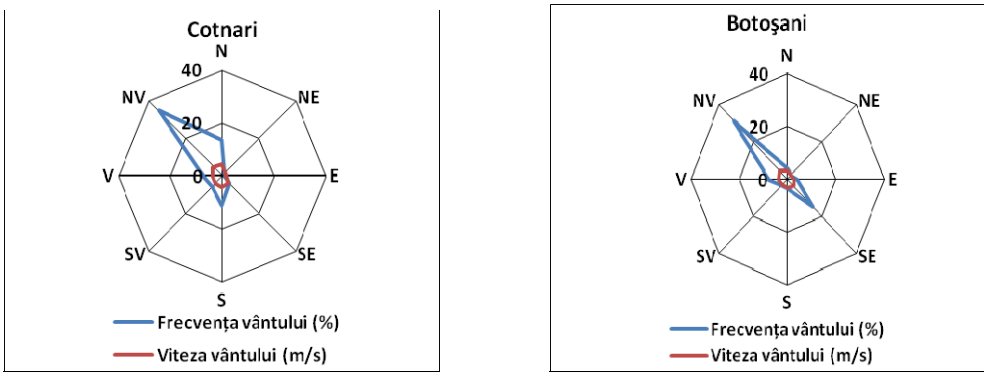

Fig. 6. Distribution of the frequency and the velocity of wind in the vegetation period (April-September) in Botoşani and Cotnari (1970-2006).

Regarding foehn phenomenon in Cotnari Vineyard region, we can say that it appears when warm air masses from west slopes of Great Hill are cooling in ascending movement and descend warm on the eastern slopes of Cotnari Coast. Thus, on sheltered slopes of Cotnari Coast, the air temperature is higher and the nebulousness, the relative humidity and the atmospheric precipitations are lower than on those exposed to the wind from Great Hill. In Cotnari Vineyard region, winds, which come from NV, contribute in great measure to the forming of foehn phenomenon, adding to the winds from V and SV. Maximum manifestation of this phenomenon can be remarked in July, when the length of sun shining is high (291.4 hours) and the frequency of NV winds is large (40.9 %). This phenomenon favors the grapevine culture in Cotnari Vineyard region because the warm air is driven to the base of Cotnari Coast, in long of the depression corridor, keeping a favorable microclimate for the ripening and even for the super-ripening of grapes.

The special sheltered microclimate, met in the erosion basins in Cotnari Vineyard, add to this the influence of foehn phenomenon favor the unrolling in

optimum condition of the grapevine phenological phases, whose finality leads to super-ripening stage of the grapes.

The presence on the East slope of Cătălina Hill of an island with *Fagus taurica, Quercus pubescens* (Submediterranean climatic elements) indicates that, due to the influence of foehn phenomenon, the air temperature is here higher than in neighboring areas.

Soil

Soils play a very important role in viticulture, because the quality and quantity of the viticole productions depend on their physical, chemical and biological properties. Among all the soil characteristics, texture and chemical composition are the most important in this regard. In spite of the considerable adaptability of the grapevine to a significant diversity of soils with different textures, the most favorable soils for practicing viticulture in Cotnari Vineyard are the clayey soils (chernozems) and the sandy soils (rendzinas).

On Cotnari Vineyard territory, viticulture can be practiced with best results on rendzinas (especially cambic) and on chernozems (especially cambic and argic). Good results can be also obtained on phaeozems (greic or pelic marnic). The other types of soil met in Cotnari Vineyard region (luvisols, salsodisols, hidrysols, anthrisols, protisols) cannot be used for viticulture because of restrictive influence of hydro-saline factors.

The chemical composition of soil has a great influence on the grapevine growing process due to the nutritive substances the soil contains. Thus, the calcium content of the soils in Cotnari area contribute to the forming of sugars and of the aromatic compounds of grapes, respectively wines (V. Cotea, 1996).

3. The humane factor

Cotnari Vineyard has a long viti-vinicole tradition, starting from Neolitical period. The precincts of the village dating from this period were discovered in Cucuteni area. In the same place have been discovered Greek amphoras, wine pots and pruning hooks. Two Dacia strongholds have been also discovered in the region at Horodiştea (IV-III century B. C.) and on Cătălina Hill at Cotnari (IV century B. C.). The presence in this places of some artifacts used in viticulture, which have been also discovered by archeologists, suggests the existence of ancient viticole practices in the region (Ungureanu Gh. ş.a., 1971; Cotea D. V. – co-ord., M. Ciubotaru, 2006).

However, some historians, as M. Ciubotaru, are still skeptical regarding the presence of such a tradition, dating from Antiquity, in Cotnari area. After the same author, the population of Cotnari had a special relation with viticulture only from its stabilization after the migrations period and before the setting up of the Moldova state (Cotea D. V. – coord., M. Ciubotaru, 2006).

The first historical written proof regarding the presence of viticole plantations in Cotnari region dates from 1448, when in Cotnari Market Town had been existed an Administrative Council, formed by twelve ripening men and an administrator, which had the seal and a register of all viticole transactions (Ungureanu Gh. ş.a., 1971; Cotea D. V. – co-ord., M. Ciubotaru, 2006).

4. The agronomical factor

Although the rot is a saprophyte fungus which infects the grapes immediately after blossoming, provoking damage of large proportions, in certain conditions of biotope met in some vineyards in Europe (Tokay-Hungary, Rheingau-Germany, Sauternes-France) and in certain years in Cotnari and Pietroasa (for Grasă variety) the action of this parasite has good consequences, contributing to the increasing of vintages quality. Because of low atmospheric hygroscopicity and of a higher concentration in sugars, an evaporation process takes place, followed by the drying up of the berries. Thus, conditions for the installation of *the noble rot* appear (Şt. C. Teodorescu, V. Stoian, 1987).

Very good productions of grapes from certain years are reflected in the quality of the resulted wines, as a proof being the prizes obtained in international competitions. We can mention here the gold medals obtained for certain varieties of wines, such as *Grasa de Cotnari* (the production of years 1979, 1984, 1994, 1996, 1999, 2000, 2001, 2002, 2003), *Tămâioasa Românească* (the production of years 1994, 1995, 1999, 2002, 2003, 2005, 2006, 2007), *Frâncuşa* (the production of year 2007) and *Fetească Albă* (the production of years 2005 and 2007; *Evenimentul Regional al Moldovei*, 2008). Correlating the production of grapes from the years in which were obtained medals for wines of certain varieties with the climatic data for the vegetation period of grapevine, we can affirm that for realizing good productions are necessary: the air temperature in this period between 14.5-18.1 ºC, both for *Grasă de Cotnari* and for *Tămâioasă Românească*; precipitations in the above mentioned period between 231,9-449,8 mm for *Grasă de Cotnari* and between 231.9-434.9 mm for *Tămâioasă Românească*; the relative humidity in the vegetation period between 67.5-80.6 % for *Grasă de Cotnari* and between 67.5-78.8 % for *Tămâioasă Românească*; the length of sun shining between 1311.7-1717.5 hours for *Grasă de Cotnari* and between 1438.5-1646 hours for *Tămâioasă Românească*.

Table 1. Correlation between climatic elements and years with good production for Grasă de Cotnari.

Years with good production	Air Temperature	Atmospheric Precipitations	Relative Humidity	The length of sun shining
1979	16.7 ºC	404.2 mm	80.6 %	1408.8 hours
1984	15.6 ºC	428.4 mm	75.8 %	1311.7 hours
1994	18.1 ºC	231.9 mm	71 %	1622.3 hours
1996	16.2 ºC	449.8 mm	77.1 %	1495.4 hours
1999	14.5 ºC	325.6 mm	70.6 %	1586.7 hours
2000	17.7 ºC	274.7 mm	72.1 %	1717.5 hours
2001	17.3 ºC	406.8 mm	74 %	1520.2 hours
2002	17.3 ºC	420.3 mm	72.1 %	1438.5 hours
2003	18.0 ºC	242.0 mm	67.5 %	1646 hours

Table 2. Correlation between climatic elements and years with good production for Tămâioasă Românească.

Years with good production	Air Temperature	Atmospheric Precipitations	Relative Humidity	The length of sun shining
1994	18.1 ºC	231.9 mm	71 %	1622.3 hours
1995	16.6 ºC	434.9 mm	73.6 %	1583.1 hours
1999	14.5 ºC	325.6 mm	70.6 %	1586.7 hours
2002	17.3 ºC	420.3 mm	72.1 %	1438.5 hours
2003	18.0 ºC	242.0 mm	67.5 %	1646 hours
2005	16.9 ºC	390.3 mm	78.8 %	1455.5 hours
2006	17.0 ºC	430.3 mm	68.6 %	1571.3 hours

5. Conclusions

We have to mention the fact that the best viti-vinicole productions have been obtained in Cotnari Vineyard mostly in droughty years (1994, 2000, 2003). Giving the climatic tendency of general warming in our country, this aspect could justify opotimistic predictions regarding the future of viti-vinicole productions in the area on medium term. However, one must take into account that, in spite of the grapevine reduced sensitivity to dryness, it cannot evolve optimal - especially in super-ripening stage - without a minimal quantity of water in soil, which varies for each variety respectively.

Finally, we can conclude that in Cotnari Vineyard region the ecoclimatic conditions are extremely favorable for normal grapevine phenological phases, the qualitative viti-vinicole production – also favourised by the specific pedological conditions - being an argument in this respect. The two ecoviticole components of the „terroir" concept – climate and soil – contribute (in the case of Cotnari Vineyard), in a great measure in establishing an intimate relation among the unrolling in optimal conditions of the grapevine phenological phases, the grapes composition, the wine characteristics and the viti-vinicole production.

The „*terroir viticole*" concept proves to be a valuable theoretical instrument within the framework of our endeavour of looming the Cotnari Vineyard profile. This concept helps us to identify the real borders of Cotnari Vineyard, delimiting a geographical area in which grapevine have optimal conditions for growing.

REFERENCES

Bohmrich R. (1996) – *Terroir: Competing perspectives on the roles of soils, climate and people*, Journal of Wine Research, vol. 7, issue 1, no. 4, Routledge Publishing, UK.

Cotea Victoria, Cotea V. V. (1996) – *Viticultură, Ampelografie şi Oenologie*, Edit. Didactică şi Pedagogică, Bucureşti.

Cotea D. V. (coord.), Ciubotaru M., Barbu N., Cotea V. V., Magazin P. G., Grigorescu C. C. (2006) – *Podgoria Cotnari*, Edit. Academiei Române, Bucureşti.

Gugiuman I. (1978) – *Contributions à la connaissance géographique du vignoble de Cotnari*, Revue Roumaine de Géol., Géophys. et Géogr., tome 22, № 1, Bucureşti.ôô

Jianu L., Alexandrescu I., Cotea V. D. (1973) – *Ecosistemul viticol din Podgoria Cotnari*, Lucr. Şt. Inst. Agron. Iaşi, seria Agron-Hortic., vol. 1-4, Iaşi.

van Leeuwen C., Seguin G. (2006) – *The Concept of Terroir in Viticulture*, Journal of Wine Research, vol. 17, no. 1, Routledge Publishing, London, UK.

Seguin G. (1986) - *Terroirs and pedology of vinegrowing*, Experientia, 42, 861-873, Bangor, UK.

Seguin G. (1988) - *Ecosystems of the great red wines produced in the maritime climate of Bordeaux*, Proceedings of the Symposium on Maritime Climate Winegrowing, Geneva, Department of Horticultural Sciences, Cornell University.

Teodorescu C. Şt., Stoian V. (1987) – *Oenoclimatul României*, Edit. Ştiinţifică şi Enciclopedică, Bucureşti.

Ungureanu Gh., Anghel Gh., Botez C. (1971) – *Cronica Cotnarilor*, Edit. Ştiinţifică, Bucureşti.

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