

Evaluation of the climatic conditions of Banu Mărăcine Viticultural Centre

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Abstract Vineyard microclimates vary greatly from one to another over the years according to geographical position, the climatic changes that are happening in recent years, causing changes in the zoning and delimitation of the grapevine growing areas. The purpose of this study is the evaluation of Banu Mărăcine Viticultural Centre climate, for the period of 2008-2010. In this regard, there were processed climatic data obtained from Meteorological Station nearby Banu Mărăcine Viticultural Centre, being determined a series of bioclimatic synthetical indices of the grapevine, namely: heliothermic index, hydrothermic index, grapevine bioclimatic index and oenoclimatic capacity index, climogramme also being made for the three years studied. In terms of rainfall and temperatures of the vegetation period of grapevine, 2009 stands out as the most hot and dry, followed by 2008 and 2010. The results revealed that the heliothermic index recorded values between 2326.27 and 2497.30, which do not restrict the grape ripening, hydrothermic index showed lower values (0.7) in 2008 and 2009, suggesting the necessity of irrigation, so that in 2010, it recorded a higher value, respectively 0.9, while grapevine bioclimatic index and oenoclimatic capacity index ranged within normal limits, making Banu Mărăcine Viticultural Centre to be suitable for obtaining red and white wines of superior quality.

Key words

climatic conditions, agroecosystem, viticulture, climatologic indexes

Air temperature, solar radiation, rainfall and relative humidity of the air are meteorological elements that influence the most the development, production and quality of grapes.

The major wine producing regions in the world each experience climate variability, however, depending on location they are subjected to different types, frequencies, and magnitudes of climate and weather events [1].

In the recent years, climate change affects more and more vine agroecosystems., changes in Earth's climate being projected by the end of this century because some atmospheric "greenhouse" gases, among them carbon dioxide, are increasing [4].

Considered as a multiannual basis of meteorological processes, the climate is dominant for grape quality [3], temperature being one of the environmental factors with major effects on growth and development of both shoots of vines and grapes [5].

Globally, climate change, manifest consequences of changing weather and climate in the areas of vine cultivation [8], this changes being observed also in the romanian vine growing areas.

The total warming of the climate caused many disordered states in the wine ecosystems, type of vines

being obliged to modify their annual cycle of vegetation, with generally negative consequences on the quality and quantity of the production of grapes [9] and it is necessary a reevaluation of land use based on a detailed pedo-climatic study [2].

The climate characterising a certain region or viticultural area does not represent a constant in time, there are permanent variation, depending on the climate origin [6], therefore, the appreciation of the climatic favourability of a certain region will be much more accurate if synthetic climatologic indexes are used [7].

The climatic indices available to describe the viticultural regions are above all thermal at the level of the grape-growing cycle [10].

Materials and Methods

The study was based on climatic observations for the period 2008 – 2010, as well as on the interpretation of the climatic data recorded for this specific period at the Meteorological Station nearby Banu Mărăcine Viticultural Centre (44°19'N, 23°48'E).

The climatic factors registered permitted the determination of several indexes and coefficients used in viticultural climatology for the appreciation of the viticultural biotope characteristics, such as: active thermal balance, precipitations, real insolation, grapevine bioclimatic index and oenoclimatic capacity index. These indexes are representative of the variability of the viticultural climate worldwide, related to the requirements of varieties, vintage quality and typeness of the wines [10].

Climatological Weather Station provided the climatic data and further processing was possible to determine the grapevine synthetic indexes:

- heliothermic index, Huglin, 1978;
- hydrothermic index, Seleaninov, 1936;
- grapevine bioclimatic index, Constantinescu et al., 1964;
- oenoclimatic capacity index, Teodorescu Ş t., 1977.

Results and Discussions

Grape growing and wine production are largely weather and climate driven [1], being said that, worldwide, the climate of the different grape-growing regions accounts for a large part of the diversity of varieties cultivated, viticultural products, quality and typeness of the wines [10].

The selection and determination of the grapevine suitability for certain areas and zoning the grape varieties, requires knowledge of the main climatic factors (Tab.1).

According to the climatic data registered at the Banu Mărăcine Viticultural Centre, the year of 2009, was characterized by higher temperatures and less rainfall. To be more specific, average annual temperature, average temperature during the vegetation period of the grapevine, maximum air temperature, annual and vegetation rainfalls and real insolation recorded higher values compared to the other two years in study. In terms of active and useful thermal balance, the year of 2008 had higher values, followed by the year of 2009 and 2010.

Tabel 1

Climatic characteristics during the period 2008-2010 at the viticultural centre Banu Maracine

Climate factor	Year		
	2008	2009	2010
Average annual temperature, °C	11,8	11,9	11,3
Average temperature during the vegetation period, °C	19,1	19,4	19,0
Maximum air temperature, °C	35,9	37,0	35,8
Minimum air temperature, °C	-13,7	-15,5	-18,4
Σ Annual rainfalls, mm	481,4	676,2	826,9
Σ Rainfalls during the vegetation period, mm	272,8	269,1	346,2
Air humidity, %	69	72	78
Real insolation, hours	1353,8	1450,9	1408,7
Active thermal balance, °C	3586,9	3546,0	3441
Useful thermal balance, °C	1816,9	1766,0	1641

Since climatic factors do not act alone on the vine, but together, in a strong interdependence, to have better results on the suitability of the years in study, there were calculated also, some synthetic indicators that allow the interaction between climatic factors (Tab. 2).

Thus, in all the years studied, the heliothermic index of Huglin had values over 2000, the lowest value being recorded in 2010, and the highest in 2009, followed by 2008, according to the global

géoviticulture climates classification [10], the year of 2010 is placed in the temperate viticultural climate class HI – 1 and the years of 2009 and 2008 in the very warm class of viticultural climate HI + 3.

Regarding the hydrothermic index, according to the data obtained, the years of 2008 and 2009 are characterized by restrictive values of this index (0.7), compared with 2010 which benefited from better water resources.

Table 2

**The values of the synthetic indexes of the viticultural agro-ecosystem on site at
Banu Mărăciine recorded during the vegetation period**

Year	Synthetic index			
	Heliothermic index	Hydrothermic index	Grapevine bioclimatic index	Oenoclimatic capacity index
2008	2446,08	0,7	9,3	4917,9
2009	2497,30	0,7	10,07	4978,1
2010	2326,27	0,9	7,42	4755,9

Taking in consideration the bioclimatic index of the grapevine, it is found that it outlines the climatic suitability of the Banu Maracine biotope for growing grapes, standing out the year 2009 with the highest value of 10.07.

The values recorded oenoclimatic capacity index, showed amounts over 4600 units, making Banu Mărăciine Viticultural Centre to have a favorable climate to obtain red and white wines of high quality, also, remarking the year 2009 with higher values of this index.

Most of the times, it is necessary that the synthetic indicators to be accompanied by the graphic evolution of the climatic factors, namely the climogram.

According to the climogram, the year of 2008 (Fig. 1) is characterized by relatively low water resources, having the lowest value of 0,6 mm recorded during august, a fact confirmed by the hydrothermic index and at the same time characterized by a progressive increase of the thermal resources up to august, with a value of 24,3 °C and then to decline until october, having a value of 12, 5 °C.

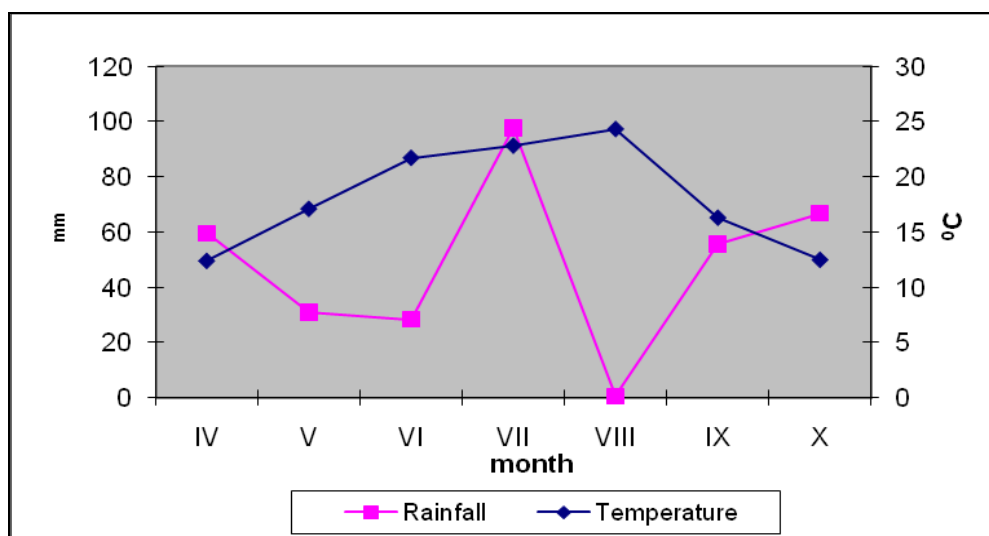


Fig. 1 The Climogram of Banu Mărăciine Viticultural Centre for the year of 2008

Unlike the previous year, the 2009 (Fig. 2) is characterized by higher temperature from april to august, with the average july temperature of 23.7 °C, after that a small decrease was observed, so that in

october to record the lowest value of 12 °C and low water resources, and a minimum of 14 mm rainfall in august.

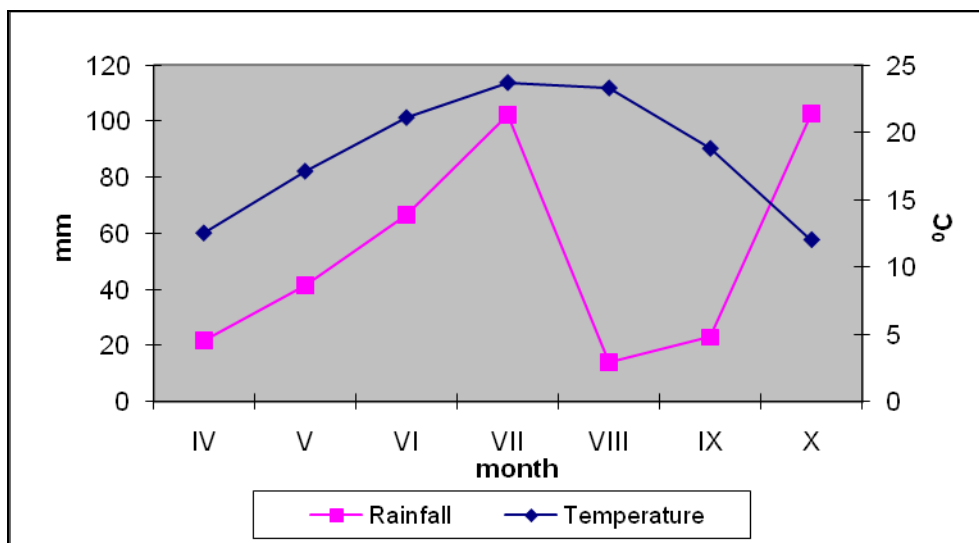


Fig. 2 The Climogram of Banu Mărăciine Viticultural Centre for the year of 2009

During the 2010 (Fig. 3) it was found an increase in the thermal resources up to august, with a maximum of 23.9 °C, followed by a decrease up to october , the water resources have registered a decrease

from may when it was recorded the maximum value of 103.8 mm and continued until september, so that in october to increase up to a value of 87.8 mm.

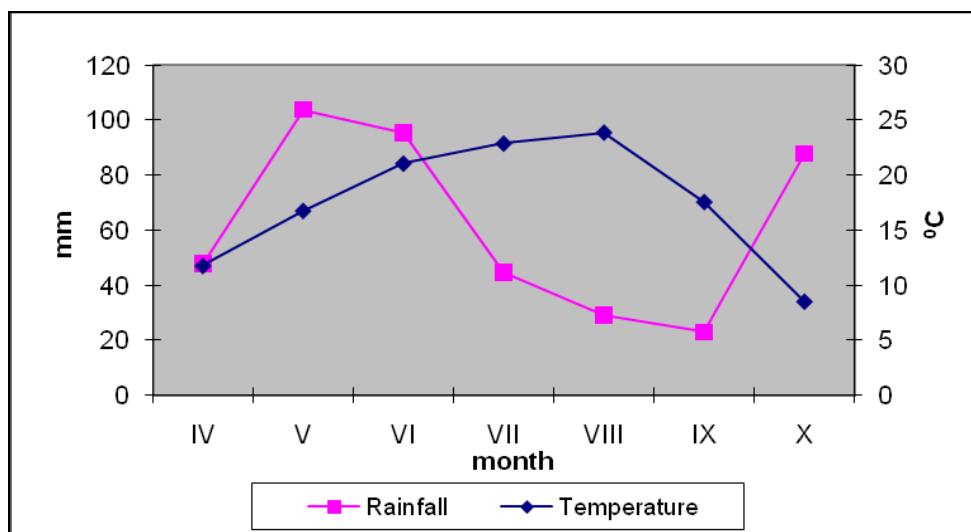


Fig. 3 The Climogram of Banu Mărăciine Viticultural Centre for the year of 2010

According to the climogram made, of the three years studied, 2010 is characterized by lower temperatures and more precipitation, with average monthly temperature of 17.5 °C and a mean monthly rainfall of 61.6 mm, the year of 2009 had average temperatures of 18,3 °C and average rainfalls of 53,1 mm and finally 2008 was characterized by monthly average temperature of 18,1 °C and monthly average rainfalls of 48,5 mm.

Conclusions

Vineyard microclimates vary greatly from one to another over the years according to geographical position, and the climatic changes that are happening in recent years, are causing changes in the zoning and delimitation of the grapevine growing areas.

In terms of rainfall and temperatures of the vegetation period of grapevine, 2009 stands out as the most hot and dry, followed by 2008 and 2010.

Analyzing the synthetic indices, the results revealed that the heliothermic index recorded values

between 2326.27 and 2497.30, which do not restrict the grape ripening, hydrothermic index showed lower values (0.7) in 2008 and 2009, suggesting the necessity of irrigation, so that in 2010, it recorded a higher value, respectively 0.9, while grapevine bioclimatic index and oenoclimatic capacity index ranged within normal limits, making Banu Mărăcine Viticultural Centre to be suitable for obtaining red and white wines of superior quality.

Evaluation of the climatic conditions of grapevine growing areas, are always needed to determine the suitability of the vine cultivation and the varieties resistant to heat and water stress, especially when climate change affects globally viticulture.

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