EVALUATION OF THE ECOCLIMATIC CONDITIONS IN TURDA WINE CENTER AND ASSESSMENT OF OENOCLIMATIC APTITUDE

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ABSTRACT

Vines act as indicators in relation with ecoclimatic changes and they are particularly sensitive to temperature and precipitation changes.

Temperature is a limiting factor and define the distribution area for all plants. Climate change in viticulture is characterized by air temperature increase, rain reduction, intensification of extreme events, mild winter and heat shock in summer but with frost in April-May.

The main objective of this paper is to present the climatic conditions such as temperature, insolation, rainfall and the interaction of these parameters in Turda viticulture area, in the last years (2009-2019), in order to assess the oenological potential of the area. Comparing the thermal coefficient values (C_t) of our country (situated between the values 16-19), we can conclude that, in Turda area there is sufficient thermal resources for vine growth and fruition. Insolation and precipitations are in normal parameters for viticulture. The values of the real heliothermic index (IH_r), hydrothermal coefficient (CH) and wine bioclimatic index (I_{bcv}) recorded in Turda winegrowing area (IHr=2.0; CH=1.3 and Ibcv=6.1) show that the ecoclimatic conditions from the studied area is favorable, that makes possible the production of grapes for white wines of high quality but also quality red wines, in some years.

INTRODUCTION

Vines need a specific climate, well defined and constantly monitored,as any changes may have a negative effect on them and as a result on the wine (Schaller, 2011, Bora et al., 2014).

The favourable ecoclimatic conditions for vine culture are divided into two categories: the compulsory (Bora et al., 2014) and the natural critical conditions. The compulsory conditions are important and directly promote growth and fructification of the vines (Dunoiu et al., 2008), some of these factors are solar radiation, temperature, light, and humidity (Bora et al., 2015, 2016; Iliescu et al., 2019). The natural critical conditions affect the growth and fructification of the vines, resulting in decreased quantitative and qualitative production (Giugea, 2001, Pop, 2010).

The quality of the grapes is also directly influenced by the variety, of ecoclimatic conditions,by the applied agrotechnical works and also by the zoning (Bunea et al., 2013).

The research shows that the ecopedological ecoclimatic conditions in Transylvania influence directly the vines, especially the cultivation of vines for producing quality white wines (Călugăr et al., 2009). Regarding the framing within the limits of a viticultural sector, the vineyards from Cluj County are located within the Transylvanian Plateau Region, particularly at northern limit of this region..

MATERIAL AND METHOD

In order to assess the potential of Turda area for vine culture in the current context, the climatic conditions data were obtained from the Turda Agricultural Research and Development Resort (46º35' lat. N, 23º47' long. E, 427 m altitude) and North Transylvania Regional Meteorological Center, for the period 2009-2019 but also the multiannual values from the last 60 years registered in this area.

Based on their specific formulas (Ţârdea and Dejeu, 1995; Pop, 2010), ecoclimatic indicators were determined, important for the growth and the fruition of vines, such as global thermal balance (Σt°g); active thermal balance (Σt°a); useful thermal balance (Σt°u); thermal coefficient (Ct); annual and monthly rainfall amount; amount of hours of sunshine (number of sunshine hours) and real sunburn coefficient (Ci).

To get a broader image on how climatic factors influence the growth and fruition of vines, the Heliothermic index (IHr), Hydrothermal coefficient (CH), Bioclimatic index (Ibcv) and Oenoclimatic aptitude index (IAOe) were calculated (Pop, 2010; Bora et al., 2015). Because ,so far, the beginning and end of the vegetation period of the vines in this area has not been analysed, in order to determine the climatic indicators we brought into the analysis the standard vegetation period from April 1 to September 30 (183 days).

RESULTS AND DISCUSSIONS

The vegetation period taken into account for the Turda area (183 days) is similar to the average value registered in Târnave vineyard, also located in Transylvania region, the oscillations was registered between 166 days and 192 days, over the period 2010-2015 (Bora et al., 2016).

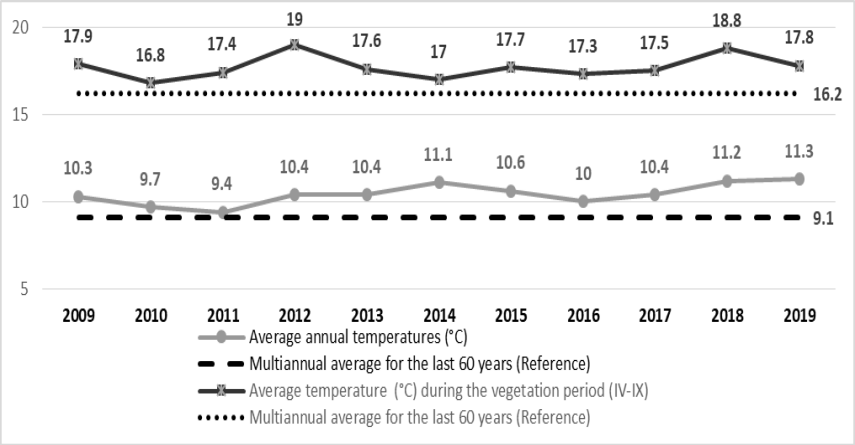

Fig.1. Average annual temperature (2009–2019), in Turda winegrowing area

The thermal regime, over the period 2009–2019, is characterized by average annual temperatures of 1.5°C, which fluctuates between 9.4°C, recorded in 2011, and 11.3°C ,recorded in 2019. Compared to the multiannual average taken as a reference value in the study ,9.1°C (Fig.1), the difference in temperature recorded being quite high, more precisely +2.4°C.

Except in 2011, when the average temperature recorded was 9.4°C (normal value compared to multiannual values), all the other years analysed can be characterized as warm compared to the values of the last 60 years.

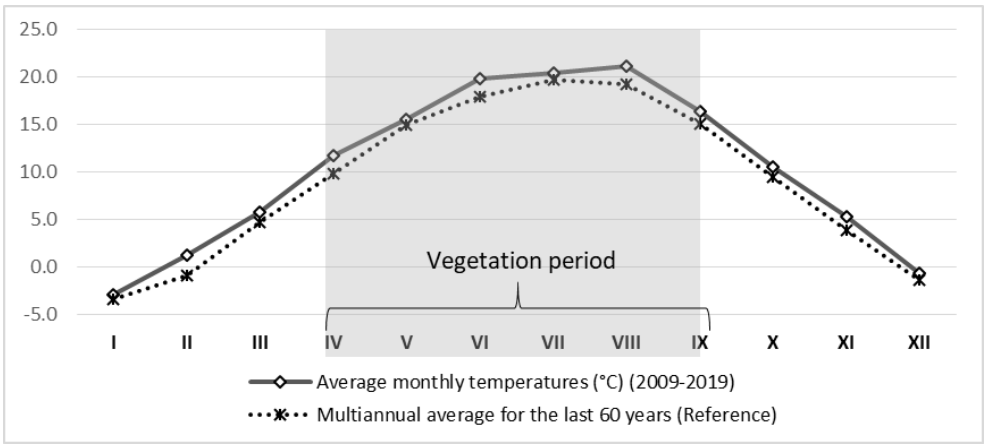

Fig.2. Average monthly temperature (2009-2019) in Turda winegrowing area

The average temperature recorded in vegetation period (from April to September) was higher (19.5°C) (Figs 1 and 2) compared to the multiannual average for the last 60 years over the same period (16.2°C.

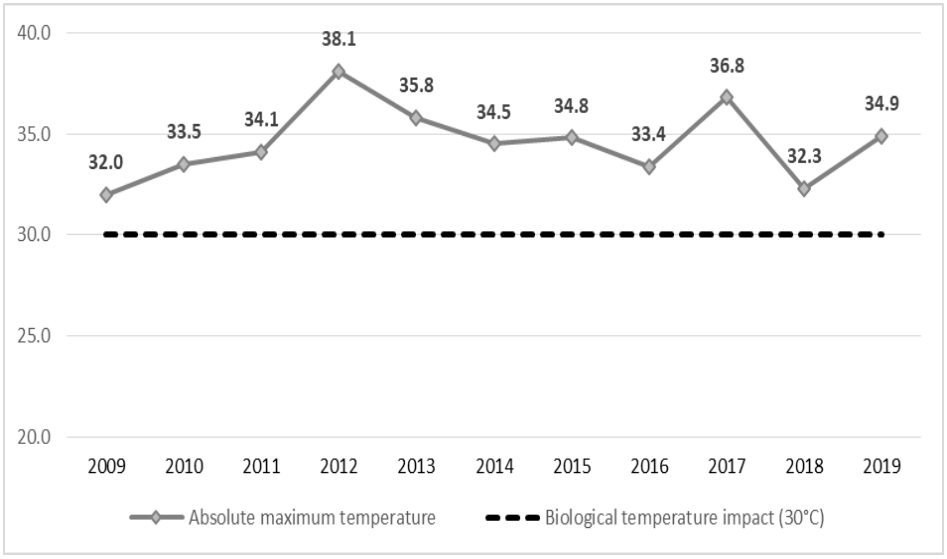

Fig.3. Maximum annual temperature (2009-2019), in Turda winegrowing area

Regarding the extreme maximum and minimum temperatures (Figures 3 and 4) recorded in the Turda area, we can say that no conditions were met that would negatively influence the growth and development of the vine..

During the vegetation period, the maximum temperatures were registered in July and August, but they did not exceed the threshold of 40°C when the growth of the shoots and that of the grapes are affected.

In the period 2009-2019, the coldest months turned out to be January and February, when the absolute minimum temperatures recorded values of -19.0°C in 2017 and -19.6°C in 2011. It should be noted that these values did not exceed the biological resistance threshold (-20°C) of the vine.

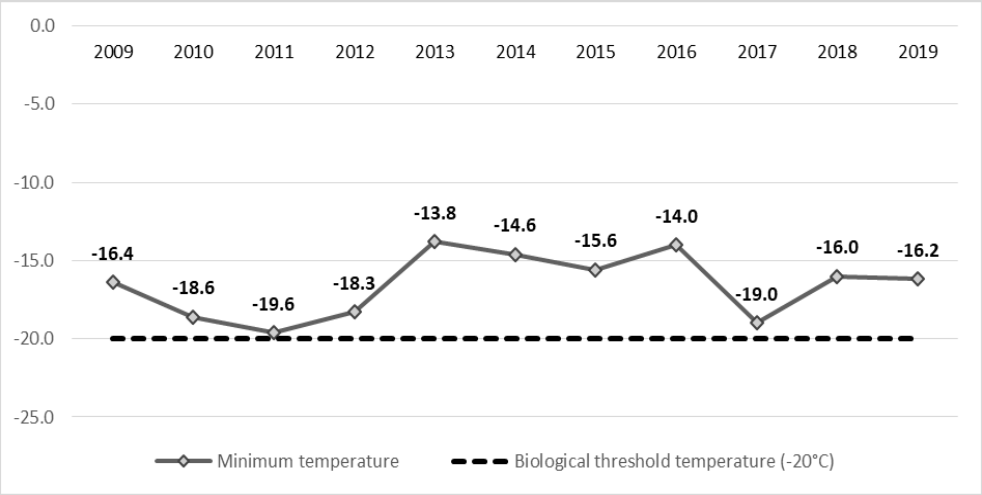

Fig.4. Minimum annual temperature (2009-2019), in Turda winegrowing area

As an indicator of the vineyard vocation, but also to establish the direction of production, the amount of temperature degrees and the thermal balance have absolute importance (Pop, 2010).

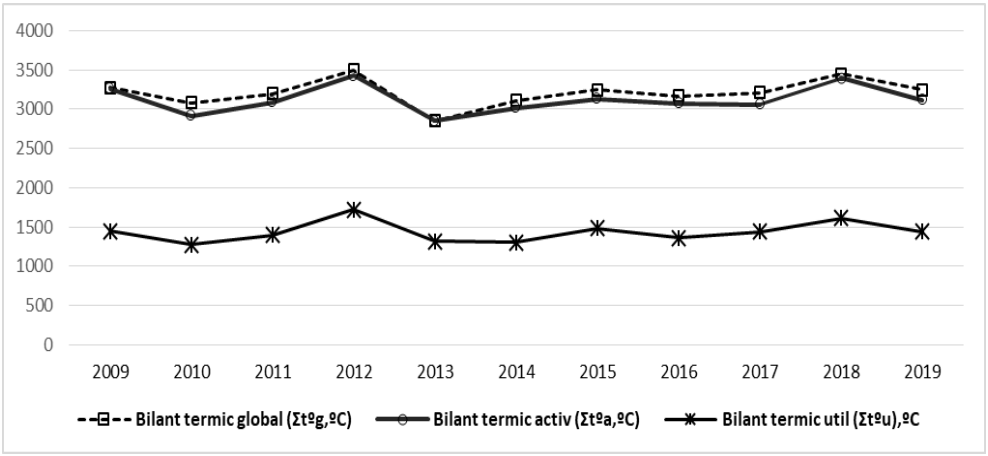

Fig. 5 Thermal Balance (2009–2019), in Turda winegrowing area

In the studied period, the average values (Fig. 5) of thermal balance was: the global thermal balance (Σtg) 3211°C, the active thermal balance (Σta) 3120°C and the useful thermal balance (Σtu) 1437°C. The values recorded are above the minimum limit required for the cultivation of vines but also above the values obtained by Pop (2010) over the period 1987-1996 for this area.

But compared to the values obtained by other researchers (Bora et al., 2014; Mursa, 2009; Popa et al., 2008; Dunoiu et al., 2008; Hodor, 2011; Iliescu et al., 2019) within other wine centers with reputation from Romania, the values of the global thermal balance and assets are lower.

Analysing the precipitations during 2009- 2019 (Fig. 6), the highest annual average was registered in 2010 (738.9 mm), 2014 (746.6 mm) and 2016 (813 mm), this values being higher than the multiannual average, therefore these years were characterized as rainy at both annual and vegetation levels. On the other hand, the years 2009 and 2011 proved to be dry.

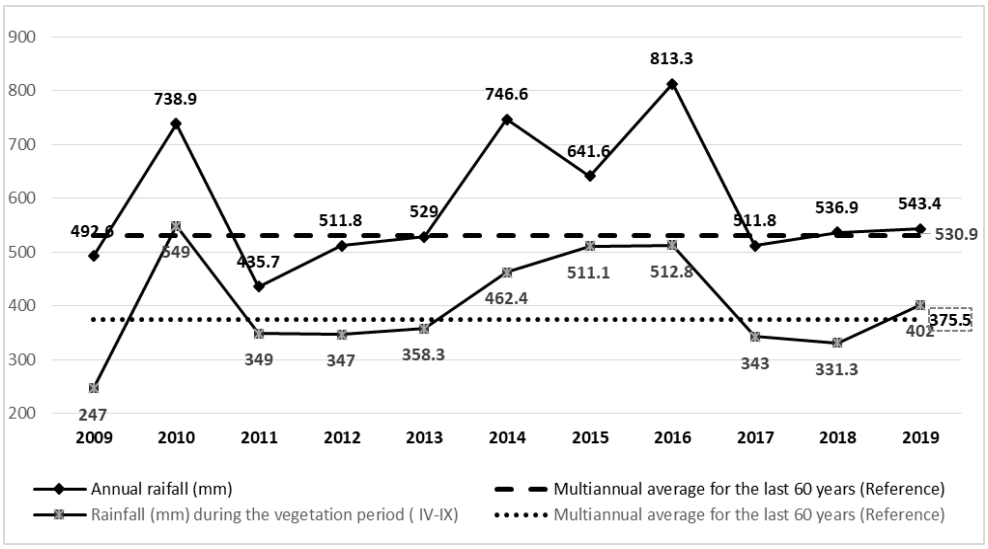

Fig. 6 Rainfall (2009–2019) in Turda winegrowing area

During the growing season, the average amount of rainfall over 11 years (401.2 mm), showed higher values compared to multiannual value (375.5 mm). Fig. 7 shows that the months with most precipitations were June and July but also the fact that the distribution or rainfalls was changed compared to the multiannual values.

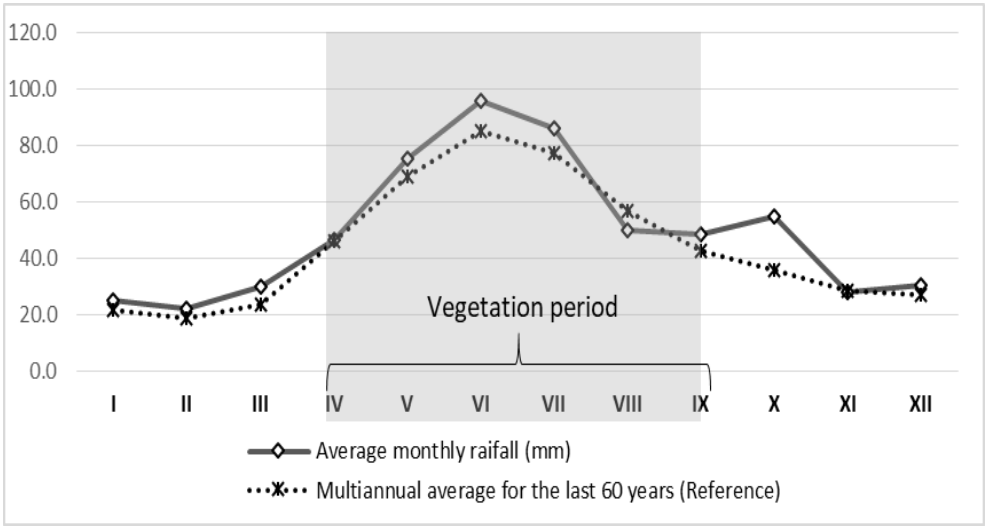

Fig. 7 Average monthly rainfall (2009-2019) in Turda winegrowing area

The real insolation, under these conditions in Romania, is between 1200-1500 hours, considered minimum values.

Over the period 2009-2019, the average annual insolation was 1972 hours and in the vegetation period 1388 hours, (Fig. 8).

These values are higher compared to values presented by Pop (2010) for this region and confirm the potential of the Turda area for the cultivation of vines and the qualitative potential of wines, including that of the red wines.

Insolation and precipitations are in normal parameters for viticulture. The coefficient of precipitations (Cp) represents the ratio between the amount of precipitation during the growing season (mm) and number of days of the growing season and the insolation coefficient (Ci) represents the ratio between the sunstroke during the growing season

(hours) and number of days of the growing season.

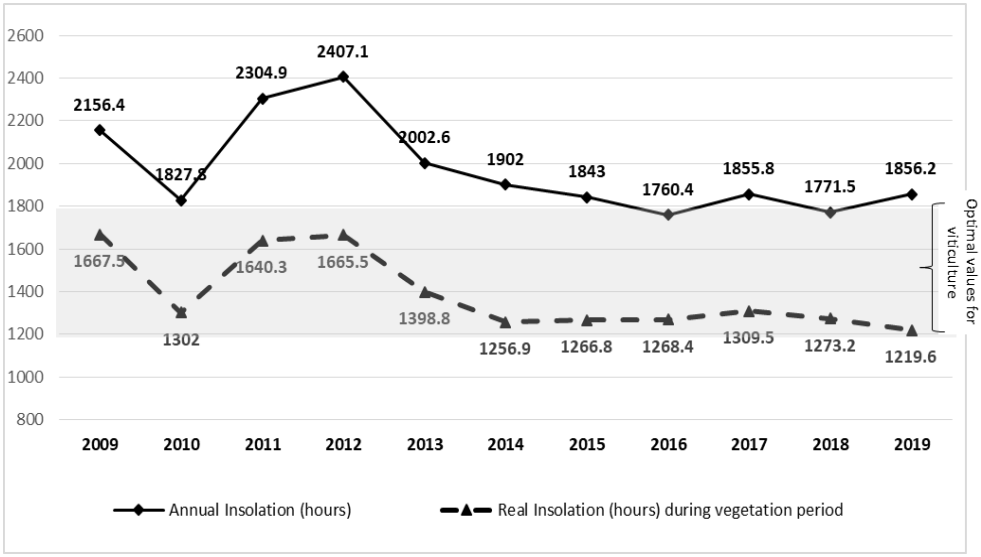

Fig.8. Evolution of insolation in period 2019 – 2019 in Turda winegrowing area

The Tab. 1 shows that during 2009-2019, these parameters, along with the thermic coefficient, fit into the optimal values for viticulture in Romania, and ecoclimatic conditions from the studied vineyards are favourable, that makes possible the production of both red and white wines of high quality in these areas.

Tabel 1

Ecoclimatic indexes of Turda winegrowing area

Studied elements	Average 2009-2019	Extreme limits (2009 – 2019)		Optimal values for viticulture
		Min.	Max.	
Thermic coefficient (C_t)	17.5	15.6	19.1	16 - 19
Insolation coefficient (C_i)	7.6	6.7	9.1	7 – 9 ore
Precipitation coefficient (C_p)	2.2	1.3	3.0	-
Heliothermic index (IH_r)	2.0	1.6	2.9	1.35 - 2.70
Hydrothermal coefficient (CH)	1.3	1.2	1.7	0.7 - 1.5
Bioclimatic index (I_{bcv})	6.1	4.0	12.1	5.0 - 15.0
Oenoclimatic aptitude index (IAO_e)	4356	3919	4991	3700 - 5200

The values of the heliothermic index for the Turda area ranged from 1.6 (in 2014) to 2.9 (in 2012), the average value for the analysed period being 2.0. This value confirms the availability of the vineyard for the cultivation of vines, and is higher than the value obtained by Pop (2010) (IHr = 1.08) in the same area during 1897-1996.

Moreover, the values of hydrothermal coefficient (CH = 1.3) and bioclimatic index (Ibcv = 6.1) recorded for the period 2009-2019 in Turda are higher than those obtained by Pop (2010) for the same area, in the period 1897-1996 (CH = 1.2; Ibcv = 5.19). This fact proves that the climate change has also affected this area in favour of growing wine grapes.

The values of CH recorded during the analysed period (between 1.2 – 1.7) express that the moisture and temperature favour constant and satisfying production from a quantitative and qualitative point of view.

The low values (between 5 and 7) of the Bioclimatic index indicate years of production rich in hydric resources but to the detriment of the wine quality. Compared to the values obtained by other authors, it is found that the value of this indicator tends to increase as a result of the climate change, also in the Turda area.

The Oenoclimatic aptitude index comes to help establish the degree of climatic favourability of the studied area. Values below 4300 indicate that the area is suitable for the cultivation of white wine grapes and between 4300 and 4600 it has a medium favourability for obtaining red wines. Through the registered values (4356) we can say that this winegrowing area is suitable for obtaining high quality white wines and in certain years including quality red wines.

CONCLUSIONS

The continuous increase of the average annual and monthly temperatures, the alternance of dry periods and periods in which abundant precipitations are recorded but also unevenly distributed confirm that the Turda area feels the danger of the climate change,being certainty highlighted lately by meteorological measurements.

The result of this research show that the ecoclimatic conditions within the studied Turda winegrowing area is favourable, making possible the production of both red and white wines of high quality in this area.

In the area of Turda, the daily average temperature in the last decade was 11.5°C, with an increase of 2.4°C compared to the multiannual average value (9.1°C).

During 2009-2019, insolation and precipitation, along with the thermic coefficient, fit into the optimal values for viticulture in Romania, and ecoclimatic conditions from the studied vineyard are favourable, making possible the production of both red and white wines of high quality in these area.

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