

DEFINITION OF CLIMATIC AND OENOCLIMATE TRAITS FOR THE VINE CULTURE IN THE JIDVEI WINE-GROWING CENTER

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ABSTRACT

The position of the Jidvei wine-growing center in climatic terms is favorable to its geographical location, 45°57' and 46°32' north latitude, 23°52' and 24°48' east longitude, at an altitude of 379 m, where the vine cultivation fulfills the best economic conditions. The summary of this work, from 2010 to 2020, shows that the Jidvei wine-growing center is part of the wine-growing zone A1 (Teodorescu Stt., and its collaborators, 1987), which has specific climatic characteristics for the production of only high quality white and aromatic wines, and in very favorable years also red quality wines. The rainfall, insolation and temperature are in normal and favorable parameters for viticulture. The values of the heliothermal index ($I_{hr}=1,83$), the hydrothermal coefficient ($CH=1,41$) and the bioclimatic wine index ($I_{bcv}=5,07$) show that they are within the optimal values for viticulture in Romania. The index of oenological fitness ($IAOe=4220,51$) shows that the most favorable conditions for high-quality white and aromatic wines have been achieved in this wine-growing center and that, in some years, favorable average conditions for red quality wines have been achieved. There are enough arguments that define the qualities of climate friendliness and oenological favoritism in the Jidvei wine center.

INTRODUCTION

Oprea Stefan., 1995, classifies the eco-climatic factors defining the specific climatic conditions for each wine-growing area into absolutely necessary factors, those which manifest themselves within moderate accepted limits and critical factors, those which have a negative influence on the holding of vines, ripening and the chemical composition of grapes (Giugea Nicolae., 2001): "Climatic factors are the first ones that restrict the economic, profitable culture of vineyards". This study allowed the use of literature, scientific works and doctoral studies in the Târnave area and other similar areas with tradition for the vine culture, with current concepts. They have been brought to the foreground, data that have been recorded and then analyzed defining the climatic characteristics of the Jidvei wine-growing region. Representative is knowledge of the value of climatic indices defining the climatic favorable characteristics which are important for the definition of the Jidva wine-growing area and the variety microzoning. The Jidvei wine-growing center shall be situated in the Târnave' Plateau, between 45°57' and 46°32' north latitude and 23°52' and 24°48' east longitude, at an altitude of 379 m, with moderate continental temperate climate, with suitable warm summers, harsh and wet winters, with long autumn and predominant serene, influenced by the western air masses. The Carpathian arc protects the region from cold currents in the north-east and east." The study was carried out at SC.Jidvei S.R.L Company, with the wine centers: Șona, Jidvei, Feisa-Tătărlăua Tăuni-Făget și Cenade .

MATERIAL AND METHOD

The climatic factors recorded in the period 2010 to 2020 were calculated by mathematical formulae and expressed mathematically as average values or sum. The 1986-2020 climatic factors shall be mathematically expressed as multi-annual average values. The interaction of two or more eco-climatic factors shall be expressed and measured by means of synthetic indices. In binary ratios, temperature-to-light interaction is expressed by the heliothermal index (Ihr) (Branas J, 1946) and temperature-to-humidity interaction by hydrothermal coefficient (CH) (Selenianov G.T., 1936). In tertiary ratios, the temperature-to-humidity interaction is expressed by the bioclimatic index (I.b.v.) (Constantinescu G., 1964), and the index of oenological aptitude (I.A.O.E) (Teodorescu C.St., 1977)/

RESULTS AND DISCUSSIONS

The work shows the evolution of some of the eco-climatic factors recorded in the Jidvei wine center in 2010-2020, which are necessary for the assessment of climate favoritism, and of the synthetic climatic indices for the assessment of oenological favoritism. Vineyards has high requirements in relation to the moisture in the soil and the humidity in the atmosphere.

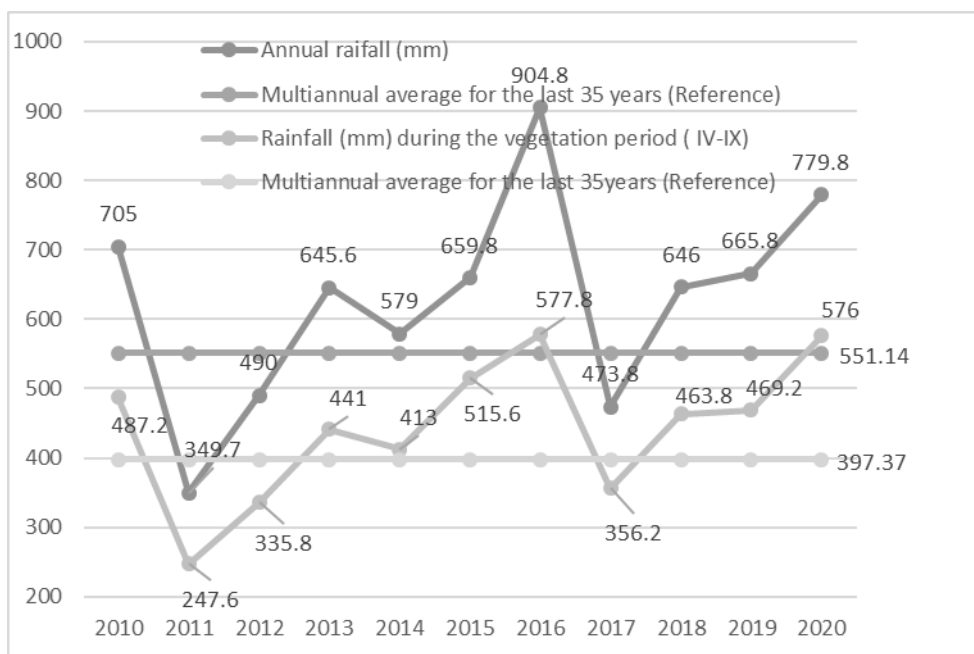


Fig.1 Evolution of precipitation in the Jidvei wine center (2010-2020)

The multiannual period 1986-2020 is 551,14 mm. Normal, the average of the period 2010 to 2020, is 627,21 mm. The year 2016 was an excessively rainy year (904,8 mm), and 2011 was over-dry (349,7 mm). The total distribution of rainfall over the whole period of the year is quite rich, and their excess over some years 2016 (904 mm) creates difficulties in such a cool environment. Of the total rain falls (627,21 mm) annually, during the growing season 2/3 (443,93 mm) were recorded and during the rest period 1/3 (183,28 mm), The lowest value of the annual average during the growing season (1 IV-30 IX), was in 2011, (247,6 mm) and the highest value in 2016, (577,8 mm). The maximum monthly rainfall was recorded in June, (119,53 mm). Since August (57,19 mm), there have been significant drops in rainfall until September (42,98 mm), October (47,31 mm), which are important for good ripening of grapes, and soil heating.(10,51 annual average).

The vine is pretentious to light, the crop has maximum output in sunny places and exhibition. (Oprea Stt.,1995). The average value of the global solation, important in the appreciation of the real light resources, 2010-2020, summed (Σ ig=1859,0 hours), with variations of the solar intensity recorded (Σ ig=2119,8 hours) in 2012 and (Σ ig=1732 hours) in 2016.

The sum of the hours of effective sunlight, entered (Σ ir=1269,37 hours). Is also important, two thirds in the warm period of the year 1269,37 hours and one third (589,63 hours) in the cold period of the year of the total (Σ ig) 1859,0 hours. The maximum sunshine was recorded in July, with a monthly average distribution (Σ ir=2676,19 hours). August, (2011), was the most sunny, (Σ ir=269,5 hours). In December (2017), the lowest values were recorded (Σ ir=35,1 hours).

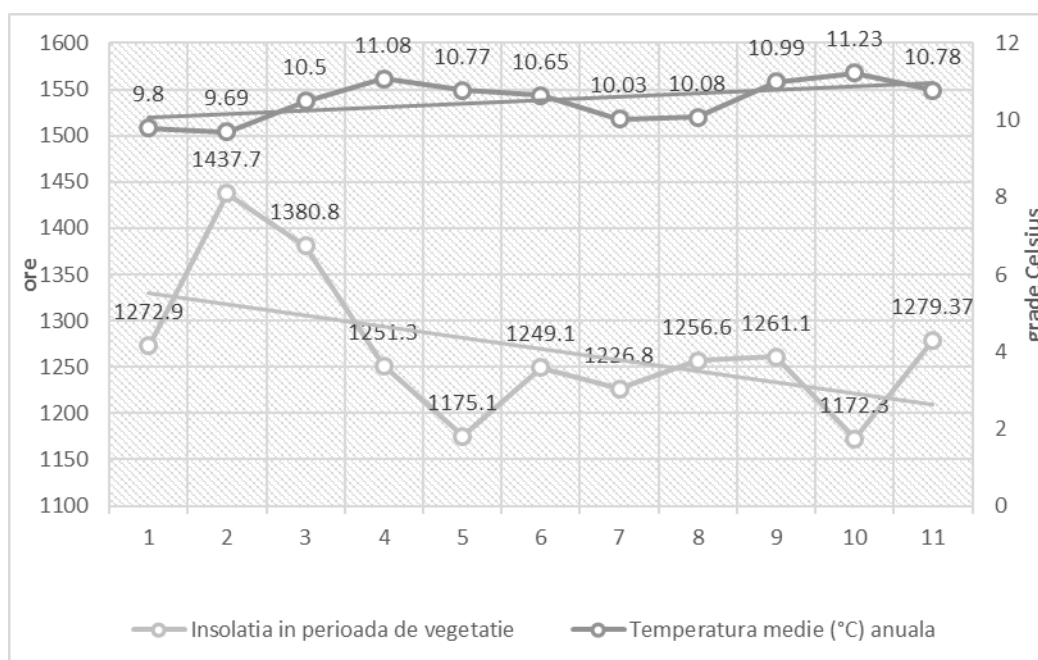


Fig.2 Evolution of the actual temperature and insolation in the Jidvei wine center (2010-2020)

The temperature evolution over the interval shows a periodic fluctuation, with a tendency to increase and decrease slightly, but the evolution of the light shows an irregular movement, at the beginning and end of the interval with sudden increases (2011), sharp drops (2014), (2019). The air temperature is a decision factor for the spread of vines. The multi-annual temperature value, the average of the period (1986-2020), was 9,76 C with values (9,7°C) close to (1995-2007) (Ioia.,2009) and 9,05°C of the period (1972-2004) Corbean., 2011. The annual temperature value, the average of the period (2010-2020), is 10,51°C, important to support the annual life cycle of vines. Values similar to the average were mentioned by other authors, 10,4°C in the period (1995-2007) Ioia., 2009 and 10,06°C (1999-2010) Corbean., 2011. Compared to normal 10,5 °C in 2019, it was a warm year (11,23 °C recorded). The same can be said for 2013, (11,08°C). The coolest years from average were considered 2011 (9,69 °C) and 2010 (9,78 °C).

The growing season in question is 183 days, corresponding to the average value between 170-215 days in the vineyards of Tînavă after (Ioia., 2009, Călugăr., 2011, Corbean., 2011, Hashegan., 2014).

4. The evolution of temperature during the growing season (1 IV-30 IX) in the period 2010-2020, is of great importance in the production of the heat balance for the growing crop. The average annual temperatures from April to September is 17,68°C, multi-annual

average, 1986-2020 (16.85°C). The highest value was recorded in 2012 (19,25°C) and the lowest value 2014 (16,78°C).

5. Annual average temperature (17,68°C), and monthly average temperatures 11,62°C (April), 15,87°C (May), 19,79°C (June), 21,11°C (July), 21,31°C (August), 16,37°C (September), achieved during the growing season (1 IV-30 IX), contributes to the evolution of physiological processes that are very intense, depending on the phenophase and to obtain qualitative yields.

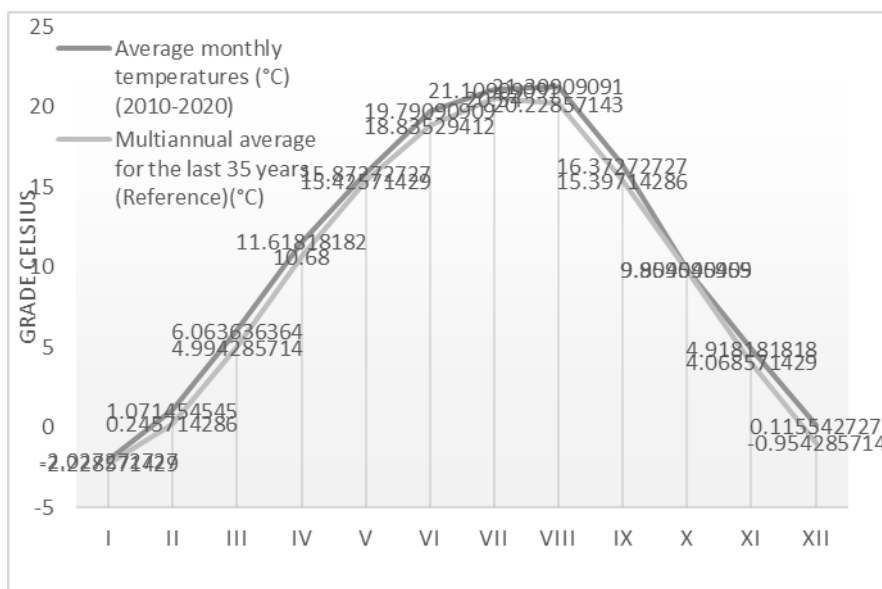


Fig.3 Temperature evolution during the growing season in the Jidvei wine center (2010-2020)

6. The sum of the temperatures or the heat balance determines the direction of production and the variety assortment in the wine-growing area, (Oprea,1995). During the growing season, the average of the period (2010-2020), the sum of the temperature degrees as follows 3145,06°C (Σt_a) and 1440,52°C (Σt_u) were estimated. The values were close to the values of the period 1994-2006, obtained by (Ioia, 2009), of those obtained by Baci, Giugea., Popescu., and Șimon., 2020. from other vineyards in Transylvania, (Turda).

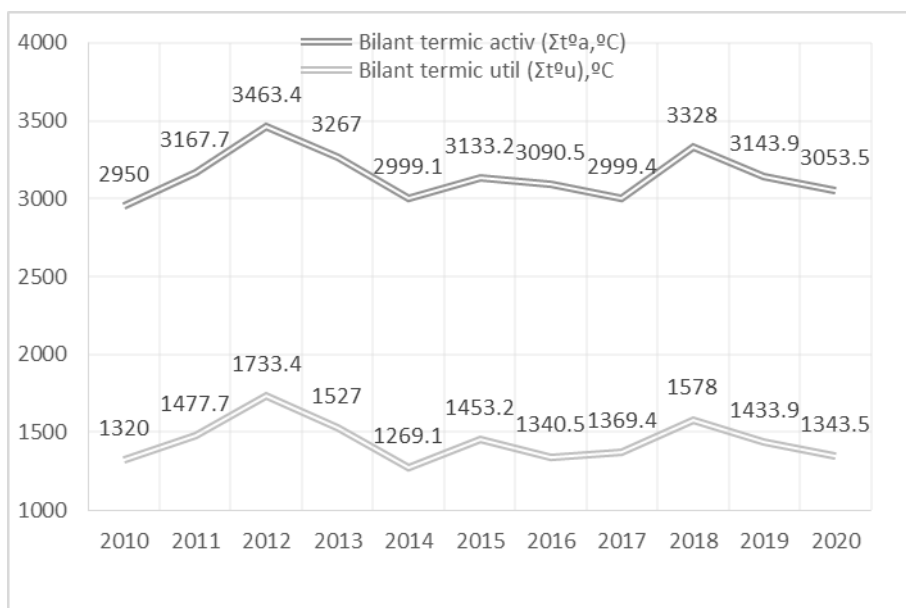


Fig.4 Evolution of the thermal balance in the Jidvei wine center (2010-2020)

7. The minimum annual average temperature is (-24,4)°C. The lowest annual minimum average temperature, reached in 2017 (-24.4 oC), During the growing period the average registered temperature is 5,3°C (July), 7,8°C (August) 6,7°C (September).

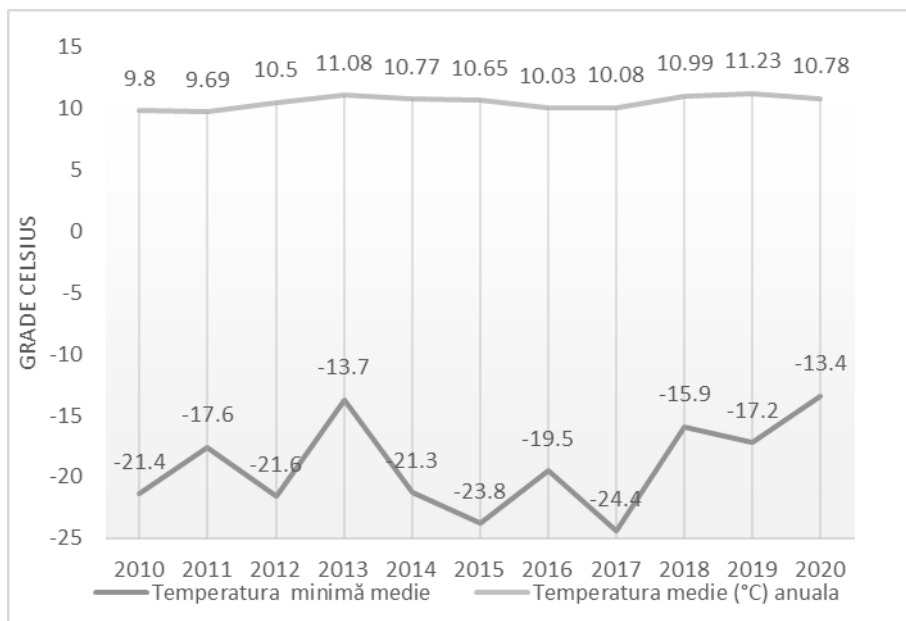


Fig.5 Evolution of the absolute minimum and minimum mean temperature in the Jidvei wine center (2010-2020)

8. The absolute minimum temperatures which exceeded the resistance limit of the vine with negative effects on it have been noted (-21,4°C, 25 January, 2010), (-23,7°C, 8 January, 2015), (-24,4°C, 10 January, 2017).

9. The highest monthly average temperatures of 8 were recorded in August, and are maintained between 19,1°C and 22,8 °C, with optimum values for the ripening of the grapes. From August, the temperature decreased by 4 °C to 6 °C until September,

sufficient to preserve compounds (flavorings and acids), sensitive to high temperatures in the grape seeds.

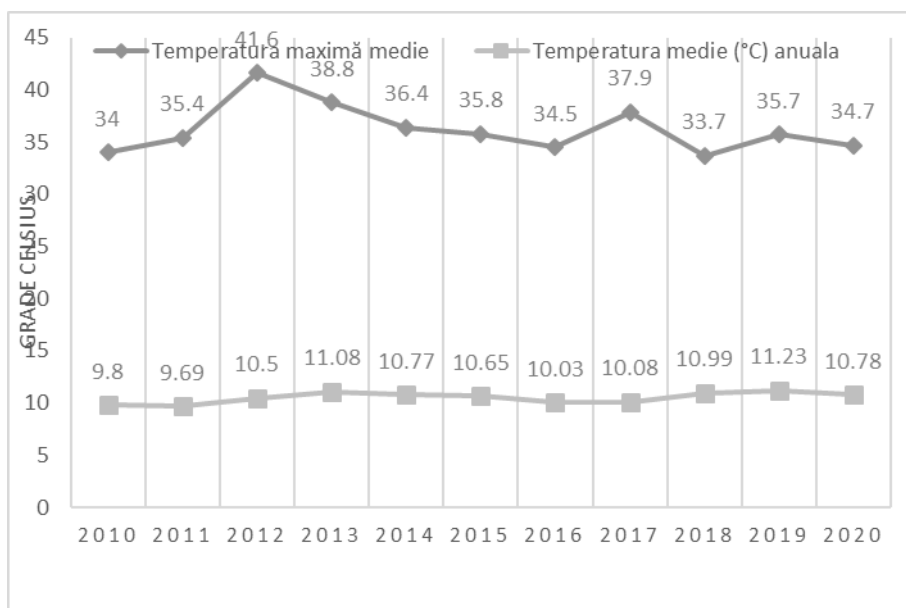


Fig.6 Evolution of the absolute maximum and minimum mean temperature in the Jidvei wine center (2010-2020)

10 The difference between the maximum absolute temperature (41,6 °C) and the absolute minimum temperature (-24.4 °C), respects the mean values (17,2 °C) for the evolution of the ripening of the grapes

11. Average of the air temperature maxima, (41,2 °C) recorded in August and (35,8 °C) September mean a range of 5,8 °C to the minimum air temperature (6,7 °C) In August and (-3 °C) September, it has a field of variation of 3,6 °C, but it satisfies a good development of synthesis compounds in the grapes grains.

12 The maximum average temperatures recorded between April and September did not exceed the maximum critical temperature threshold (of 40°C), which cause imbalances between absorption and sweat and establish stress conditions of photosynthesis.

13. The maximum critical moment has been reached at 41,6°C in (25 VIII 2012).

14. Monthly average of relative humidity (69,60 %) reached during growing season (1 IV-30 IX), and the maximum critical threshold (41,2 °C) recorded in August, and the other critical temperatures of 35,6 (June), 39,2 (July) and (35,8 °C) September have no adverse effect on the intense physiological processes carried out on the phenophases.

Table 1 Ecoclimatic indexes of Jidvei winegrowing area

Studied elements	Average 2010-2020	Extreme limits (2010– 2020)		Optimal values for viticulture
		Min.	Max.	
Thermic coefficient (C_t)	17,71	16,83	19,31	16 - 19
Insolation coefficient (C_i)	6,94	6,41	7,86	7 – 9 ore
Precipitation coefficient (C_p)	2,43	1,35	3,16	-
Heliothermic index (IH_r)	1,83	1,49	2,39	1.35 - 2.70

Hydrothermal coefficient (CH)	1,42	0,78	1,89	0.7 - 1.5
Bioclimatic index (I_{bcv})	5,07	1,14	10,39	5.0 - 15.0
Oenoclimatic aptitude index (IAO_e)	4580,59	3684,15	5092,37	3700 - 5200

To appreciate climate friendliness, between 2010 and 2020, the eco-climate indices of temperature, light and precipitation were evaluated.

The thermal coefficient (Ct) is the optimal value of ($Ct=17,72$). During the growing season, the sum of temperature degrees $3145,06^{\circ}C$ ($\Sigma ta^{\circ}C$) and $1440,52^{\circ}C$ ($\Sigma tu^{\circ}C$) was averaged. The average annual temperatures in August ($19,10^{\circ}C$ and $22,8^{\circ}C$), annual average temperature ($17,68^{\circ}C$), and monthly average temperatures reached during the growing season (1 IV-30 IX), the physiological evolution of processes is very intense, depending on the phenophase, and for qualitative productions., aspect highlighted by Teodorescu C.Stephen., and the collaborators, 1987.

The insolation coefficient (CI) is averaged 6,94. Depending on the normal of the sum of hours of effective sun shine 1269,37 (referred hours), during the growing season 1 IV-30 IX, favorable crop years with the highest values of 1437,7 hours (2011), 1380,8 hours (2012), 1279,37 hours (2020) are highlighted.

The coefficient of precipitation (Cp) has the value ($Cp = 2,43$), the value of the moisture resources is expressed as the normal 627,21 mm (average annual temperature of $10,51^{\circ}C$ and average of August $21.1^{\circ}C$), and the direction of production. (white aromatic wines of high quality and some years red wines of medium quality).

In order to assess the oenological favoritism in the Jidvei wine-growing center, the following binar and ternari eco-climatic indicators were followed: The actual heliothermal index (Ihr), the hydrothermal coefficient (CH), wine-growing bioclimatic index, (I_{bcv}) and the index of oenological aptitude.

-for a helithermal index (IHr) =1,83), the Jidvei wine center has an average potential for helithermal resources. The maximum value ($IHr = 2,39$) was reached in 2012, the year in which the helithermal resources were in excess. The smallest helithermal resources ($IHr = 1,49$) were made in 2014. The helithermal index distinguishes the wine centers in Transylvania, which means that the helithermal resources in the Jidvei wine center are sufficient ($IHr = 1,83$), but lower than those made in the Turda wine center ($IHr = 2$).

-for a hydrothermal coefficient (CH)=1,41), this index shows that in a wine year with a sufficient humidity associated with the temperature, high quality output can be ensured.(Nastasya Pop, 2003). The highest value, $CH = 1,89$ was recorded in 2020, considered a year with sufficient moisture to produce high medium quality output, and the lowest value was 0,78 in (2011), considered a year with low moisture, favorable for large production, constant high quality.

-for a bioclimatic index (I.b. c.c.v)=5,03), this index basically meets the requirements of years of production rich in water resources, with high quality output. The maximum value of this index of $I.b.cv = 10,39$ was reached in (2011) had rich helithermal resources and little precipitation with small, high-quality production was achieved.

For an index of oenological aptitude, $I.A.O.e = 4220,51$, the oenological vocation of this wine center shows that the conditions are very favorable only for the production of high quality white and aromatic wines. In some years, it is possible to achieve average conditions favorable to the production of quality red wines. In 2012 ($I.A.O.e = 4758,40$), 2011 ($I.A.O.e = 4607,80$), 2013 ($I.A.O.e = 4327,3$) the most favorable conditions were achieved for high quality white and aromatic wines and favorable average conditions for red quality wines.

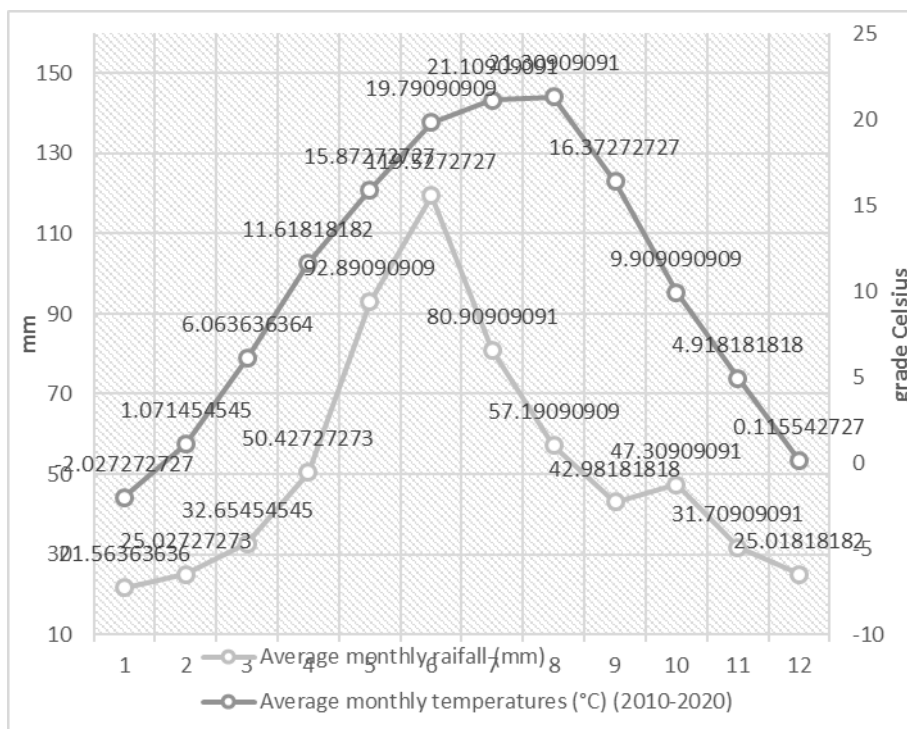


Figura 6 The climatgram in the Jidvei wine center

In the Jidvei wine center, between 2010-2020 the climate shows the evolution of temperature and precipitation environments with a time-to-comparison for the current climate space. During the same period (April-June), coinciding with different growing foxes in vines, temperature and precipitation averages are on a positive trend. The peak of the average rainfall is in June and the temperature is rising slightly, and in July and August. Between June and September, coinciding with rodire phenophase, the average temperature and precipitation volumes are on the same slow downward trend until September.

CONCLUSIONS

Rainfall fully meets the high water requirements of the vine – vines – against the moisture in the soil and atmosphere. Light is sufficient and excessive for the synthetic processes in the chemical compounds of the grapes, which creates favorable conditions for quality crops. The average annual temperature and monthly averages achieved are very sufficient for the annual life cycle, the evolution of very intense physiological processes in terms of phenophysase and quality production. The average of the air temperature maxima and the average of the minima recorded in August satisfy a good development of synthesis compounds in the grapes grains. The monthly average relative humidity is satisfactory, shows that the maximum critical threshold recorded in August, and other critical temperatures June, July and September have had no adverse effect on the intense physiological processes carried out on the phenophysase.

Between April and June, the positive growth trend of the two values (temperature and humidity), has a very favorable climate framework for the good conduct of biological, morphological, photosynthesis and other physiological processes. During the second period, June-September the same favorable climate framework for the physiological processes, the evolution of the maturation of the grapes, the production of grapes and its quality is maintained. The climatic taste with evaluated indices (temperature, light and precipitation) shows that the Jidvei wine center has resources from satisfactory to favorable for the economic culture of the vines. The wine-making qualities differ from those of the climate; in that the climate in question is offered, it can take action on the

oenological circumstances, which meet requirements only for the production of white and aromatic wines of superior quality. In some years, favorable average conditions can be achieved for quality red wines.

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