Scientific Papers. Series B, Horticulture. Vol. LXVII, No. 2, 2023
Print ISSN 2285-5653, CD-ROM ISSN 2285-5661, Online ISSN 2286-1580, ISSN-L 2285-5653

GLOBAL RADIATION AND ITS IMPORTANCE FOR WHITE (YOUNG) WINE QUALITY IN THE JIDVEI WINE-GROWING CENTER

Liana-Maria ROPAN[1], Raluca-Iuliana TRUŞCĂ (POPESCU)[1, 2], Nicolae GIUGEA[1], Alina-Mariana ȘIMON[3], Claudia-Adriana HORȘIA[4]

[1]University of Craiova, Faculty of Horticulture, 13 Alexandru Ioan Cuza Str., Craiova, Romania
[2]Research and Development Station for Viticulture and Winemaking Drăgăşani, 64 Regele Ferdinand Str., Drăgăşani, Romania
[3]Agricultural Research-Development Turda, 27 Agriculturii Str., Cluj, Romania
[4]Jidvei Research Department, 45 Garii Str., Jidvei, Romania

Corresponding author email: raluk_trusk@yahoo.com

Abstract

Global warming and climate change are leading to disruptions in the viticultural ecosystem, with grapevine varieties having to modify their biological life cycle, in particular to adapt to a shorter growing season, with consequences for harvest quality. The study was carried out between 2019 and 2021 in the Jidvei wine-growing center, Târnave wine-growing region in Romania. The Fetească regală variety, the most cultivated white grape variety in Romania, was studied. The compounds in grape juice have a small amount of energy in their molecule, estimated using the heat of reaction. Their synthesis in a balanced relationship is with the climatic requirements of the biotope, the place where the vine grows and ripens, to which abiotic factors are added. In the first part it was necessary to evaluate the climatic resources. Also, the estimation of solar radiation was carried out with the help of the global radiation indicator and the coefficient of conversion of solar energy into chemical energy in life was calculated. In the second part, the grape variety Fetească regală was analyzed. The applied research methods were the ANOVA analysis and the Pearson method. Through the analysis of variance (ANOVA), the smallest significant differences - LSD - (5%, 1% and 0.1%) were established for the parameters of grapes at full maturity: sugars and total acidity. The ANOVA analysis was also applied for the following parameters of young wine: alcohol concentration, reducing sugar, total acidity in tartaric acid, non-reducing dry extract. Using linear regression and correlation coefficient, several trends were established between global radiation and analyzed variables. It was found that global radiation and grape parameters (sugars and total acidity) were very strongly associated. Stability relationships between global radiation and several young wine parameters (alcoholic concentration, total acidity and non-reduced dry extract) also revealed very strong relationships. The limited data for only three years (2019-2021), revealed insignificant statistical correlations, but the linear relationships between several variables suggest continuing the study for more years.

Key words: *analytical characteristics, climate resources, ecosystem, energy flow, global radiation, variety, grapevine.*

INTRODUCTION

Sudden changes in temperature, frost, frost and excessive heat during the growing season can adversely affect production and quality.

Giugea (2001) appreciates that climatic factors are the first to respond and impose restrictions on the economic culture of the grapevine.

The vine is an active component of the viticultural ecosystem, and through its activity, as a functional component, it modifies the biotope and the microclimate (Malschi, 2014).

Cosmulescu (2015) appreciates that the vine receives essential mineral resources for growth and development from the outside. Through the exchange of substance and energy transfer, it finally has the capacity to produce, the capacity to care is expressed through its biological and productive potential.

Calo et al. (1997) carried out privileged determinations on the influence of climatic factors such as temperature, precipitation and solar radiation in triggering the vegetation and ripening phases of grapes. There is a correlation between weather conditions and sugar accumulation, shoot and leaf growth.

A decrease in global radiation can reduce the concentration in sugars or increase the total acidity in the same proportion. In order for the photosynthetic activity of the leaf apparatus to be intense, at least 70% of the leaves must be exposed to direct solar radiation. Severe water stress negatively influences photosynthesis by closing the stomata, reducing the accumulation of sugars and aromatic compounds (Irimia, 2012).

Higher values of solar radiation accelerate the process of budbreak, flowering and ripening of the grapes. The same values extend the vegetation period, have a better effect on the maturation of the wood and the winter hardiness of the vines (Oprea, 1995).

The flow of energy in a viticultural ecosystem is ensured by electromagnetic energy of solar radiation, in two forms: caloric radiation and radiation used for photosynthesis. As a result of this process, organic substances are produced and oxygen from the atmosphere is regenerated. Part of the radiation is reflected on the surface of the leaves, part passes through the leaves and another part is used in physiological processes (Malschi, 2014).

The studies carried out by Pap & Bozac, (1982), highlight the fact that of the total solar radiation, 43% is lost through reflection and diffusion, and 57% is absorbed and transformed into other forms of energy. Out of the amount of 57%, only 43% radiation reaches the soil and water surface in the form of direct and diffuse radiation.

Radiation from the visible spectrum (wave length 0.7-0.3μ), has an energetic and informational function for the viticultural biosystem. In the vine, the amount of solar energy is converted into a useful biological product (grapes) (Olteanu & Mărăcineanu, 2008).

The vine uses the caloric energy and the light energy of solar radiation. Differences greater than 15-20% of global radiation correlated with differences in slope and land exposure create differences for the development of phenophases, in increases in production and quality (Oşlobeanu et al., 1991).

In Romania, the distribution in the north is 107 Kcal/cm^2 (Oprea, 1995).

MATERIALS AND METHODS

The Târnavelor vineyard is located in the hydrographic basin of the two rivers, Târnava Mică and Târnava Mare, more precisely between parallels 45°57' and 46°32' north latitude and between meridian 23°52' and 24°48' east longitude. Also between these coordinates, north latitude 46°19' and east longitude 24°14', is the Jidvei wine-growing center.

The climatic resources of the Jidvei wine-growing region placed in value, place the Jidvei wine-growing center in the wine-climatic zone A_1 (Blaj-Jidvei), the area with specific climatic characteristics (Teodorescu et al., 1987).

The climate conditions in the Jidvei wine-growing center, during the study period (2019-2021), were established based on a complex of meteorological factors: temperature, light, humidity, global radiation.

Primary data were collected from weather stations Jidvei, Blaj and Târnăveni.

They were processed mathematically, as the annual average of the air temperature and the annual amount of precipitation (Tables 1 and 2). During the vegetation period (April-September), the sum of the effective hours of sunshine, the amount of precipitation, the active heat balance was calculated (Tables 3 and 4).

The insolation fraction is calculated by the formula (Pap & Bozac, 1982):

$$F = d/D$$

The correlation between cloudiness and relative insolation was obtained by the formula (Pap & Bozac, 1982):

$$N = (1 - F) * 10.$$

The length of the period of active vegetation in the vine, expressed in days, to calculate using the temperature level of +10°C, spring and autumn biological zero.

The oenological aptitude index was calculated according to the formula (Teodorescu, 1987):

$$IAOe = \sum t^o a\ (^oC) + \sum ir - (\sum P\ (mm) - 250)$$

The biological material used was the Fetească Regală variety, a representative variety for the vine culture in the Târnave area, with good characteristics for high-quality white wines and base wines for sparkling wines.

The analysis of variance (ANOVA), posthoc test Least Significant Differences (LSD) - (5%, 1% and 0.1%) was applied for grape parameters (sugars and acidity) at full grape maturity. The same approach was applied for the young wine parameters: alcohol concentration, reducing sugar, total acidity in tartaric acid and non-reducing dry extract.

Through correlation analysis, the degree of association between solar radiation and the

mean of the variables under study was determined.
Another factor used in the study was solar radiation. The estimate cannot be made using the global radiation indicator, measured in W/m^2, by reading the average from the vegetation period (April-September, 2019-2021). The paper used the formula for the standard unit of measure $Kcal/h*m^2$ expressed by: 1 $kcal/(h*m^2)$ = 1.1629800200033 W/m^2
The aim of the work was to highlight the influence of climatic factors and solar radiation on the quality of the young white wine of the Fetească Regală variety.

Table 1. Average air temperature, during 2019-2021, in the Jidvei wine-growing center

Years of experience	January	February	March	April	May	June	July	August	September	October	November	December	April-September average	Annual average
2019	-1.3	1.9	7.4	11.9	15.0	21.6	20.0	21.5	16.4	10.3	9.2	0.9	17.7	11.2
2020	-2.5	3.2	6.6	10.1	14.6	19.5	20.2	21.3	17.3	11.6	3.6	3.9	17.2	10.8
2021	0.2	0.4	3.4	8.3	14.9	19.5	22.6	19.8	14.3	8.2	4.6	2.2	16.6	9.8
The average 1986-2021	-2.2	0.3	5.0	10.6	15.4	18.9	20.6	20.2	15.4	9.8	4.1	0.9	16.8	9.8

Table 2. Amount of precipitation, in the period 2019-2021, in the Jidvei wine-growing center

Years of experience	January	February	March	April	May	June	July	August	September	October	November	December	Amount in IV-IX	The annual amount
2019	34.0	31.6	11.6	74.4	132.4	47.8	103.4	95.0	16.2	46.4	31.4	41.6	469.2	665.8
2020	3.6	45.2	46.0	18.8	65.4	208.6	69.0	112.2	102.0	61.6	20.4	27.0	576.0	779.8
2021	28.4	18.8	65.0	82.0	112.0	76.4	82.4	99.6	88.8	15.6	34.0	69.2	541.2	772.2
The average 1986-2021	19.3	18.3	24.8	48.9	72.8	91.8	76.0	58.0	53.6	39.1	26.1	28.2	401.0	557.0

Table 3. The sum of the effective hours of sunshine, during the vegetation period (1IV-30 IX), 2019-2021 (Târnăveni weather station)

Years of experience	April	May	June	July	August	September	Effective sunshine during the growing season (hours)
2019	194.8	171.6	304.9	279.5	306.7	234.2	1,491.7
2020	288.3	209.7	196.1	260.2	304.1	237.3	1,495.7
2021	165.3	236.1	280.6	327.2	277.8	211.2	1,498.2
The average 1986-2021	184.3	220.9	240.1	257.8	253.7	179.6	1,336.4

Table 4. The sum of active temperature degrees during the vegetation period (April-September), 2019-2021, in the wine-growing center of Jidvei

Years of experience	April	May	June	July	August	September	October	The sum of active temperatures during the growing season
2019	136.4	449.5	648.1	619.4	667.3	355.7	0	2,876.4
2020	43.1	452.1	583.7	626.2	658.9	518.9	199.2	3,082.1
2021	39.6	460.6	584.9	701.0	615.0	318.0	0	2,719.1

RESULTS AND DISCUSSIONS

Baducă Câmpeanu et al. (2012) confirm that climate changes modify the life cycle of the grapevine, this cycle occurring earlier than normal. Mărăcineanu (2011), states that the length of the vegetation period is influenced by the climatic characteristics of the respective year.

The statements are similar to the continuation obtained in our study, the period of active vegetation calculated in the Jidvei viticultural center, had an average of 156 days in the interval 2019-2021. The average was below the value of 170-180 days, from the Blaj, Jidvei and Turda vineyards confirmed by other researchers Călugăr (2011), Corbean (2011), Ciobanu (2012), Hașegan (2014) and Baciu et al., (2020).

The data analysis, in the period 2019-2021, (Table 5) confirms that the climate resources achieved value the favorable climate conditions for the economic culture of the vine.

The rich thermal resources were more than enough for the requirements of the vine, throughout the annual vegetation cycle (Table 1). Average annual precipitation fully satisfied the high-water requirements of grapevines relative to soil and atmospheric moisture (Table 2).

The light was sufficient, throughout the vegetation period, useful in the sequence of growth and fruiting phenophases and for the entire vegetation period (Table 3).

The active heat balance registered during the period of active vegetation made it possible to go through normal biological and physiological processes from the life of the vine (Table 4).

In our study, the insolation fraction was used to measure the level of effective insolation. According to this correlation, during the vegetation period the maximum level was reached in August (Table 6).

The results in Table 7, show that depending on normal to the sum of the hours of effective sunshine, during the vegetation period, appreciates very good years, of quality, in the three years for the vine culture.

The data analyzed in the normal operation of the amount of precipitation during the vegetation period, estimates a favorable average for the vines (Table 8).

The oenological aptitude index (IAOe) reached an average value suitable for the growing conditions of white wine varieties. The achieved value falls within the optimal limits (3700-5200) for viticulture in Romania. The value of this index was lower than the data argued from the Jidvei and Turda area by other collaborators, Ioia (2009), Baciu et al. (2020).

Bucur & Dejeu (2022), state that short, medium and long-term adjustment strategies are needed for viticulture practice, considering climate change and local biotope conditions.

Table 5. Climatic resources achieved in the period 2019-2021, in the Jidvei wine growing center

Studied years 2019-2021	The amount of precipitation yearly (mm)	Medium temperature yearly (°C)	Active thermal balance (ºC)	Actual duration of the brightness of the sun April-September (hours)	Precipitation April-September (mm)	Oenological aptitude index
2019	665.8	11.2	2,876.4	1,491.7	469.2	4,148.9
2020	779.8	10.8	3,082.1	1,495.7	576.0	4,251.8
2021	772.2	9.8	2.719.1	1,498.2	541.2	3,926.1

Table 6. Insolation fraction during the vegetation period (April-September), 2019-2021, in the wine-growing center of Jidvei

Studied years	April	May	June	July	August	September	Insolation fraction
2019	0.48	0.37	0.65	0.59	0.70	0.62	0.57
2020	0.71	0.45	0.42	0.55	0.70	0.63	0.57
2021	0.41	0.51	0.59	0.69	0.63	0.56	0.57

Table 7. Climatic favorability for studied years (2019-2021) in relation to the reference period (1986-2021) for the amount of sunshine during the vegetation period (April-September), in the Jidvei wine-growing center

Studied years	The amount of actual sunshine, (hours)	Average 1986-2021, (hours)	Deviation from normal (%)
	V	N	V/N*100-100
2019	1,491.7	1,336.4	+11.6
2020	1,495.7	1,336.4	+11.9
2021	1,498.2	1,336.4	+12.1

Table 8. Climatic favorability for studied years (2019-2021) in relation to the reference period (1986-2021) for rainfall during the growing season (April-September), in the Jidvei wine-growing center

Studied years	The amount of precipitation (mm)	Average 1986-2021 (mm)	Deviation from normal (%)
	V	N	V/N*100-100
2019	469.2	401.0	+17.0
2020	576.0	401.0	+43.6
2021	541.2	401.0	+35.0

Table 9. Cloudiness during the growing season, 2019-2021, in the Jidvei wine-growing center

Studied years	April	May	June	July	August	September	Cloud
2019	5.21	6.31	3.54	4.14	3.00	3.78	4.34
2020	2.94	5.50	5.85	4.54	3.04	3.68	4.32
2021	5.95	4.93	4.06	3.13	3.65	4.38	4.31

The amount of radiant solar energy received by the earth's surface during a year depends on latitude, adverse weather factors, seasons and relief. Water vapor and carbon dioxide are decisive factors for the accumulation of caloric energy through the absorption of infrared radiation. Climatically, cloudiness influences solar and terrestrial radiation (Pap & Bozac, 1982).

From the results of the study, the values obtained for the global radiation indicator between April and September, in the 3 years of the study, confirm the data in Table 10.

The achieved average was 1195 Kcal/h*m^2.

Similarly, these achieved values are closely related to the cloudiness during the vegetation period (Table 9).

Table 10. Estimation of the influence of solar radiation using the global radiation indicator, 2019-2021, in the wine-growing center of Jidvei

	Global radiation (W/m^2)							April-September (Kcal/h*m^2)
Studied years	April	May	June	July	August	September	April-September	
2019	202.0	205.2	292.9	266.4	253.7	189.0	1,409.2	1,212
2020	240.2	217.3	239.0	255.1	252.6	190.6	1,394.8	1,200
2021	179.0	233.1	276.0	278.3	229.1	168.8	1,364.3	1,173
Average 2019-2021	207.1	218.5	269.3	266.6	245.1	182.8	1389.4	**1,195**

As Malschi (2014) says, it was taken into account that the vine stores the amount of solar energy, to transform it into organic matter through the process of photosynthesis.

(Seybold, 1932), shows that the radiation with wavelengths between ƛ= 0.7-0.3ų involved in photosynthesis activity is estimated at 50% of the total global radiation received from the sun.

Georgescu (1991) confirms that the leaf is the place where solar energy is converted into chemical energy.

The active leaf apparatus retains 80% of the radiation included in the chlorophyll assimilation processes and another 10% of the inactive radiation, Oșlobeanu et al. (1991).

The results of the indirect calorimetry studies in the Banu Mărăcine wine center (Dealurile Craiovei vineyard) demonstrated a conversion coefficient of solar energy into chemical energy of 0.84%. The same study reveals the cultivation of varieties with a high potential for converting this caloric energy into organic matter to capitalize on the energetic conditions in the given viticultural ecosystem. (Olteanu, 1991).

Our research demonstrated that in the Jidvei wine-growing center, a conversion coefficient of solar energy into chemical energy of 0.58% was obtained to the vine (Table 11).

We believe that it was not necessary to calculate for each year of the study, in part, this conversion coefficient, because close values of the global radiation resulted in the three years analyzed.
By comparison, this coefficient is lower than the value of the conversion coefficient in the Banu Mărăcine wine area. Oșlobeanu et al. (1991), state that the amount of global radiation received from the sun is smaller in the vineyards of Târnave and recommends the cultivation of cultivars with certain morphological characteristics of the leaf or internodes that improve the penetration of solar energy for the most leaves on a shoot.

Table 11. Conversion of solar energy into chemical energy in the vine, 2019-2021, in the Jidvei viticultural center ($Kcal/h*m^2$)

Steps for converting solar energy into chemical energy	Author	Scoring and calculation method	$Kcal/h*m^2$
(A) Global radiation (direct + diffuse), in the interval (April - September), 2019-2021, value calculated according to the data obtained in Table 10	-	A (average)	1195
(B) The radiation contained in the process of photosynthesis estimated at 50% of the total radiation (from A)	Oșlobeanu and others (1991)	B = (A x 50)/100	598
(C) Radiation intercepted by leaf apparatus estimated 50% of that used in photosynthesis (from B)	Oșlobeanu and others (1991)	C = (B x 50)/100	299
(D) Incident radiation retained by active leaf apparatus 80% (from C)	Oșlobeanu and others (1991)	D = (C x 80)/100	239
(E) Radiation not participating in photosynthesis, 10% of that intercepted by the leaf apparatus (from D)	Oșlobeanu and others (1991)	E = (D x 10)/100	24
(F) Total absorbed active radiation	Oșlobeanu and others (1991)	F = D - E	215
(G) Energy value of grape production for 10 t/ha	Olteanu & Mărăcineanu, 2008	G = C / D	1.25
The coefficient of conversion of solar energy into chemical energy, % (H)	Oșlobeanu and others (1991)	H = (G / F) x 100	**0.58**

Table 12. Influence of climatic conditions on sugars (g/L) and total acidity (g/L H_2SO_4) at full maturity of grapes, in the wine-growing center of Jidvei

Experimental variants	**Analyzed parameters**	**Difference**	**Statistical significance**
	Sugars (g/L)		
Average	213.00	0.00	Mt
2019	214.00	1.33	--
2020	215.67	2.67	--
2021	209.00	-4.00	--
DL (p 5%)		7.70	
DL (p 1%)		10.44	
DL (p 0.1%)		14.08	
	Acidity expressed as H_2SO_4 (g/L)		
Average	5.98	0.00	Mt
2019	5.70	-0.29	--
2020	5.69	-0.29	--
2021	6.56	0.58	--
DL (p 5%)		0.61	
DL (p 1%)		0.84	
DL (p 0.1%)		1.18	

The studies carried out by Oprea (1995), reveal the fact that during the ripening of grapes, sugars accumulate progressively, until they reach a maximum level at full maturity. Exceptions are years with excessive pedological drought when the sugar accumulation process becomes very slow, and years with excess moisture in which the sugar concentration is reduced by dilution. The glucoacidimetric index, as a ratio between sugar and acidity, is decisive for wine grapes.

(Georgescu, 1991), estimates that of the total sugars, 90% are stored in grapes and 10% in the other annual organs.

The action of the climatic conditions in the three experimental years, in the Fetească Regală variety, for sugars and total acidity at full maturity of the grapes, is presented in Table 12. From the analysis of the obtained values, in the year 2021, it emerges that the sugars accumulated at full maturity registered a decrease of -4 g/l below the average of the 3 years taken as a control. The concentration in sugars was reduced by dilution, the year 2021 being considered normal from a thermal point of view and very rainy.

Compared to the years 2019 and 2020, the accumulated sugar values are higher than the 3-year average, without statistical assurance.

Regarding the acidity in the must, from the data presented in Table 12, insignificant differences emerge from a statistical point of view compared to the control. The biggest big difference +0.58 g/l H_2SO_4, compared to the average was registered in 2021.

The variability of several parameters of young wine (alcohol concentration, reducing sugar, acidity in tartaric acid, non-reducing dry extract), in the period 2019-2021, is presented in Table 13.

Table 13. The influence of climatic conditions on the analytical characteristics of young wine, in the Jidvei wine-growing center

Experimental variants	**Analyzed parameters**	**Difference**	**Statistical significance**
	Alcohol concentration (% vol.)		
Average	12.26	0.00	Mt
2019	12.47	0.21	**
2020	12.29	0.03	--
2021	12.02	-0.24	00
DL (p 5%)		0.12	
DL (p 1%)		0.17	
DL (p 0.1%)		0.24	
	Reducing sugar g/L		
Average	4.31	0.00	Mt
2019	6.04	1.73	**
2020	3.12	- 1.19	--
2021	3.78	- 0.53	--
DL (p 5%)		1.21	
DL (p 1%)		1.64	
DL (p 0.1%)		2.21	
	Total acidity expressed as tartaric acid g/L		
Average	6.98	0.00	Mt
2019	6.69	-0.29	--
2020	6.84	-0.14	--
2021	7.41	0.43	**
DL (p 5%)		0.29	
DL (p 1%)		0.41	
DL (p 0.1%)		0.57	
	Non-reducing dry extract g/L		
Average	17.42	0.00	Mt
2019	17.74	0.32	--
2020	17.32	- 0.11	--
2021	17.22	- 0.21	--
DL (p 5%)		0.32	
DL (p 1%)		0.44	
DL (p 0.1%)		0.61	

The same author shows that, the climatic favorability according to the normal rainfall, divides the harvest years into favorable, when less than 9.7% compared to the average is recorded, and unfavorable when the values are above 10.7%.

In our study, in the three years, determinations were made of the influence of the climatic favorability of the harvest years on the studied parameters.

In 2019, the alcohol concentration registered increases of +0.21 vol % compared to the average of the years taken as a reference, a distinctly positive statistically significant difference. At the opposite pole was the year 2021, a year in which a distinctly negative difference was registered, statistically assured (-0.24 vol %).

Similar results were also obtained for reducing sugar, in 2019 the difference obtained compared to the average of the reference years was +1.73 g/l, being statistical as significantly positive.

Regarding the total acidity in tartaric acid in 2021, this parameter increased by +0.43 g/l, compared to the average of the 3 years taken as a control, a difference ensured statistically as significantly positive.

In the case of the non-reducing dry extract, in 2019, the difference obtained compared to the medium of the control years was not statistically significant.

Correlation analysis was used to identify the strength of the relationship between the studied variables and establish their statistical significance.

At the full maturity of the grapes, the following results were highlighted:

From the analysis of the data (Figure 1), it follows that there is a very high positive relationship between solar radiation and sugar content, but statistically insignificant, given by a correlation coefficient (r = 0.8794).

The analyzed data on the correlation between solar radiation and averages of total acidity (Figure 2) show that there is an inverse very strong relationship between these two variables (r = -0.951), but statistically insignificant.

The following results were evident for the young wine:

From the analysis of the data presented in Figure 3, it appears that there is a very strong association between solar radiation and alcohol concentration, but statistically insignificant, given by a correlation coefficient (r = 0.9946).

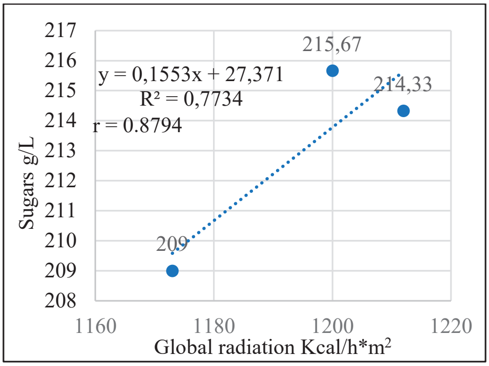

Figure 1. Correlation between solar radiation and sugar content at full maturity of grapes, in the Jidvei wine-growing center

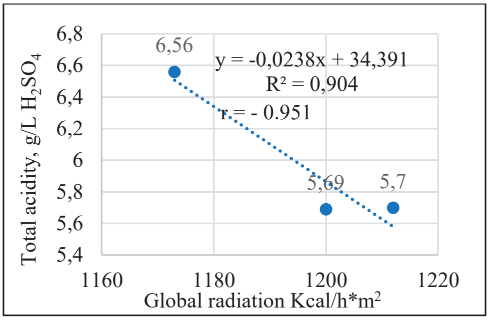

Figure 2. Correlation between solar radiation and total acidity at full ripeness of grapes, in Jidvei viticultural center

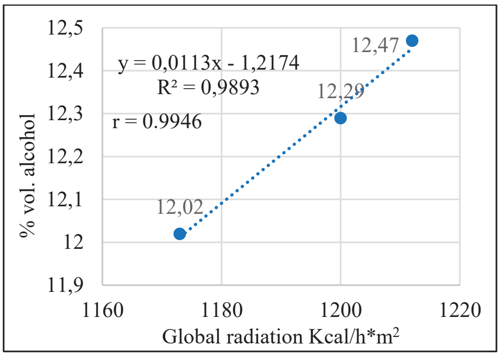

Figure 3. Correlation between solar radiation and alcohol concentration in young wine

Between solar radiation and reducing sugar, Figure 4, there is a moderate positive relationship, the correlation coefficient with the value of (r = 0.5741).

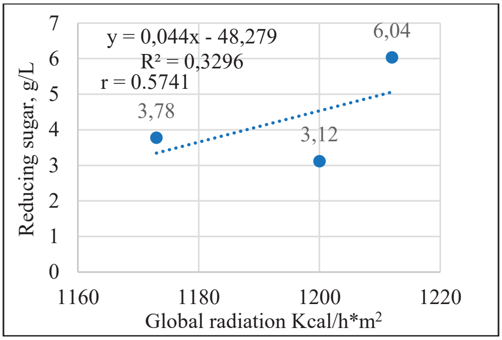

Figure 4. Correlation between solar radiation and reducing sugar in young wine

There is a very strong inverse relationship between solar radiation and total acidity in tartaric acid (Figure 5), statistically insignificant (r = -0.994).

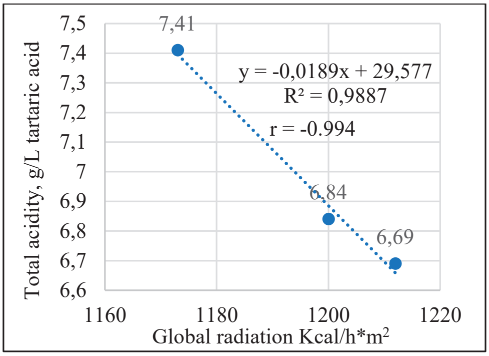

Figure 5. Correlation between solar radiation and total acidity (tartaric acid g/l) in young wine

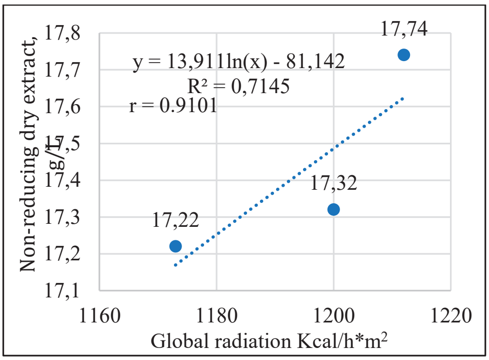

Figure 6. Correlation analysis between solar radiation and non-reducing dry extract (g/l) in young wine

Relationship between solar radiation and non-reducing dry extract (Figure 6), revealed a very strong positive relationship (r = 0.9101), but statistically insignificant.

CONCLUSIONS

From the synthesis of the work during 2019 and 2021, it follows that in the Jidvei wine-growing center the assessed climatic resources are very favorable for the cultivation of varieties for white wines and the oenological aptitude index reached an average value suitable for the growing conditions of white wine grape varieties.

The applicative potential was argued by the climatic favorability of the Jidvei wine-growing area, evaluated as favorable for the economic culture of the vine.

The lower value of the chemical energy conversion coefficient obtained in our study emphasizes the value of this index in everyday practice in viticulture. As a recommendation, sun cultivation with characteristics that allow the leaf to capture more solar energy on the one hand and at the same time to capitalize on the maximum ecoclimatic conditions in the Târnavel area, with positive results in the phenophases of growth and fruiting in the vine.

In the Fetească Regală variety, the climatic conditions during the three years of the study did not significantly influence the content in sugars and acidity at the time of harvesting the grapes at full maturity.

Alcohol content and total acidity of young wine are the main parameters influenced by climatic conditions.

The reduction of sugars in wines was not influenced by climatic conditions, the differences resulting in the three years of the study were statistically insignificant. Fermentation conditions (different yeast strains, temperature, nutrients, exposure to oxygen during fermentation) are the uncontrolled factors responsible for different final concentrations, as they were not completely turn into alcohol. The young wine was fermented almost to dryness.

From the research data, it was found that global radiation and grape parameters were very strongly associated. Between global radiation and several young wine parameters also revealed very strong relationships. In all graphs presented, Pearson „r" takes values below the critical value from the statistical tables, which means that all these correlations are statistically insignificant, even if the strength of the association suggests a relationship between the studied variables.

Limited data for only three years (2019-2021) revealed insignificant statistical correlations, but the linear relationships between several variables suggest continuing the study for more years.

ACKNOWLEDGEMENTS

This work was financed by contract POCU/993/6/13-153178, a project co-financed by the European Social Fund, through the Human Capital Operational Program 2014-2020.

REFERENCES

Baciu Liana, Giugea N., Popescu D, Șimon Alina (2020). Evaluation of ecoclimatic conditions in the Turda wine-growing center and evaluation of oenoclimatic suitability, November 26, 2020, Craiova, Romania, 16th annual meeting "Sustainable agriculture - agriculture of the future", Vol.50 / NO.2 (2020), page 13-20, Craiova, RO.

Badućă Câmpeanu C., Beleniuc G., Simionescu V., & Panaitescu L., Grigorica L. (2012). Climate change effects on ripening process and wine composition in Oltenia's vineyards from Romania, Acta Horticulturae 931, XXVIII International Horticultural Congress on Science and Horticulture for People (IHC2010): International Symposium on the Effect of Climate Change on the Production and Quality of Grapevines and Their Products.

Bucur Georgeta Mihaela, Dejeu L. (2022). Research on viticulture adaptation measures to climate change: General presentation, Scientific papers. Series B, Horticulture. Vol. LXVI, No. 2, 2022, Print ISSN 2285-5653, CD-ROM ISSN 2285-5661, Online ISSN 2286-1580, ISSN-L 2285-5653

Calo A., Tomasi D., Crespan M, Costacurta A., (1996), The relationship between environmental factors and the dynamics of grapevine growth and composition, Actahortic. 427.27.

Călugăr Anamaria. (2011). Research on the behavior of some grape varieties created at SCDVV Blaj, in Târnave Vineyard, Cluj-Napoca conditions, PhD. UASMV Cluj-Napoca, RO.

Ciobanu Florentina. (2012). Research on the influence of special green works on the quantity and quality of the harvest of grape varieties for semi-aromatic and aromatic white wines from SCDVV Blaj, Cluj-Napoca, PhD Thesis. UASMV Cluj-Napoca, RO.

Corbean D.G. (2011). New technologies for the production of vine planting material in the Târnave vineyard, Cluj-Napoca, Dr. Teses. UASMV Cluj Napoca, RO

Cosmulescu Sina Niculina (2015). Ecology of anthropic systems, Doctoral School in Animal and Plant Resources Engineering, University of Craiova, RO, Course support,

Hașegan F. (2014). The influence of soil type on the yield and quality of the main vine varieties grown in the Târnave vineyard, Cluj-Napoca, Dr. Teses. UASMV Cluj-Napoca, RO.

Georgescu Magdalena, Dejeu L., Ionescu P. (1991). Ecofiziologia viței de vie, Ceres Publishing House, Bucharest,

Giugea N. (2001). Research on how some biopedoclimatic factors influence the chemical composition of grapes, Doctoral Thesis, Faculty of Horticulture, Craiova, RO

Ioia Claudia. (2009). Improving the technology of the production of quality dry white wine in the Jidvei Podgoria Târnave Viticultural Center, Iași, PhD theses, University of Agricultural Sciences and Veterinary Medicine "Ion Ionescu de la Brad" Iași.

Irimia L. M. (2012). Biologia, ecologia şi fiziologia viței de vie (*Biology, ecology and physiology of the grapevine*). "Ion Ionescu de la Brad" Publishing House Iași.

Malschi Dana (2014). Ecologie și management ecologic (*Ecology and ecological management*), Course support. Babes-Bolyai University, Cluj-Napoca Faculty of Environmental Science, RO.

Mărăcineanu L.C. (2011). Aplicații ale ecologiei în viticultură (*Applications of ecology in viticulture*), Universitaria Publishing House, Craiova, RO.

Olteanu I., & L.C. Mărăcineanu (2008). Agroecosistemele viticole și protecția mediului (*Viticultural Agroecosystems and Environmental Protection*), Sitech Publishing House, Craiova, RO.

Olteanu I. (1991). Viticultură I. - Bazele biologice (*Viticulture I. - Biological bases)*. Printing house of Craiova University, RO.

Oprea Ș. (1995). Viticultură (*Viticulture*), Dacia Publishing House, Cluj-Napoca, RO.

Oșlobeanu M., Macici M., Georgescu Magdalena, Stoian V. (1991). Zonarea soiurilor de viță de vie în România (*Zoning of grape varieties in Romania*), Ceres Publishing House, Bucharest, RO.

Pap G & Bozac Rodica. (1982). Fizică și agrometeorologie - curs (*Course in physics and agrometeorology*), Agronomic Institute, Dr. Petru Groza, Cluj-Napoca, RO, Faculty of Agriculture and Horticulture, Teaching material workshops.

Seybold (1932). Uber die optimischen Eigenschafterder Lubblӓter, Planta 18.

Teodorescu, C. Șt., Popa I.A., Sandu N. Gh. (1987). Oenoclimatul României, Editura Științifică și Enciclopedică, Bucharest.

***Analysis and Control Laboratory, Jidvei Research Department, RO

***Jidvei SRL network of private weather stations, Jidvei weather station, RO

***Regional Meteorological Center Transylvania South Sibiu, weather station Blaj, RO.

***http://www.endmemo.com, accessed 30.03.2023 and 27.05.2023