TRENDS OF CLIMATE ELEMENTS IN COTNARI AND LOCAL AGROGEOGRAPHIC SUSTAINABILITY

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Abstract
The present study presents the evolutions of the main climatic elements (air temperature, relative humidity of the air, the nebulozity, the shine duration of the Sun, atmospheric precipitation and winds) between 1961-2018 and the probability of local agricultural activities in Cotnari area, under growing conditions. the vulnerability of the environmental components to the variability of the climatic elements.
The Cotnari area is located in the transition zone the Plateau of Suceava towards the Moldavia Plain, between the Ruginoasa - Tg. Frumos to the south and Bucecea - Botoşani, to the north. Climatically, Cotnari is located at the intersection of Eastern European air masses specific to the Moldavian Plain, characterized by hot and dry summers, cold winters with cold winds and Scandinavian-Baltic influences specific to the Suceava Plateau, characterized by cool summers and cold winters [3]. The average values of the main climatic elements calculated for the period 1961-2018 are of 9.6 ° C for the air temperature, 520mm the average amount of atmospheric precipitation, the relative humidity of the air of 76% the dominance of the winds from the northwest (31%) and the longer duration of Sun shine in the northern Moldovan area of 2140 hours/year. Elementary climatic conditions for the phenological regime of local agricultural plants and the scientific explanation of the cultivation of native white vine species on Cătălina Hill: Grasă of Cotnari, Frâncuşa, Fetească Albă, Chardonnay, Sauvignon, Pinot gris, Pink Traminer, Tămâioasa, Muscat Ottonel.

Key words: *Mann-Kendel test, evolutionary trend, climatic element, agroclimatic potentia, oenology*

JEL Classification: Q00, Q01, Q15, Q16, Q18, Q19

I. INTRODUCTION

The building of the ancient house and the important wine-growing area of Moldova, Cotnari has been in the attention of historians, geographers, oenologists and botanists under general and thematic conditions that can provide an important fund for scientific knowledge and deepening. The reference area can be found in The Chronicles of Cotnarilor (Ungureanu, Anghel, et.al., 1971), with the boyar estates covered with significant wine-growing areas in the Cotnari area, and the agro-wine-growing activities did not cease despite wars, natural calamities and incursions from enemies.

With the establishment of the national network of meteorological stations (Iasi-1886, Cotnari-1895) the first works of regional climatology appear (Gugiuman, Pleşca, et.al.,1960; Mihăilă, 2006; Patrichi, 2008; Sfică, Ichim, 2014), in which the climatic specificity of the area in the climate sector with arid influence, the climatic support of the low hills, the climatic subregion around the Cotnarilor (Mihăilă, 2006).

II. MATERIALS AND METHODS. STUDY AREA

The data were collected from the Cotnari Meteorological Station, based on the partnership agreement with "Ștefan cel Mare" University of Suceava. Data processing was performed using statistical methods in the Microsoft Excel program and the Mann-Kendall statistical tests and the t test were used. The Mann-Kendall test (Kendall, 1975; Mann, 1945) combined with the Sen slope, is used to determine the trend of monthly, seasonal and annual time series. This program performs two types of statistical analyzes: the first, it tests the presence of a positive or negative monotone tendency using the nonparametric Mann-Kendall test, and the second calculates the slope of the linear trend. The levels of statistical significance α are: 0.001; 0.01; 0.05; 0.1.The Mann-Kendall test is applicable if the values of Xi data in a time series are subordinate to the model: Xi = *f* (ti) + and where: *f* (t) is a continuous monotone function and there are residuals (Partiche, 2009; Bistricean, 2018). Sen slope can be used in cases where the tendency can be assumed to be linear. This means that f (t) in the equation is equal to f

(t) = Qt + B, where Q is the slope and B is a constant, (Piticar, 2013; www.statisticshowto.com).
Cotnarilor area is located in the northeast of Romania, the northern half of Iaşi county, between the following geographical coordinates 26°25' long. E - 27°35' long. E and 47°05' lat. N - 47°30' lat.N (Fig.no.1).

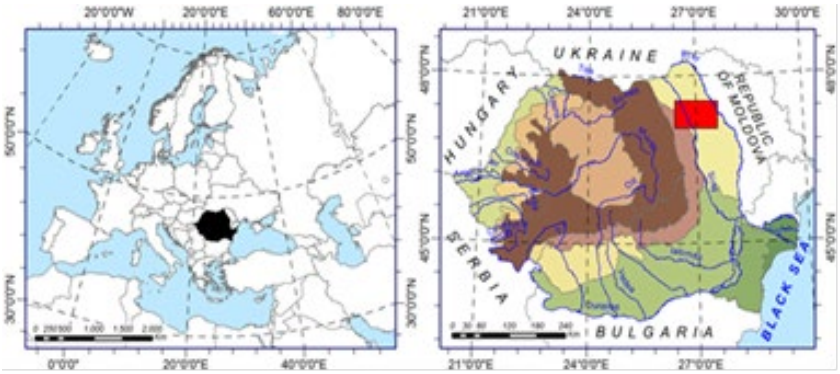


Figure no.1 Location of the study area

III. RESULTS AND DISCUSSIONS

The climate of Cotnari is in the temperate-continental transition, specific to the geographical position, but strongly influenced by the local topography and the specifics of the atmosphere dynamics. Cotnari meteorological station is located on the Dealul Mare -Hârlău structural plateau at an altitude of 289 m and the intersection of the parallel 470 22'lat. N with meridian of 260 56'long. E. From the observation data for the period 1961-2018, the average annual air temperature was 9.7 ºC, the warmest year 2015 being on average 11.5ºC, and the coldest year 1969, with an average temperature of 7.7 ºC. The 58year period shows trends of significant increase in air temperature by 1.6 ºC, according to decadal calculations (Tab.no.1).

Table no.1 Decadal regime of air temperature in Cotnari (1961-2018)

Decades	1961-1970	1971-1980	1981-1990	1991-2000	2001-2010	2011-2018
Temp. average (ºC)	9.0	9.1	9.3	9.5	10.2	10.6

The average **annual temperatures** are characterized by an upward curve in the first part of the year, with maximums in July (between 24ºC / 2015 and 18.5ºC / 1985), after which the variation curve has a downward direction to the minimum values from January (between -11,4 ºC/1963 şi 5 ºC/2007)(Fig.no.2). In order to have a good appreciation of the thermal characteristics at Cotnari, we also performed an analysis of the distribution of average temperatures in the four seasons (Tab.no.2). These are important for the distribution of agricultural crops, the phenological regime of the plants and the scientific explanation of the cultivation of the species of native white vines on the Cătălina Hill: Grasă of Cotnari, Frâncușa, Fetească Albă, Chardonnay, Sauvignon, Pinot gris, Pink Traminer, Tămâioasa, Muscat Ottonel

Table no.2 The annual air temperature (°C) regime at Cotnari (1961-2018)

Temp. air (°C)	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	AN	I	P	V	T	Cool seazon	Warm seazon
Temp.min. average (°C)	-11,4	-9,1	-3,0	0,0	11,9	16,6	17,8	17,0	11,3	6,8	-3,1	-6,2	7,7	-6,5	5,2	17,6	7,3	-1,5	14,9
Temp.average (°C)	-2,5	-1,2	3,3	9,8	15,8	19,1	20,8	20,4	15,9	10,1	4,2	-0,5	9,6	-1,4	9,6	20,1	10,1	2,2	17,0
Temp.max. average (°C)	5,0	5,7	8,8	15,4	20,5	22,4	24,7	24,0	19,5	14,3	9,3	5,0	11,9	3,0	12,1	23,0	12,6	5,5	19,3

In the spring, the increasing values of the radiant energy received from the terrestrial surface and the frequency of the air purification processes at the descent of the Mare Hârlău Hill (Mihăilă, 2006), determine the increase of the average air temperature, the early melting of the snow layer and supplementation of the water supply of the local hydrographic network. In summer, the average temperature increases by 10ºC, being significantly the nebulosity regime and, in general, the anticyclonic regime with stable and serene weather. In autumn, the cooling of the air takes place more slowly than the heating by spring, because the active surface has accumulated in the hot season a thermal reserve which it gradually yields to the lower troposphere.

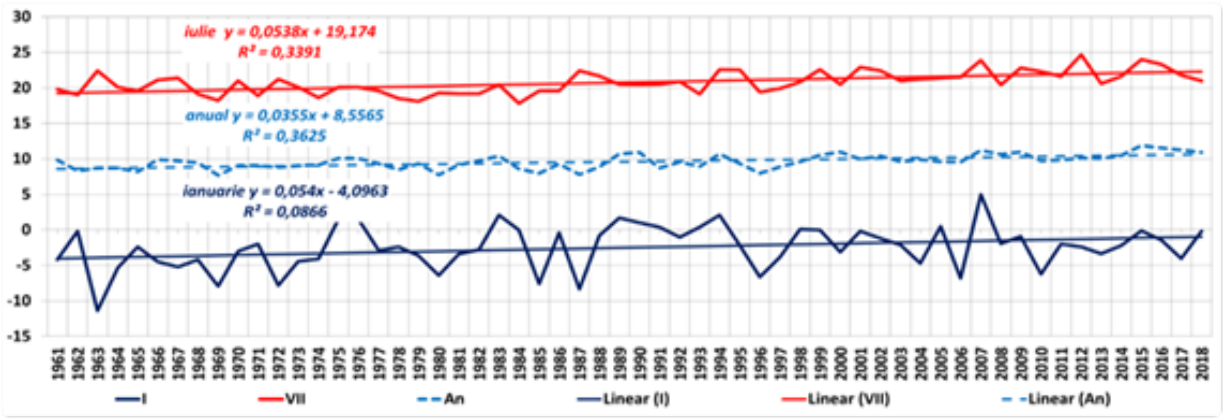


Figure no.2 Variability and evolutionary trends of the average annual temperature (°C) of January and July in Cotnari (1961-2018)

Table no.3 Evolutionary trends of air temperature (°C) for the average temperature parameter, related to different temporal entities for Cotnari (1961-2018).

Temp.aer (°C)		Test Mann-Kendall		Testul t	
Analyzed period	Analyzed interval	Means statistics	Spole	Means statistics	Spole
1961-2018	I	*	**0,048**	*	**0,054**
1961-2018	F	+	**0,042**	NS	0,036
1961-2018	M	*	**0,052**	*	**0,052**
1961-2018	A	**	**0,050**	*	**0,057**
1961-2018	M	*	**0,033**	*	**0,034**
1961-2018	I	***	**0,040**	*	**0,033**
1961-2018	I	***	**0,052**	***	**0,054**
1961-2018	A	***	**0,050**	***	**0,049**
1961-2018	S	NS	0,013	NS	0,015
1961-2018	O	NS	0,006	NS	0,003
1961-2018	N	NS	0,009	NS	0,008
1961-2018	D	NS	0,035	NS	0,032
1961-2018	An	***	**0,035**	***	**0,036**
1961-2018	I	+	**0,035**	*	**0,034**
1961-2018	P	***	**0,049**	***	**0,048**
1961-2018	V	***	**0,044**	***	**0,045**
1961-2018	T	NS	0,013	NS	0,009
1961-2018	Oct-Mar	**	**0,026**	**	**0,030**
1961-2018	Apr-Sept	***	**0,042**	***	**0,040**

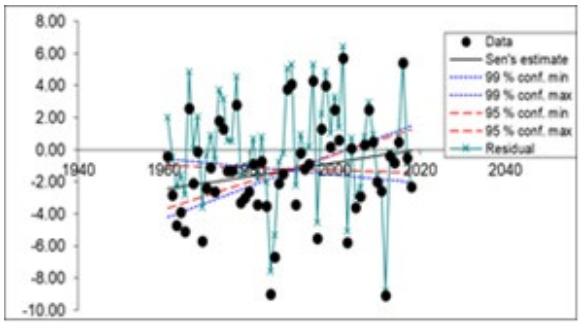


Figure no.3 Graphical representation of the evolutionary trends of the air temperature at Cotnari (1961-2018).

The evolutionary trends of the air temperature calculated with the Mann-Kendall test and the Test t, confirm the increase of the air temperature in the last decades, especially in the hot spring-summer season (obviously being the months of June, July and August). The maximum values show a slight warming of the winters (January), and the minimum temperatures are maintained at constant, statistically insignificant values (Tab.no.3, Fig.no.3).

Between 1961-2018, the annual trend of **the relative humidity** of the air in Cotnari decreased. More evident are the spring-summer seasons with March and August (Tab.no.4), as a result of the specific dynamics of the air, the reduction of precipitation quantities and the increase of evaporation. This characteristic is determined by the variation of the air temperature, the nature of the active surface, the use of the land, the peculiarities of the vegetal cover, the absence or the presence of permanent water sources (Tab.no5).

Table no.4 The annual regime or the relative humidity (%) of the air at Cotnari (1961-2018)

Relative humidity (%)	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	AN	I	P	V	T	Oct - Mar	Apr-Sept
Relative humidity min. average (%)	64.0	63.0	59.0	50.0	55.0	56.0	54.6	49.0	53.0	61.0	65.0	70.0	67.2	70.3	58.3	53.7	65.0	72.0	59.8
Relative humidity average (%)	83.0	82.6	77.6	71.5	70.4	72.1	71.5	70.7	72.9	77.3	83.0	83.5	76.3	82.9	73.2	71.4	77.8	81.3	71.5
Relative humidity max. average (%)	94.0	98.0	95.0	87.0	89.0	86.0	88.0	86.0	88.0	93.0	94.0	97.0	86.6	95.7	86.3	86.0	90.0	91.3	84.2

Table no.5 Evolutionary trends of the relative humidity (%) to different temporal entities for the Cotnari (1961-2018)

Humidity (%)		Test Mann-Kndall		Testul t	
Analyzed period	Analyzed interval	Means statistics	Spole	Means tistics	Spole
1961-2018	I		-0,024	NS	-0,040
1961-2018	F		-0,074	NS	-0,089
1961-2018	M	*	**-0,157**	*	**-0,145**
1961-2018	A	+	**-0,094**	*	**-0,095**
1961-2018	M		-0,067	NS	-0,019
1961-2018	I		-0,027	NS	-0,028
1961-2018	I		-0,059	NS	-0,080
1961-2018	A	*	**-0,138**	*	**-0,134**
1961-2018	S		-0,019	NS	-0,059
1961-2018	O		0,032	NS	0,004
1961-2018	N		0,000	NS	0,022
1961-2018	D		-0,065	NS	-0,058
1961-2018	An		-0,060	+	**-0,060**
1961-2018	I		-0,069	NS	-0,066
1961-2018	P	*	**-0,107**	+	**-0,087**
1961-2018	V		-0,074	NS	-0,081
1961-2018	T		-0,015	NS	-0,011
1961-2018	Oct-Mar		-0,042	NS	-0,048
1961-2018	Apr-Sept		-0,077	NS	-0,069

Table no.6 Evolutionary trends of the nebulosity of the air (tenths) for the Cotnari (1970-2004)

Nebulosity (tenths)		Testul Mann-Kendall		Testul t	
Analyzed period	Analyzed interval	Means statistics	Spole	Means statistics	Spole
1970-2004	I	*	**0,033**	*	**0,032**
1970-2004	F	NS	0,003	NS	0,002
1970-2004	M	NS	0,021	NS	0,018
1970-2004	A	NS	0,010	NS	0,012
1970-2004	M	NS	-0,007	NS	-0,013
1970-2004	I	NS	0,017	NS	0,013
1970-2004	I	NS	0,013	NS	0,014
1970-2004	A	NS	0,020	NS	0,018
1970-2004	S	**	**0,045**	**	**0,053**
1970-2004	O	*	**0,038**	+	**0,026**
1970-2004	N	NS	0,027	NS	0,024
1970-2004	D	NS	0,006	NS	0,008
1970-2004	An	**	**0,018**	**	**0,017**
1970-2004	I	+	**0,019**	+	**0,016**
1970-2004	P	NS	0,006	NS	0,005
1970-2004	V	+	**0,014**	+	**0,015**
1970-2004	T	**	**0,035**	**	**0,034**
1970-2004	Oct.-Mar	**	**0,021**	**	**0,020**
1970-2004	Apr-Sept	*	**0,017**	*	**0,016**

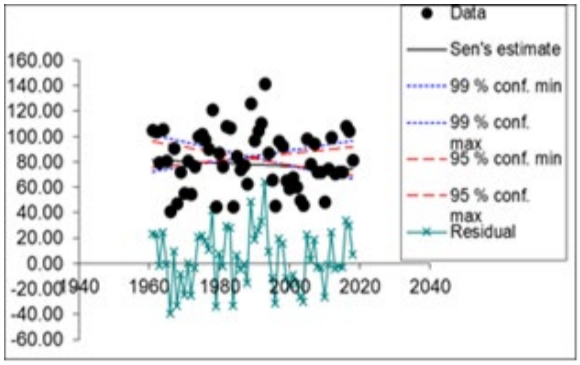
The atmospheric nebulosity between 1970-2004 (Tab.no.7), was at Cotnari of 6.4 tenths, with peaks in the cold season, December (7.3 tenths), January and February (7.1 tenths), explained by the frequency of barrel depressions, in the interior of which, the air moves upward generating cloudy systems (Tab.no.6). The minimum values below 5 tenths in August can be explained by the intensification of the anticlonal activities (in particular the Anticyclone of the Azores) (Tab.no.6).

Table no. 7 The annual regime of the nebulosity of the air (tenths)at Cotnari (1970-2004

Nebulosity of the air (tenths)	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	An	I	P	V	T	Oct-Mar	Apr-Sept
Nebulosity min. average (tenths)	7.1	4.5	5.1	5.4	3.5	4.7	4.1	3.0	2.9	4.3	4.7	5.3	4.6	5.6	4.6	3.9	3.9	5.1	3.5
Nebulosity average (tenths)	7.1	7.1	7.0	7.0	6.1	6.0	5.5	4.9	5.5	5.9	7.1	7.3	6.4	7.1	6.7	8.8	6.1	6.9	5.8
Nebulosity max. average (tenths)	8.7	9.9	8.4	8.4	7.8	7.7	6.7	6.6	8.3	8.0	9.4	8.9	8.2	9.1	8.2	7.0	8.5	8.8	7.5

Table no.8 Evolutionary trends of duration brightness of the Sun for the parameter of the sum of the values of the duration of brightness of the Sun, related to different temporal entities at Cotnari (1961-2018)

The shine duration of the Sun.(number of hourse)		Testul Mann-Kendall		Testul t	
Analyzed period	Analyzed interval	Means statistics	Spole	Means statistics	Spole
1961-2018	I	NS	-0,126	NS	-0,089
1961-2018	F	NS	0,268	NS	0,289
1961-2018	M	NS	0,247	NS	0,282
1961-2018	A	NS	0,237	NS	0,258
1961-2018	M	*	**0,755**	*	**0,754**
1961-2018	I	NS	-0,040	NS	0,066
1961-2018	I	NS	0,323	NS	0,289
1961-2018	A	NS	-0,015	NS	0,012
1961-2018	S	NS	-0,493	+	**-0,483**
1961-2018	O	NS	-0,288	NS	-0,238
1961-2018	N	NS	0,306	NS	0,310
1961-2018	D	NS	-0,133	NS	-0,174
1961-2018	An	NS	0,106	NS	0,106
1961-2018	I	NS	0,004	NS	0,009



1961-2018	P	**	**0,474**	*	**0,432**
1961-2018	V	NS	0,151	NS	0,122
1961-2018	T	NS	-0,192	NS	-0,137
1961-2018	Oct-Mar	NS	0,040	NS	0,060
1961-2018	Apr-Sept	NS	0,194	NS	0,149

Figure no.4 Graphical representation of the evolutionary trends of the shine duration of the Sun at Cotnari (1961-2018)

The evolutionary trends of the duration **of the shine duration of the Sun**, calculated by the Mann-Kendell test and the T-test, highlight the upward trend of the duration of the sun's brightness in the spring months and in the more special months (Tab.no.8, Fig.no.4).

The variability in time and space of **the atmospheric precipitation** quantities is influenced by the general circulation of air masses, the thermal convection and the local topography.

The analysis of the decayed values highlights the cyclicality of the rainy and dry years. The years 1970-1980 and 2000-2010 are characterized by large amounts of precipitation and currently we are going through a period of rainfall deficit, justified by the annual values of 405.7mm / 2011, 409.8mm/2015 and 509.4mm/2017(Tab.no.9, Fig.no.5).

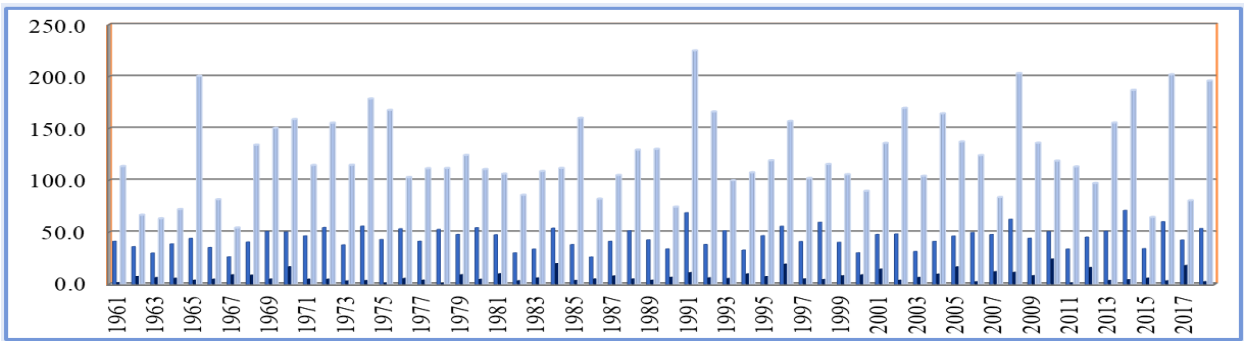


Figure no.5 The annual regime of atmospheric precipitation (mm) in Cotnari (1961-2018)

Table no.9 Decadal regime of atmospheric precipitation (mm) in Cotnari (1961-2018)

Decades	1961-1970	1971-1980	1981-1990	1991-2000	2001-2010	2011-2018
The atmospheric precipitation (mm)	4719	5847	4785.3	5575.2	5638	4696.7

The analysis of the evolutionary tendencies in case of atmospheric precipitations, confirms the slightly ascending character of the precipitation quantities for the cold season, the autumn season and especially October. Although the number of days with measurable precipitation decreases in most of the year, the torrential character and the unpredictable temporary regime, justify the characteristics of the local temperate-continental climate in Cotnari and the practice of the wine-making activities (Tab.no10).

Table no.10 Evolutionary trends of atmospheric precipitation for the parameter of the sum of the values of atmospheric precipitation (mm) related to different temporal entities at Cotnari (1961-2018)

The atmospheric precipitation (mm)		Testul Mann-Kendall		Testul t	
Analyzed period	Analyzed interval	Means statistics	Spole	Means statistics	Spole
1961-2018	I	NS	0,043	NS	0,015
1961-2018	F	NS	0,090	NS	0,042
1961-2018	M	NS	0,183	NS	0,194
1961-2018	A	NS	0,063	NS	0,018
1961-2018	M	NS	-0,089	NS	-0,055
1961-2018	I	NS	0,523	NS	0,448
1961-2018	I	NS	-0,103	NS	0,021
1961-2018	A	NS	-0,207	NS	-0,179
1961-2018	S	NS	0,245	NS	0,202
1961-2018	O	**	**0,561**	**	**0,734**
1961-2018	N	NS	0,158	NS	0,136
1961-2018	D	NS	0,080	NS	0,179
1961-2018	An	+	**1,733**	+	**1,757**
1961-2018	I	NS	0,068	NS	0,220
1961-2018	P	NS	0,030	NS	0,158
1961-2018	V	NS	0,350	NS	0,290
1961-2018	T	*	**0,907**	*	**1,072**
1961-2018	Oct-Mar	*	**0,992**	**	**1,357**
1961-2018	Apr-Sept	NS	0,137	NS	0,455

The wind frequency in Cotnari is characterized by the dominance of the NV sector at all seasons, with an average of 31.08% per year (Tab.no.11). The high frequency of the wind in this direction and the increasing trends of wind speed in the transitional seasons (spring, autumn), are favored by the orientation of the north-west / south-east streams and valleys, but also by the circulation at the continent level (Mihailă, Tănasă, 2010).

Secondary, we observe the high value of the atmospheric calm with an annual average of 20.78% per year, with a maximum frequency in summer (22.71%) in August, conditions that help the grapes ripen by accumulating the nutrients necessary for the quality of the wine and minimum autumn (17.89%) in spring and winter (over 20%) (Tab.no.12).

Table no.11 Frequency (%) and average speed annual (m/s^2) a wind direction and atmospheric calm (%) at Cotnari (1961-2004)

		N	NE	E	SE	S	SV	V	NV	CALM
Winter	Frequency (%)	10.98	0.49	1.09	4.52	12.42	10.36	10.54	29.18	20.12
	Average speed (m/s^2)	5.16	0.98	1.03	2.42	4.31	4.11	4.26	5.83	
Spring	Frequency (%)	14.34	1.80	2.26	6.18	14.68	6.82	7.20	28.51	17.89
	Average speed ((m/s^2)	4.69	2.10	1.94	4.05	4.50	3.88	4.00	5.31	
Summer	Frequency (%)	12.81	1.11	0.95	2.94	8.41	4.45	7.42	39.17	22.71
	Average speed (m/s^2)	4.43	1.42	1.23	2.92	3.44	3.17	3.47	4.92	
Autumn	Frequency (%)	10.32	0.87	1.29	4.22	15.15	9.02	8.96	27.48	22.41
	Average speed (m/s^2)	4.57	1.22	1.11	3.31	4.06	3.76	3.99	5.11	
Average year	Frequency (%)	12.11	1.07	1.40	4.47	12.67	7.66	8.53	31.08	20.78
	Average speed (m/s^2)	4.71	1.43	1.33	3.17	4.08	3.73	3.93	5.29	

Table no. 12 Evolutionary trends wind for the average wind speed parameter at 10m (m/s2) related to different temporal entities at Cotnari (1961-2018)

Average speed wind at 10 m (m/s^2)		Testul Mann-Kendall		Testul t
nalyzed interval	Means statistics	Spole	Means statistics	Spole
I	NS	0,000	NS	-0,003
F	NS	0,002	NS	0,002
M	*	**0,019**	+	**0,014**
A	*	**0,013**	*	**0,012**
M	*	**0,012**	NS	0,009
I	*	**0,013**	**	**0,013**
I	NS	0,007	NS	0,004
A	+	**0,006**	+	**0,007**
S	***	**0,020**	***	**0,020**
O	*	**0,011**	**	**0,010**
N	NS	0,013	NS	0,008
D	*	**0,015**	NS	0,011
An	**	**0,010**	**	**0,009**
I	NS	0,002	NS	-0,001
P	**	**0,014**	**	**0,011**
V	**	**0,010**	*	**0,008**
T	***	**0,014**	***	**0,013**
Oct-Mar	+	**0,007**	NS	0,006
Apr-Sept	***	**0,012**	***	**0,011**

The balanced character of the climatic elements and the local topography favors the heating of the air on the eastern and south-eastern slopes of Dealul Mare-Hârlău. Their effects are favorable for the cultivation of vines: the vegetation period of more than 180 days, the effective sunshine of 1400-1500 hours, the rainfall of the vegetation period satisfactory for the culture of the vines. To Cotnari cultivates vine varieties with medium vegetation period, frost resistant, moderately drought resistant and with high heliotermic requirements (Clima României, 2008).

According to the INS (Romanian National Institute of Statistics), at the level of 2014, the agricultural area dominates in the structure of the land fund with over 68% both of Iasi county and at the level of Cotnari commune (Tab.no.13). Of the all agricultural areas, the vineyards occupy 3.06% in the county of Iasi, while in Cotnari they exceed 17%.

The evolutionary trends of the main climatic elements from 1961-2018 and the distribution of the generous areas with vines in the Cotnari area, justify the profitability of this agricultural crop. By correlating the wine production with the climatic data from the vegetation period of the vines, it can be stated that in order to achieve a very good production air temperature values between 14.5 ° -18.1 ° C are needed, precipitation amounts between 232 mm-450 mm , values of relative humidity between 67.5% -80.5% and values of the shine duration of the Sun over 1300 hours (Chiriac, 2009; Cotea, et.al. 2006). Climatic conditions that are ensured by the local geographical and topographic position. According to popular forecasts, good quality vineyard yields are predominantly obtained in the drought years, an assertion confirmed by the general trend of climate warming from the values of the climatic indices from 1994, 2000, 2003, 2007, 2019. It should be mentioned that although the vine is not a very sensitive plant to decrease humidity, it needs water in the ripening stage depending on each vine variety.

The lithological, pedological and relief substrate play an important role in the specificity of the wine preparation. Cernoziomic soils (leachate, rendzinic leachate, pseudo-rendzinic leachate) are the most profitable

and occupy more than half the Cotnari surface followed by gray ash and brown soils (Badea,, Gâştesc, et.al.,1983; Badea, Bugă, et.al.,1994).

Far from considering that we have exhausted the analysis of the evolutionary trends of the climatic elements and of the local agro-geographic sustainability, mentioning the influence of the wine activity through the following aspects: vineyards are a means of combating soil erosion and reducing pollution; ensures the rational use of sloping lands; ensures high incomes per unit area and imposes a high degree of professional training; although it presents trends of European integration, the Cotnari prints a specific way of life, preserving the local tradition and customs.

Table no.13 The structure of the land fund at the level of 2014, Source: National Institute of Statistic

Structure of the land fund (2014)	Property form	District Iaşi	Village Cotnari
Total area	Total	547558	9159
	Private property	425023	6262
Agricultural surface	Total	381300	6188
	Private property	347866	5326
Arable surface	Total	256098	2573
	Private property	250177	2335
Pastures	Total	84231	1645
	Private property	58525	1031
Meadows	Total	22465	573
	Private property	21554	572
Vine	Total	11679	1039
	Private property	11252	1039
Fruit trees	Total	6783	358
	Private property	6358	358
Non-agricultural land	Total	166303	2971
	Private property	77157	936
Forests and other firest vegetation	Total	97890	1896
	Private property	30509	299
Water and ponds	Total	1310	153
	Private property	5029	7
Construction surfaces	Total	19022	177
	Private property	16328	160
Comunications and railways	Total	19285	277
	Private property	2404	20
Degraded lands	Total	25999	468
	Private property	22887	450

(Source: Romanian National Institute of Statistics.)

IV. CONCLUSION

The Cotnari is characterized by average values of the main climatic elements specific to the temperate-continental climatic type with evolutionary tendencies, increasing-statistically significant for: air temperature, nebula, the shine duration of the Sun, the atmospheric precipitation and wind. Particular situations are given by the predominant north-westerly winds and the slopes to the Jiji-Bahlui depression, which favor the heating of the air and the improvement of the thermal balance and the duration of the Sun's brightness, which are significantly higher at Cotnari than in the other vineyards around Iasi. Given the local agroclimatic potential, this theme can be detailed using means (satellite images, thematic maps) and modern GIS processing methods (Bistricean, 2018; Partiche, 2009).

ACKNOWLEDGMENT

This work is supported by project POCU 125040, entitled "Development of the tertiary university education to support the economic growth - PROGRESSIO", co-financed by the European Social Fund under the Human Capital Operational Program 2014-2020.

V. REFERENCES

1. Badea, L., Gâștesc, P., et.al. (1983) Geografia României, vol. I, Editura Academiei R.S.R., București, p.662
2. Badea, L., Bugă, D., et.al. (1994) Geografia României, vol. IV, Editura Academiei, București, p.580
3. Bistricean, P.I. (2018) Metode şi tehnici GIS de analiză spaţială a datelor meteo-climatice, lucrări practice, Universitatea "Ștefan cel Mare", Suceava
4. Chiriac, C. (2009) Climatic requirements for optimum development of grapevine in Cotnari Vineyard, Luc.Ştiinţifice, Vol.51/2011, seria Horticultură, USAMV, Iaşi
5. Cotea,V.V. et.al. (2006) Podgoria Cotnari. Editura Academiei Române, București, p.651
6. Gugiuman, I., Pleşca Gh., et.al. (1960) Unităţi şi subunităţi climatice din partea de est a R.P.R., Lucrările sesiunii ştiinţifice jubiliare din oct.1960. Analele Ştiinţifice ale Universitatea "Al. I. Cuza", secţiunea II-Ştiinţe Naturale, tomul VI, facicolul 4, Iaşi
7. Kendall, M. G. (1975) Rank correlation method. 4th edn., London, p.202
8. Mann, H.B. (1945) Non-parametric test against trend, Econometrica,13, p.245-259
9. Mihăilă, D. (2006) Câmpia Moldovei-Studiu climatic, Editura Universităţii din Suceava, Suceava, p.465
10. Mihailă, D., Tănasă, I. (2010) Introducere în meteorologia practică, Editura Universităţii din Suceava, Suceava, p.414
11. Patrichi, E. (2008) Câmpia Moldovei. Evaluarea generală a potenţialului agroclimatic, teză de doctorat, Universitatea "Al.I. Cuza", Iaşi, p.185
12. Partiche, C.V. (2009) Modele statistice aplicate în climatologie, Edit.Terra N., Iaşi, p.170
13. Piticar, A. (2013) Studii privind schimbăriel climatic recente din nord-estul României, teză de doctorat. Universitatea "Babeş-Bolyai", Cluj-Napoca, p. 222
14. Sfîcă, L., Ichm P., et.al. (2014) Cotnari vineyard- a gift of hydraulic foehn? Luc.Ştiinţifice, vol.57/2014, seria Agronomie, USAMV, Iaşi
15. Ungureanu, Gh., Anghel, Gh., et.al. (1971) Cronica Cotnarilor, Editura Ştiinţifică, București
16. ***Clima României (2008) ANM, Editura Academiei Române, București, p. 316
17. Romanian National Institute of Statistics. Querying the TEMPO database and the IPC database, http://statistici.insse.ro:8077/tempo-online/#/pages/tables/insse-table, accessed on 10.03.2020.
18. Basic/advanced statistics sites and probabilities, https://www.statisticshowto.com/mann-kendall-trend-test/, accessed on 20.01.2020.