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THE IDENTIFICATION OF THE CLIMATE PROFILES IN THE VITICULTURAL AREA DOC DEALU MARE-VALEA CALUGAREASCA. THE DATABASE ASSOCIATED TO THE CLIMATIC PROFILE

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Abstract

The climatic profiles is a succint document, easy to understand, that contains the relevant information in a historical climatic context, the present and climate forecast and which specifies the viticultural potential effects of climate change, climatic variability and type of the climate. The study was achieved at ICDVV Valea Calugareasca, using the climatic parameters registered during the years 2004-2013. The objective of the study was to identify the climatic profile of the viticultural area DOC Dealu Mare Valea Calugareasca, which in terms of zoning is an area of the regional level. The viticultural climatic profile was designed with for basic components, one for climatic dormancy period, the second climate for the growing season, the third for the climate during the grapes ripening period (veraison-harvest) and the fourth for climatic risks in relation to the vines. The annual climate and the ripening period climate were defined by using the climatic indices recommended in the specialized literature. The differentiation between climatic types was done through the principal component analyses. The information obtained was conducted in an Excel database. By processing the information have been identified the following five types of climate. The climatic profile is an important viticultural technical document that can be used to predict the climatic changes, the climatic risks associated with the vine culture, establishing the possible adaptation of the viticultural technologies.

Key words*: climatic profile, climat of the growing season, climate of the ripening period, DOC Valea Calugareasca area, climate type*

INTRODUCTION

The annual behavior of vines and hence the quality of the grapes are in direct relationship with the climate vintage. In the last two decades significant progress in knowledge of the associated macro, meso and microclimate have recorded. A special importance had the realization of the Geoviticulture Multicriteria Climatic Classification System (MCC), (Carbonneau, Tonietto, 2000). It is a reference system of world viticulture, based on the using of three climatic indicators: Heliotermal Index, Dryness Index and Cold Night Index. This system also has the terms of comparison with the climate from any of the climate wine-growing regions.

Viticultural climate indicators are specific macroclimate, meso and microclimate. The defining of these indicators gave the opportunity to identify and characterize the types of climate in the main wine-growing regions (Dumas et al., 1997, Jacquet and Morlat, 1997, Tonietto, 1999, Tonietto and Carbonneau, 1998). In our country, were identified the climate types in the system MCC of the main wine-growing regions and the types of climate in the wine-growing region (Tudorache et al. 2013). The type of climate was multicriterial evaluated, by using the climatic indicators proposed by Joly et al. (2010).

Knowledge of the climatic vineyard has scientific and technical implications. The most important implications of climate are in the establishing of the vineyard management practices adapted to the climatic change and in the performing the strategies for making the best wine taking into account the enological potential of grapes. This work aimed to design a datasheet for the climatic of the vintage, to identify the climatic profiles based on a founded methodology for the climatic parameters registered in the 2004-2013 from Dealu Mare - Valea Calugareasca.

MATERIALS AND METHODS

Climate

Climate data used in this study were obtained from a meteorological station during the period 2004-2013 from the automatic station AddVANTAGE A720 only for 2013 and from the manual station for the period 2004-2012. The meteorological station is located in Valea Calugareasca with the following coordinates: 44°59' N and 26° 1'E an elevation of 210 m. The data were manually collected by manually and consisted of 4 daily records for temperature, precipitation and hours of insolation. The automatic station records were made daily at an interval of 15 minutes. For each day were calculated the following statistical parameters: average, minimum, maximum and the amount.

Indicators of the bioclimate vineyards

These general climate parameters were used in order to derive other variables used in viticulture studies. The vegetation period (April 1-September 30) is characterized by Heliotermal Index (HI), Cold Night Index (FI), Winkler degree-days (GDD), Hours of insolation amount (INS) and the rainfall amount (Pp). For the determinations the rippening period was taken into consideration the conventional specification made by Carbonneau and Tonietto (2002), this can be considered during the maturation period of 30 days before the date of theoretical harvest. In this study it was used as a reference the time at which actuall harvest took place.. The grape ripening period was characterized by the specific indicators of the growing season, which included the following indicators: maximum temperature and thermal amplitude.

The statistical analysis

The statistical analysis of data was done with 2014 XLSTAT program. The fallowing modules were used: Data for the database, Descriptive statistique for the calculations, Principal component analysis (PCA), cluster analysis and Chart for graphic representation.

The climate risc indicators

The climate risc indicators were selected from the literature. They are: frost of winter (-17°C), spring and autumn (-3°C), the maximum temperature during the budburst to veraison and during the ripening period (35°C) and rainfall (>50 mm).

The database

Tha database was the list type and was created in Excel program. Its query was performed using two methods, the filter standard method and an advanced filter for the calculated criteria.

RESULTS AND DISCUSSIONS

The concept of climatic profile

The climatic profile of wine-growing vintage is designed as a technical data sheet, which contains data about the viticultural area (name, the type of weather station and its coordinates), the climate in the dormant period, the climate in the growing season, the climate in the ripenning period and the climatic accidents. Each period is described by monthly climatic parameters, bioclimatic indicators, climatic profile and through a synthetic text. The climatic accidents were evaluated based on the risk indicators.

The climate of the growing period

The climatic vegetative period is specific to the vintage. The integrative climate indicators were interpreted through the principal component analysis (Figure 1). The following climatic types were identified:

- type 1: 2012
- type 2: 2009, 2010, 2011, 2013
- type 3: 2008, 2004, 2006
- type 4: 2007
- type 5: 2005

The potential of the first climate type is maximum, all climatic indicators are in the range with maximum values.

Thermal resources the climate Type 2 are medium (HI between 2310 and 2540), insolation max level (INS>1560 hours), low rainfall and the FI had an average value.

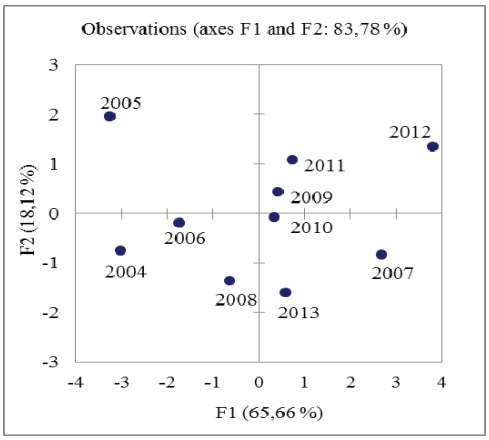


Figure 1. The score of the climate recorded during the growing season of the studied period (2004 to 2013), established by PCA

Climatic indicators of the 3rd type had the minimum level, except in the case of FI that had an average value. The 4th type to the wine climat differs from Type 2 by through insolation, which had a mean value (1410-1560 hours) and the cold night index, which had a low value (FI < 12.9°C). The climate Type 5 is characterized by minimum heliothermic resources and excess of rainfall (Table 1).

Table 1. The climate types during the growing period and their characteristics

The climatic indicator	Type 1	Type 2	Type 3	Type 4	Type 5
HI	>2540	2310-2540	<2310	2310-2540	<2310
Pp	500-660	<500	<500	<500	>660
INS	1410-1560	>1560	<1410	1410-1560	<1410
T° med	>20.6	19.8-20.6	<19.8	19.8-20.6	<19.8
FI	>14.3	12.9-14.3	12.9-14.3	<12.9	12.9-14.3

In terms of the frequency of the types of the climatic years Types (Figure 2), it is found that the frequency of the 2nd was the highest (40%), followed by Types 3 with 30%, while types 1, 4, and 5 showed a frequency of 10%.

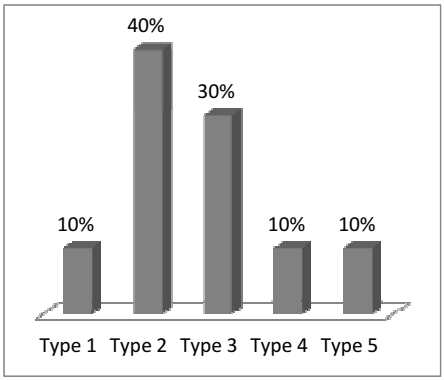


Figure 2. Frequent types of climate/vegetation period in the 2004-2013 period

The climatic profile of the growing season of the vine at the level of wine-growing vintage can be well represented in the form of a radial graph, in which each indicator has a nonparametric value. The transition to the values of climatic indicators to the nonparametric evaluation (score from 1-5) correspond to the specifications in Table 2.

Table 2. Correspondence between the score and the value of the climatic indicators

Score	T° med	HI	FI	Pp	INS
1	<19.48	<2214	12.34	<433 and >727	<1350
2	19.48-19.96	2214-2355	12.34-13.18	433-531 and 629-727	1350-1439
3	19.96-20.44	2355-2495	13.18-14.02	531-629	1439-1527
4	20.44-20.92	2495-2636	14.02-14.86		1527-1616
5	>20.92	>2636	>14.86		1616

The rainfall are evaluated with a score between 1 and 3, because the excess rainfall influence negatively the vegetative cycle of the vine. For example, the climatic profile/the growing period of the years 2008 and 2009 is presented in Figure 3.

The year 2009 had a normal climate. Specific indicators of year, characterized by a higher values than the average, were FI and INS.

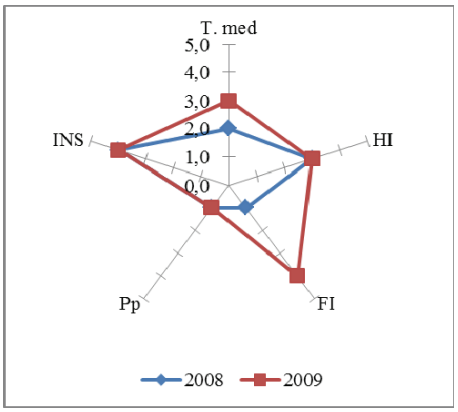


Figure 3. The climatic profil/the vegetation period of the years 2008 and 2009

In terms of hidrological year 2009 was a poor year in rainfall. As favorability, the climate of 2008 was below 2009. This was a year of poor rainfall and low favorability for the grapes maturation (FI = 1).

The climatic profile of the ripening period of the red grapes

The climate types of the grapes ripening period established by principal component analysis are as follows: (Figure 4):

- type 1: 2011, 2012
- type 2: 2009, 2010
- type 3: 2013, 2008, 2004, 2006
- type 4: 2007
- type 5: 2005

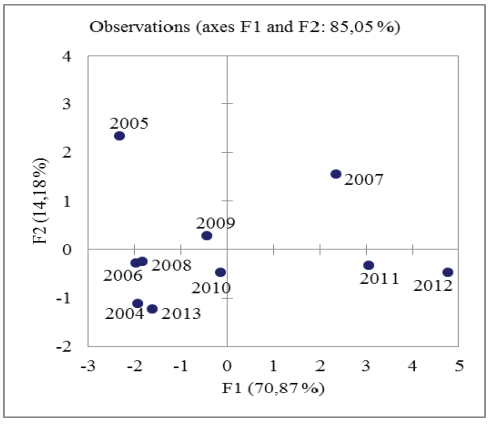


Figure 4. The vintage score by the principal component analysis

Each type of the climate is characterized by specific values of the parameters and climatic indicators. The type 1 represents an exceptional climate for the grape maturation. The thermal resources and cold night index are at the maximum level and the rainfall are below the risc value of the vine.

The type 2 is characterized by an average level of the thermal regime and the cold night index an average level and normal values for rainfall. The climatic characteristics of the type 3 presented values situated below their average values and rainfall is normal. The type 4th different from the first type by an excess of rainfall. The last type is an unfavorable climate for vine, all parameters being at the minimum level, with the exception of rainfall which is at the maximum level (Table 3).

Table 3. The climatic types is the grapes ripening period and their characteristics

The climatic indic.	Type 1	Type 2	Type 3	Type 4	Type 5
HI	>400	<400	<400	>400	<400
Pp	<65	<65	<65	>65	>65
INS	>250	>250	<250	>250	<200
T° med	>20	<20	<20	>20	<20
FI	>15	14-15	<14	>15	<14

The climatic profile in the grapes ripening period is similar with the climate of the growing period.

Comparing climate in the growing period with that in the ripening period

The climate in grape ripening period has similar characteristics with as the climate in the growing period in 2012, 2009, 2010, 2004, 2006, 2008 and 2005 (Figure 5). Thus, in the year 2011, although the climate in the growing season has been framed in type 2, the climate of the ripening period was exceptional of level (type 1). 2007 year was classified in type 2 as well as the climate in the growing season, but the rainfall has similar characteristics with that classified in the type 4. In 2013, the climate of the growing season was framed in level 4 and the ripening period in level 3.

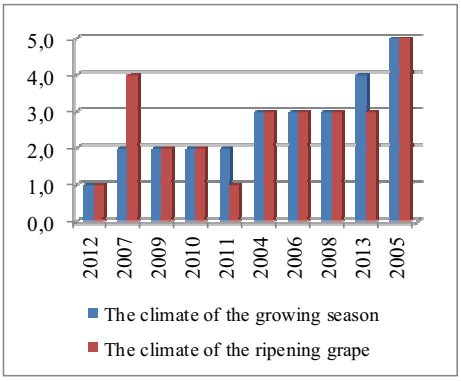


Figure 5. The specificity of the growing season climate type and the ripening in relation to vineyard milesima

The frequency of the years with the same type of climate during the growing season and the ripening period was of 70%.

The database associated to the climatic profile of wine-growing vintage

There had been two list for the database, one for the wine climate and another for the climatic risks. The daily climate list had the following fields: the year, the day and the month, hours of insolation, medium, minimum and maximum temperature and rainfall (Figure 6).

	Anul	Ziua luna	Insolatia reala	Temp. med. aer °C	Temp. max. aer °C	Temp. min. aer °C	Precipitatii
2	2004	1-ian.	0,0	5,0	5,2	5,0	4,0
3	2004	2-ian.	0,0	4,1	4,2	4,0	5,7
4	2004	3-ian.	0,0	-1,3	0,2	-2,3	3,9
5	2004	4-ian.	0,0	-4,8	-4,3	-5,6	1,0
6	2004	5-ian.	0,0	-7,1	-6,5	-8,4	4,4
7	2004	6-ian.	0,0	-8,3	-6,5	-10,0	0,8
8	2004	7-ian.	0,4	-4,8	-3,6	-10,6	0,0
9	2004	8-ian.	2,2	-5,0	-3,2	-8,2	0,0
10	2004	9-ian.	6,8	-5,0	-2,0	-6,6	0,0
11	2004	10-ian.	7,5	-4,4	0,8	-9,0	0,0
12	2004	11-ian.	0,0	-2,5	1,0	-8,6	0,0
13	2004	12-ian.	4,2	-2,3	0,0	-3,8	0,0
14	2004	13-ian.	0,0	-1,0	0,5	-4,6	0,0
15	2004	14-ian.	1,8	2,1	3,6	-0,6	7,0
16	2004	15-ian.	0,0	2,1	4,2	0,5	11,9
17	2004	16-ian.	2,4	2,7	4,4	0,5	2,6
18	2004	17-ian.	6,1	1,3	5,7	-4,6	0,0
19	2004	18-ian.	4,5	4,1	9,4	-3,2	0,0
20	2004	19-ian.	0,0	2,1	4,2	0,6	0,0
21	2004	20-ian.	0,0	1,9	3,6	0,0	2,2

Figure 6. The structure of the daily climate list

Query parameters and the climatic indicators were achieved by using the data form, ilustrated for the grapes ripening climate (Figure 7).

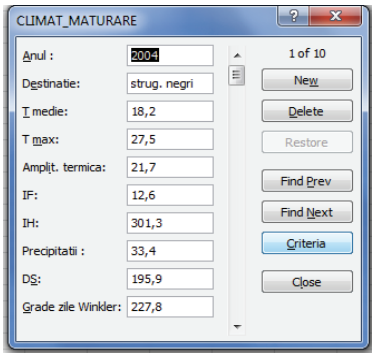
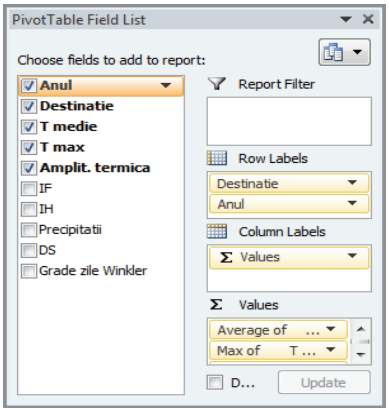


Figure 7. The query to view the ripening period climate

The analysis in detail and the comparison of the climatic data were achieved through the Pivot Table report which represent an interactive way to summarize the data. In the Pivot table (Figure 8), it is easily seen how to report the climatic parameters of medium temperature, maximum temperature and thermal amplitude during 2004-2013, according to the destination of the production.



Destinatie	Average of T medie	Max of T max	Average of Amplit. Termica
strug. negri	19,7	37,2	23,1
2004	18,2	27,5	21,7
2005	18,7	22,6	19,6
2006	18,7	22,4	18,3
2007	21,6	37,2	25,6
2008	18,6	22,2	26
2009	19,8	23,9	21,8
2010	19,8	23,4	25,2
2011	22,3	27	22,6
2012	21,9	29,4	28,7
2013	17,7	23,2	21,3
Grand Total	19,7	37,2	23,1

Figure 8. The query of the data through Pivot table

The reports were made by the model VBA Project. As an example was generated the climatic profile report of the ripening period of the year 2004 (Figure 9).

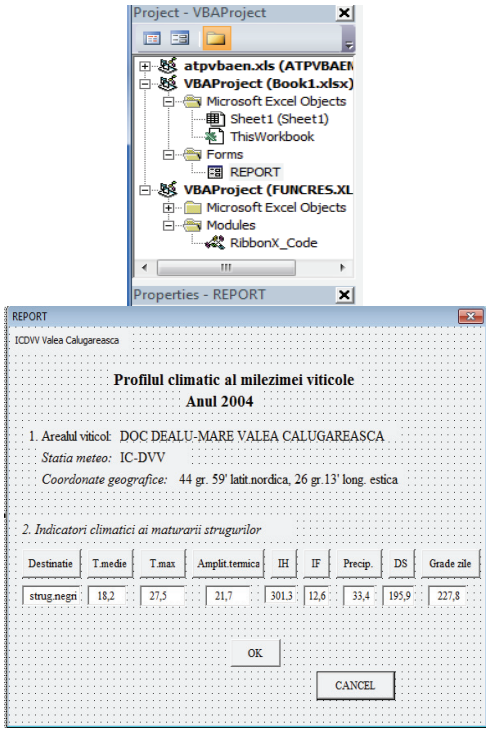


Figure 9. The climatic profile report of the ripening period of the year 2004

CONCLUSIONS

A file was conceived for the description and the identification of the vintage climatic profile, in which the summary information regarding the climate of the dormancy period, the growing season, the ripening period and the climatic risks are shown.

5 types of the viticultural climate, evaluated on numerical scales from 1 to 5, during the years 2004-2013 were identified

The frequency of the climatic types in the growing season was the following: 10% type 1, 40% type 2, 30% type 3, 10% type 4 and 10% type 5.

The climatic type in the ripening period was similar to the climate in the growing season for 7 years (2012, 2009, 2010, 2004, 2006, 2008 and 2005) and different for 3 years (2011, 2007, 2013).

The climatic profile is presented in the form of a radar type chart.

The information concerning wine climate of the period 2007-2013 was organized in a database of Excel type and was processed by queries and specific reports.

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