

Research on Climate – Grapevine Yield Relationship and the Impact of Global Warming

Georgeta Mihaela BUCUR¹⁾, Liviu DEJEU^{1*)}

¹⁾Department of Horticultural Bioengineering Systems, University of Agronomic Sciences and Veterinary Medicine, Bucharest, Romania.

^{*)}Corresponding author, e-mail: livuidejeu@gmail.com

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Abstract. Trends of climate variables were studied for the latest 41 years (1973-2013) and their effects on the quantity and quality of the grape production for Feteasca regala variety, clone 21 Bl, grafted on Kober 5 BB, in the plantation of the University of Agricultural Sciences and Veterinary Medicine, Bucharest, for the latest 16 years (1998-2013). Following the trend of main climate variables, there was a highly significant heating, especially in the summer. Some significant correlations were established between climate variables and production, sugar accumulation in the berries and titratable acidity in the must. Significant results were obtained with bioclimatic indices Huglin and Winkler. It also increased the number of hot days (with maximum temperature above 30°C) and very hot days (with maximum temperature above 35°C), which adversely affects the metabolism of vines, producing unbalanced wines. Since it is expected that this trend of temperature rising continues in the future and that the ripening period of the grapes takes place in warmer conditions, there are necessary adjustments of viticulture development strategies under the new conditions.

Keywords: *grapevine, climate change, yield*

Introduction. Global warming from the latest years has been favourable for grapevine growing and for berries ripening. Grapes composition changes, leading among other things, to a high sugar content, a decrease in acidity and it inevitably affects wine typicity (Cotea *et al.*, 2008; Carbonneau, 2011; Bucur *et al.*, 2012).

Aims and objectives. The aim of this paper is to determine the trends of climate change in the latest 41 years and their effect on vine between 1998 and 2013.

Materials and methods. The climatic data were obtained for a period of 41 years (1973-2013), for Bucharest meteorological station (44°47'N; 26°07'E), in order to calculate minimum, maximum and average temperature, the number of days with very hot (Tmax > 35°C) and hot (Tmax > 30°C) temperature, Huglin Index, Winkler Index in the growing season and in different periods of the year. It was followed their evolution in time and there were settled correlations between these parameters and grape production, accumulation

of sugars in the berries, grape acidity in clone 21 Bl Feteasca regala cultivar, at the experimental plantation of the University of Agricultural Sciences and Veterinary Medicine Bucharest, in the period 1998-2013.

Results and discussion. It has been found a highly significant trend of increasing average temperature during the growing season (IV-X), especially in the summer (VI-VIII) (Tab.1). At the same time, there was a highly significant increase in the number of hot days (with Tmax > 30°C) and very hot days (with Tmax > 35°C), associated with more frequent heat waves during ripening. The same high level of significance was obtained in terms of increasing trends of annual maximum and average temperatures of the warmest month of the year (July), unlike the average minimum temperature in January (not significant variations). Highly significant increasing trends were also found, in time, for bioclimatic indices Huglin and Winkler. There have been established correlations between climate variables and grapes

Tab.1 Trends of some climate variables in different periods of the year (Bucharest, 1973-2013)

Variable	Period of the year	Significance	Decadal trend	Average	Maximum	Minimum
Average temperature (°C)	I-XII	**	0.31	11.4	13.4	10.2
	IV-X	***	0.37	17.9	19.8	16.4
	XII-II	NS	0.12	0.1	4.0	- 4.3
	III-V	NS	0.24	11.7	13.8	8.5
	VI-VIII	***	0.63	22.2	25.3	19.9
	IX-XI	NS	0.21	11.7	13.8	9.5
No of days with Tmax > 35°C	V-IX	***	2.70	5.8	28.0	0.0
No of days with Tmax > 30°C	V-IX	***	9.00	43.7	79.0	14.0
Average annual Tmax (°C)	I-XII	***	0.48	16.9	19.2	15.0
Average Tmax in July (°C)	VII	***	0.90	29.5	34.9	25.6
Average Tmin in January (°C)	I	NS	- 0.10	-5.3	-1.2	-11.8
Huglin Index (°C)	IV-IX	***	100	2265	2734	1942
Winkler Index (degree days)	IV-X	***	74	1573	2042	1243

Tab. 2 Correlations between some climate indicators, production and its quality

Variable	Significance	Correlation coefficient
Average maximum temperature in July (°C) – sugar (g/L)	NS	0.266
Average maximum temperature in July (°C) – titratable acidity (g/L H ₂ SO ₄)	*	0.520
No of days with Tmax > 30°C – sugar (g/L)	NS	0.371
No of days with Tmax > 30°C – titratable acidity (g/L H ₂ SO ₄)	**	0.636
Precipitations (III-V) – production (kg/vine)	*	0.590
Huglin Index (°C) – production (kg/vine)	NS	0.285
Huglin Index (°C) – sugar (g/L)	*	0.512
Huglin Index (°C) – titratable acidity (g/L H ₂ SO ₄)	**	0.629
Winkler Index (degree days) – production (kg/vine)	NS	0.395
Winkler Index (degree days) – sugar (g/L)	*	0.503
Winkler Index (degree days) – titratable acidity (g/L H ₂ SO ₄)	NS	0.454

production for Feteasca regala, during 1998-2013, the accumulation of sugars in the grape berries and titratable acidity from the must (Tab.2). Distinctly significant correlations were identified between the number of days with Tmax above 30°C and titratable acidity of the grape, and between Huglin index and the same variable quality.

Conclusion. In the last decade, there was a highly significant increasing trend of the temperature during the growing season, more evident for the summer. The documented effects of the historical trends and their influence on the vine are a valuable indicator of what could be expected in the future, highlighting the need to implement measures of adaptation to these climate changes.

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