INFLUENCE OF CLIMATE CONDITIONS ON BIOPRODUCTIVITY AND QUALITY IN SOME WINE GRAPE VINE VARIETIES

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Abstract: *Between 2014 and 2016, we carried out studies and made observations on the impact of certain climate parameters on productivity and quality in some wine grape vine varieties: this paper presents some of this research results. To carry out our research, we assessed the climate resources depending on ecologic demands of white and red wine grapevine varieties, cultivated in the Pleniţa viticultural area of the Plaiurile Drâncei grapevine plantations, and the bioproductive and quality potential of the grapevine varieties studied.*

Keywords*: wine grapes, bioproductive and qualitative potential, climate resources, the Plaiurile Drâncei vineyard – the Pleniţa viticultural area.*

INTRODUCTION

Research was carried out at the **S.C. Pomiviticola S.R.L. Pleniţa**, Dolj County, Romania, on a viticultural plantation 4-5 years after planting.

The goals of the study were:

- *Assessing climate resources of the studied area*:
  - Mean monthly temperatures (ºC), absolute temperatures (minimal and maximal), active thermal balance, useful thermal balance etc.;
  - Mean monthly precipitations (mm), sum of annual precipitations, sum of precipitations during vegetation;
  - Duration of sunlight (hours).
- *Assessing bioproductive potential*:
  - Percentage of fertile shoots ();
  - Vegetative growths per vine (m/vine and m/m^2), maturation rate of annual wood (m/vine; %);
  - Relative fertility coefficient;
  - Absolute fertility coefficient.
- *Measuring sugar content* (g/L);
- *Measuring total acidity* (g/L H_2SO_4).

MATERIALS AND METHOD

To reach our goals, we studied seven wine grape varieties: four high quality red wine grape varieties – Merlot, Syrah, Cabernet Sauvignon, Black Feteasc㠖 and three high quality white wine grape varieties – Italian Riesling, the semi-flavoured Sauvignon variety, and the flavoured Romanian Tămâioasă variety. These varieties were grafted on the *Berlandieri x Riparia Oppenheim Selection 4 (OS4)* graft at a planting distance of 2.2 x 1.0 m, with an average of 4545 vines/ha, in a semi-protected cultural system, semi-high leading, Guyot cutting type, and a mean load of 10-12 buds/m^2. Soil works and tillage works were applied evenly in all studied varieties.

Research was carried out on 10 vines of each variety using the randomised block method. We made both field observations – the level of annual vegetative growths, the degree of maturation of the wood and the percentage of shoots – and in the laboratory – on sampled tendrils and grapes. To analyse grapes qualitatively, we used two working methods: Zeiss hand refractometer to determine sugar content and the titrimetric method to determine total acidity in the must and wine.

RESULTS AND DISCUSSION

Appreciated overall depending on climate conditions (multiannual data), the studied viticultural area is characterised by the richness of heliothermal resources during vegetation, which confers high availability to a wide range of grape varieties in both red and white wine grapes and table grapes.

Table 1

Main climate indices (2015)

General climate indices		**Characterisation**
Average Ta°C	12,00	High favourability
∑ t °a	3535	High favourability
∑ t °u	1855	High favourability
Insolation (h) during active vegetation	1678	High favourability
∑ P annual (mm)	436,6	Sub moderate
∑ P (mm) during active vegetation	274,5	Sub moderate
Synthesis climate indices		**Characterisation**
Martonne Index (A)	1,07	Arid
Ibcl	6,86	High favourability
Iaoe	5026	High favourability
Huglin IH heliothermal Index	2503	IH5- Warm
Night cooling index (IF)	14,33	IF 2 – with temperate nights

Source: Data processed after http://romanian.wunderground.com/history/airport/LRCV

Annual climate variability determines the quantity and quality of the viticultural material (better or worse viticultural years). For instance, for the studied area, the values recorded in 2015 – 14.33 (>14 ≤ 18) ranked that year in the class 2 – with temperate nights – which makes it highly favourable for antocyan and flavour formation in late varieties that benefited from cooler temperatures during maturation.

Table 2

Annual vegetative growths and degree of maturation of the wood in the studied wine grape varieties (November 2014)

Variety	**Total length of annual growths/vine (m/vine)**	**Total length of annual growths (m/m2)**	**Total length of matured wood (m/vine)**	**Matured wood (%)**
Merlot	11,57	5,26	8,02	69,32
Syrah	17,88	8,13	12,56	70,27
Cabernet Sauvignon	17,51	7,96	15,43	88,12
Black Feteasc㠠	18,34	8,34	15,66	85,37
Romanian Tămâioasă	13,59	6,18	10,12	74,46
Sauvignon	14,87	6,76	10,60	71,26
Italian Riesling	15,26	6,94	11,63	76,24
Average/assortment	**15,57**	**7,08**	**12,00**	**76,43**

Source:*Own research*

The comparative study regarding vegetative growths in the viticultural year 2014 pointed out that the highest growths in the studied wine grape varieties in the viticultural area Plenița were in the Black Fetească (18.34 m/vine), while the lowest ones were in the Merlot (11.57 m/vine), with an assortment mean of 15.57 m/vine and 7.08 m/m^2 .

As for the maturation degree of the wood under the ecological conditions of the viticultural area Plenița among the studied wine grape varieties, there was good maturation in the grape varieties Cabernet Sauvignon (88.12%) and Black Fetească (85.37%), which ensures favourable behaviour during low winter temperatures.

Table 3

Percentage of damaged buds during vegetative resting and percentage of fertile shoots in the studied wine grape varieties (2014-2015)

Variety	Main damaged buds (%)	Secondary damaged buds (%)	Fertile shoots (%)
Merlot	58,34	31,24	44,24
Syrah	64,35	37,18	43,91
Cabernet Sauvignon	36,38	16,29	47,27
Black Fetească	31,26	18,48	29,71
Romanian Tămâioasă	59,27	29,53	43,68
Sauvignon	51,25	34,32	47,31
Italian Riesling	44,59	17,89	46,62
Average/Assortment	**49,35**	**26,42**	**43,24**

Source: *Own research*

According to the site http://romanian.wunderground.com/history/airport/LRCV, the most intense frost was on January 1, 2015: for 12 consecutive hours, air temperature in the meteorological station was below -14.0°C, with an absolute minimal temperature of -20.0°C. These critical temperatures had negative effects on both bud viability and vine evolution in 2015.

Among wine grape varieties, the highest values of unviable buds during 2014-2015 were in the varieties Syrah (64.35% of the main buds and 37.18% of the secondary buds), Romanian Tămâioasă (59.27% of the main buds) and Merlot. The lowest values of unviable buds were in the Black Fetească (31.26% of the main buds).

In 2015, the percentage of fertile shoots was rather low, with an assortment mean of 43.24%. Though wood maturation was not very good (71.26%) and the percentage of damaged main buds was rather high (51.25%), the Sauvignon variety had the highest percentage of fertile shoots (47.31%), unlike the Black Fetească. This was caused by the less favourable conditions of 2014, a rainy year, and to the intense attack by diseases that affected the integrity of the vegetative system and the proper assimilation of nutrients.

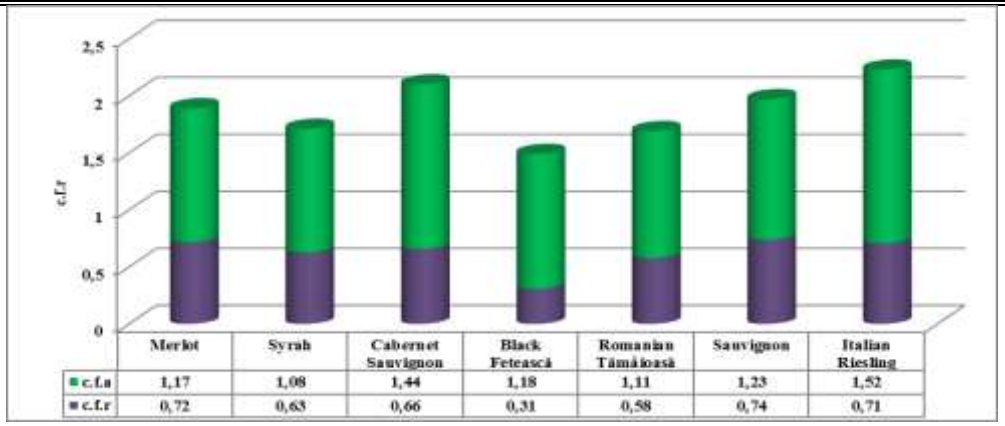

Figure 1. Fertility coefficients (2015)

Synthesis analysis of the values recorded for the relative (c.f.r.) and absolute (c.f.a.) fertility coefficients shows that the highest fertility rate was in the wine grape varieties Italian Riesling and Cabernet Sauvignon. Relative fetility coefficient ranged between 0.31 in the Black Feteasc ă variety and 0.74 in the Sauvignon variety, while absolute fertility coefficient ranegd between 1.08 in the Syrah variety and 1.52 in the Italian Riesling variety.

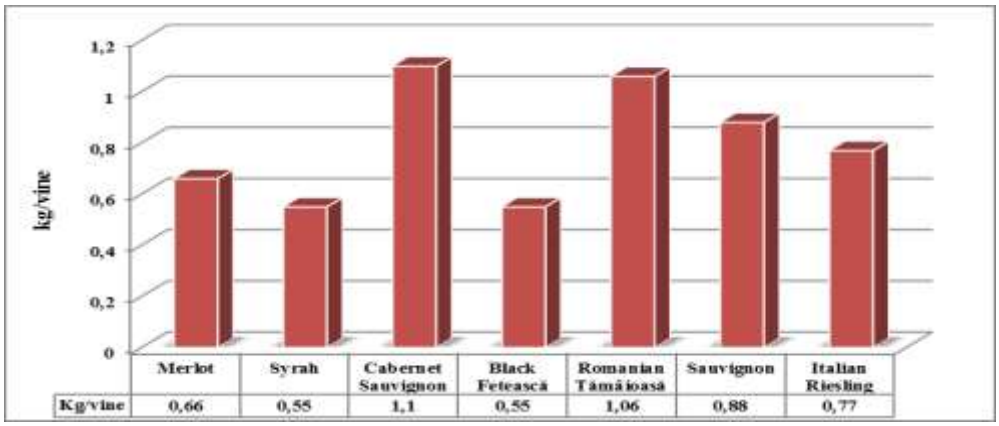

Figure 2. Yield in the studied wine grape varieties (kg/vine) (2015)

As for the quantitative yield (kg/vine) in the year 2015, it was much below the productive potential of the varieties, ranging between 0.55 kg/vine (2500 kg/ha) in the varieties Syrah and Black Feteasc ă and maximum 1.10 kg/vine (5000 kg/ha) in the variety Cabernet Sauvignon. This is largely due to the losses of buds caused by the critical negative temperatures during vegetative resting in 2014-2015 and to the cumulated effect of the critical conditions of the previous year.

However, we need to mention that the variety Romanian Tămâioasă, that had the highest bud losses, reciovered the losses due to its fruit-producing tillers producing 1.06 kg/vine.

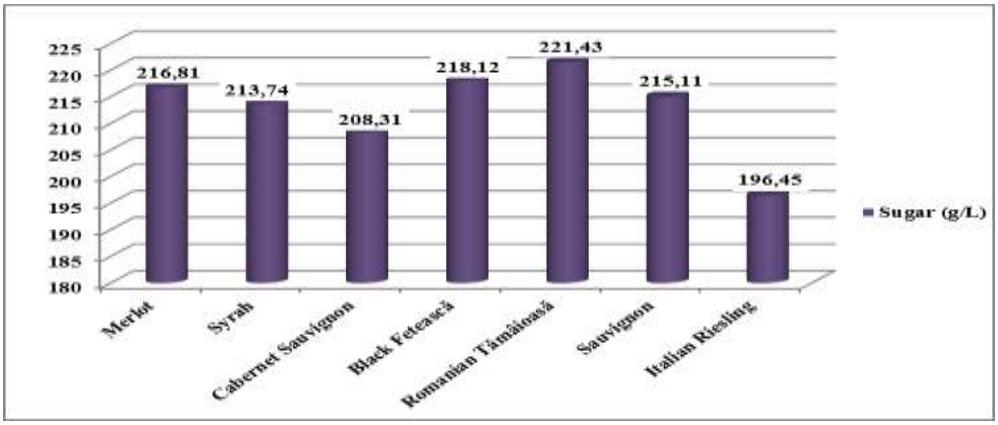

Figure 3. Sugar accumulating potential (g/L) (2015)

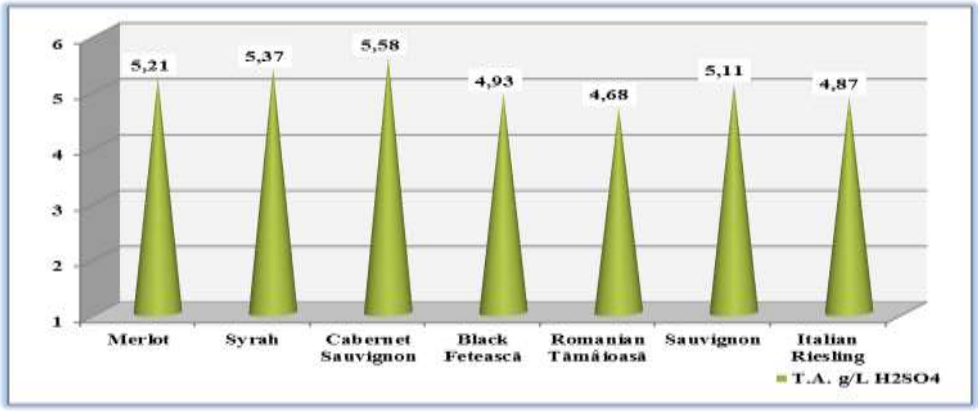

Figure 4. Total acidity (g/L H_2SO_4) (2015)

In the conditions of 2015, a year rich in heliothermal conditions (an index of oenoclimate aptitude of 5026 units) and arid depending on the Martonne aridity index, but rich in rainfalls during August and September, the white wine grape varieties recorded the highest sugar accumulation potential in the Romanian Tămâioasă (221.4 g/L sugars in the must) with a total mean acidity of 4.68 g/L H_2SO_4.

Among red wine grape varieties, we noted the Black Feteasca due to its highest sugar accumulation potential: 218 g/L sugars in the must and total acidity of 4.93 g/L H_2SO_4.

CONCLUSIONS

- The generous heliothermal conditions of the Plenița viticultural area (both multiannual and annual specific climate indices) and the oenoclimate aptitude index values confirm the high favourability of this area for both high quality red and white wine grapes and table grapes.
- Annual climate variability can generate negative thermal risks during vegetative resting, with impact on wine production.
- Critical climate conditions during vegetative resting in experimental years had a negative impact on fertility potential and productivity in the studied wine grape varieties.
- With the same ecological and technical conditions, the intrinsic potential of the wine grape variety determines the level of quantitative and qualitative grape yield.

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