

# RESEARCH ON THE INFLUENCE OF ENVIRONMENTAL CONDITIONS ON SOME BIOPRODUCTIVE PARAMETERS OF THE MERLOT VARIETY GROWN IN DEALURILE CRAIOVEI VITICULTURAL REGION

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## Abstract

*The culture of the vine on certain areas with superior productive results requires the continuous assessment of the ecological favorability of the space used for this purpose, as well as the identification and application of the most appropriate technological measures in accordance with the variable factors within the ecosystem. In accordance with the proposed research theme, the observations and determinations of this study focused on monitoring the climatic factors to evaluate the favorability of the study year and studying the influence of environmental conditions on some bioproductive parameters of the Merlot variety grown in the Banu Mărăcine viticultural center.*

*The effect of varying environmental conditions on the varieties studied was evaluated by analyzing some indices: biological and productive at the variety studied during the 2022 year. The ecological conditions during the research period influenced the results obtained.. The Merlot variety interacted with the environmental conditions specific to the study period expressing its productive potential in a specific way.*

**Key words:** *environmental conditions. bioproductive parameters, Merlot variety, grapevine, terroir*

## INTRODUCTION.

The influence of the specific conditions of the culture area, of terroir, on the productive results of the vineyard has been the subject of numerous studies (Cichi Daniela Doloris et al. 2009,2015, Xenophon V. et al 2020)

The notion of "viticultural terroir" includes the specific conditions of climate, soil, topography, biodiversity but also includes the cultural management of a site. Vitivicultural "terroir" is "a concept which refers to an area in which collective knowledge of the interactions between the identifiable physical and biological environment and applied vitivicultural practices develops, providing distinctive characteristics for the products originating from this area" (Resolution OIV/VITI 333/2010).

The ecological conditions specific to the cultivation area have a decisive role in establishing the assortment of vine varieties cultivated in order to obtain a quality production (Băbeanu Cristina et al. 2017, Bucur Mihaela, Dejeu L:C: 2016, Cardel M.F. et al 2019).

Each of the areas favorable to the cultivation of vines have specific pedoclimatic conditions which, if they are correlated with the ecological requirements of the varieties and rootstocks, allow the production of grapes and wine of high quantitative and qualitative level (Costea D.C 2006, Cocklar H. 2017, Radu V. et al 2019, Ubalde J.M. et al 2010).

The variation of climatic conditions during the year of cultivation influences the physiological and biochemical intensity processes in the plant, the accumulation in

the grapes of substances that determine the quality of the harvest and give the specificity of the wines obtained (Costea D.C. et al 2008, 2015, Căpruciu Ramona et al 2022, De Orduna R.M. 2010)

As a result of climate changes whose effects also affect wine plantations, in order to implement specific technologies for sustainable, quality-oriented viticulture, numerous researches are trying to identify the reaction mechanisms of the grapevine in variable environmental conditions and the adaptive response of the grapevine to abiotic stress conditions (Leeuwen C. et al 2019) to identify the most suitable technological measures that can be applied (Cardell M.F. et al 2019, Tissot C. et al 2017)

## MATERIALS AND METHODS

Observations and determinations were made at the Viticultural Farm from the Experimental Didactic Station on the University of Craiova, located in the Banu Mărăcine viticultural center, the demarcated area for the production of wines with Designation of Controlled Origin (DOC) "Banu Mărăcine" in Dealurile Craiovei viticultural region

In accordance with the research topic proposed, the observations and determinations focused on: monitoring climatic factors for the evaluation of the favourableness of the study year (2022) and studying the influence of the ecoclimatic resources characteristic to the study years on the bioproductive parameters in the Merlot variety grafted on the Teleki 4 Selection Oppenheim 4 (SO4) rootstock, with a planting distance of 2 x 1.2 m, semi-tall growth, the vineyard being in the 7-th year after planting

The effect of the varied climatic resources on the studied varieties was evaluated through the analysis of the biological

indicators: shoot growth and maturation bud viability and bioproductive parameters – evolution of weight, volume, acidity, sugar and anthocyanins content of berries during ripening .

For the evaluation of the climatic conditions, the meteorological data from the data provided by WorldWeather Online.com were used. Other observations and determinations that have been made are specific to the field of study

## RESULTS AND DISCUSSIONS

### Evaluation of climate conditions during the experimental period.

Weather data during the experimentation period (2022 year) are presented in the figures 1-4, in detail in the upper part of the figures and in the bottom of the figure the variation of the climate index in the period 2010-2022

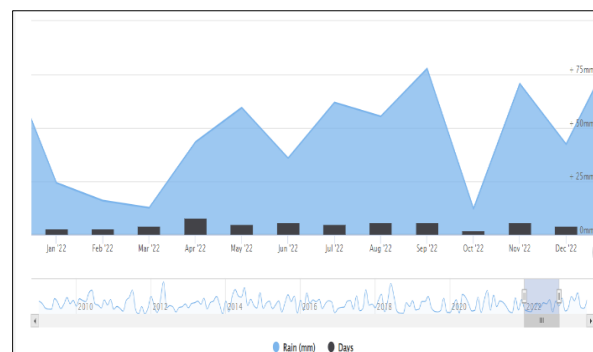
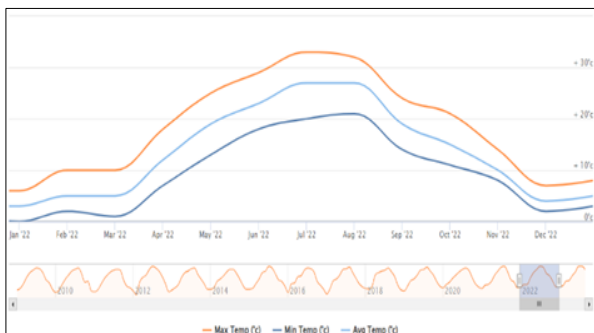


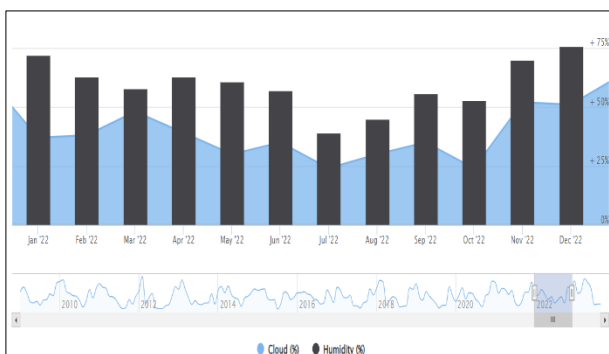
Figure 1. Monthly rainfall amount and rainy days- Banu Mărăcine during the experimentation period

Studying the amount of precipitation from the year 2022, it is found a larger amount of precipitation in the first part of the vegetation period (April-May 2022 - figure 1) and precipitation above the multiyear average in September at the end of the period of the ripening period, a fact that was reflected in the slightly lower sugar content at harvest

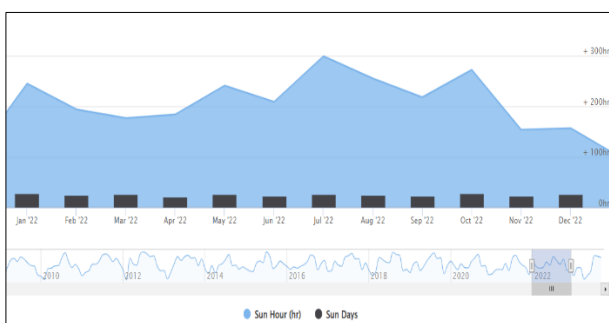


**Figure 2. Monthly average of minimum, average and maximum temperatures in Banu Mărăciine during the experimentation period**

Comparing the average temperatures from the year 2022 with the multi-year average, higher values of temperatures are found, especially in the period June - September (fig 2) when the average temperature values were higher with approximately 2 degrees Celsius.



**Figure 3. Hygrospecificity and cloudiness values in Banu Mărăciine during the experiment period**



**Figure 4 – Sun hours and Sun days in Banu Mărăciine during the experiment period**

The values of hygrospecificity (fig. 3) and sunshine hours (fig. 4) indicate the favorability of the crop year for the vine, with higher insolation values and lower

hygrospecificity being recorded in July and August, a fact that influenced the determined bioproductive indices and was found in the quantity and quality of the production obtained.

### Analysis of the biological indicators

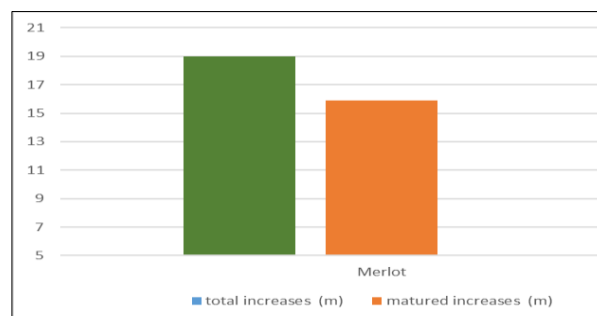
**The evolution of the main phenophases** of the variety Merlot in 2022, when the study was carried out, is presented in the table 1

**Table 1. The evolution of the main phenophases of the variety Merlot in the 2022 year**

Variety	Budburst	Flowering	Veraison	Maturation and Harvest
Merlot	20.IV-30.IV	1.VI-8.VI	20.VIII-30.VIII	1.X-10.X

From the data presented in table 1 it can be observed that the budburst started on April 20 and lasted about 10 days; the flowering started at the beginning of June (1.06.2022) and lasted 7-8 days; the veraison started in the last decade of the month August, and the grapes reached full maturity at the beginning of October.

**The maturation of canes.** The results found in the length of matured and



unmatured canes are shown in figure 5

**Figure 5. The length of the total and matured annual growths of canes**

The length of the matured growths (83.8%) shows a good preparation of the wood for the following year

### The viability of the buds

Due to the loss of buds that occur during the winter and early spring, checking the viability of the buds is an absolutely necessary work before cutting the vines. The values of viability and the bud fertility vary depending on the genetic characteristics of the variety in question, the vegetative growths, as well as on the quantity and quality of last year metabolites, being determined by the ecoclimatic and pedological resources.

The determination of the viability of the buds was carried out in March, after the danger of severe frost had passed and before cutting, and aimed to determine the percentage of viable and dead buds, as well as their position on the strings in order to determine the fruit load and the length of the fruit elements .

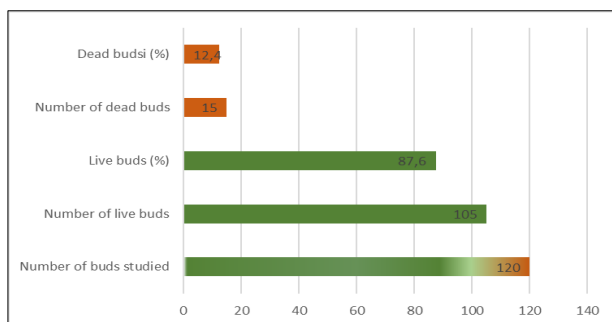


Figure 6. Bud viability

In the year 2022, for the grape variety Merlot cultivated at Banu Mărăcine viticultural center the bud viability had values of about 87.6% viable buds (figure 6). This high value was also due to the mild winter 2021/2022 and allowed the vine cuttings to be done without problems

### Analysis of the bioproductive parameters

Vine plants interact with environmental factors specific to the crop year and respond in the form of morphological, physiological and biochemical reactions that result in quantitative and qualitative changes in the chemical composition of the whole plant, but especially of the grapes obtained

The analysis of the experimental results obtained at the Merlot variety, highlights the existing correlation between the environmental conditions specific to the crop year and the analyzed variety through the differences determined regarding the growth rate of the berries and the accumulation of content in sugars and acidity and anthocyanins. Figure 7 shows the dynamic evolution of grain weight and volume during ripening (from veraison to harvesting)

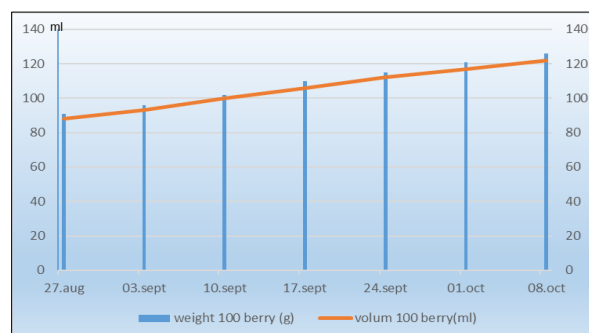


Figure 7. The dynamic evolution of the weight and volume of the berries during ripening

It is important to note that the precipitation in September had a negative influence on the ripening process, in terms of quantitative (fig 7) and qualitative parameters (fig 8, 9), the volume and weight of the berry being higher but the amount of sugars and, with a smaller amplitude, the content of anthocyanins at harvest being lower than in the previous year, with a different climate profile,

respectively less precipitation in the period before ripening.

We can see that the lower amount of precipitation during the vegetation period did not negatively influence the growth and fruiting process, but the precipitation at the end of September had an influence affecting the sugar content of the grapes, which could have been higher- fig 8

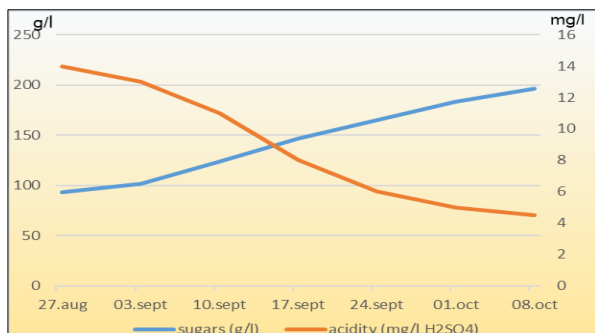


Figure 8 Evolution of sugar content and acidity of berries during maturation

However, the Merlot variety demonstrated a high accumulation potential, the sugar parameter increasing by 136 g/l in the period 12.08-8.10 to a value of 198g/l under the conditions of acidity at harvest of 4.4 g/l - figure 8.

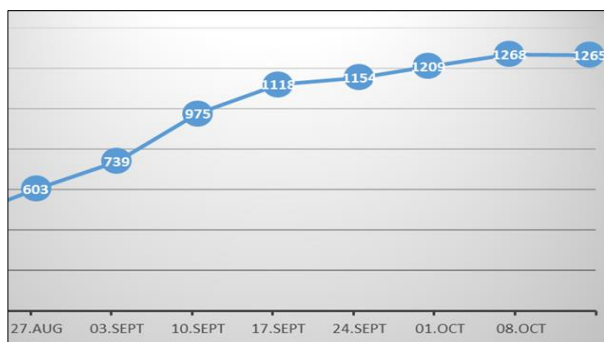


Figure 9. The dynamics of the accumulation of anthocyanin compounds in Merlot grapes

The content of anthocyanins in grape berries varies depending on the genetic characteristics of the variety, ecological factors, viticultural agrotechnics.

The richness of the heliothermic resources specific to the cultivation area determined

an accelerated rate of growth of this qualitative parameter, so that at harvest the Merlot variety achieved anthocyanin maturity with a level of 1268 mg/kg grains - fig 9

## CONCLUSIONS.

The diversity of environmental conditions during the research period was found in the variations of the bioproductive indicators studied.

The Merlot variety has interacted with environmental conditions, expressing its adaptive potential in a specific way.

The Merlot variety taken in the study demonstrated a good ripening of the wood, a good viability and fertility of the buds and a high potential for the accumulation of chemical constituents that indicate the quality even in the conditions of a year in which the amount of precipitation was not distributed according to the plant's requirements to obtain very good quality products

In this context, considering the favorable environmental conditions and the tradition of obtaining quality wine products in this area, the cultivation of the vine represents a successful economic activity.

## REFERENCES

- Băbeanu Cristina, Matei Gheorghe, Dodocioiu Ana Maria, (2017). *Evaluation of sugar content in stem juice from sweet Sg hybrids grown in South West of Romania*, Annals of the University of Craiova - Agriculture, Montanology, Cadastre Series Vol. XLVII , pp 25-29
- Bucur Georgeta Mihaela, Dejeu L.C.( 2016). *Researches on situation and trends in climate change in south part of Romania and their effects on grapevine*, Scientific Papers. Series B, Horticulture. Vol. LXI, 2017, pp 243-247

- Cardell, M. F., Amengual, A., Romero, R., (2019). *Future effects of climate change on the suitability of wine grape production across Europe*. Regional Environmental Change 19, 2299–2310
- Căpruciu R., Cichi D.D., Mărăcineanu L.C., Costea D.C. (2022). *The resveratrol content in black grapes skins at different development stages* - Scientific Papers. Series B, Horticulture. Vol. LXVI, No. 1, pp 245-252.
- Cichi Daniela Doloris, Costea D.C., Olteanu I., Popa Camelia, Giugea N., Maracineanu L.C., Cichi M. (2009). *Adjustment of the viticultural assortment to the climatic restraints from several viticultural areas of Oltenia*, Lucrări Științifice, Vol 52, Seria Horticultură, Editura "Ion Ionescu de la Brad", Iași , Scientific Papers, pp 701-707
- Cichi Daniela Doloris, Costea D.C., Gheorghiu N. (2016). *The cold hardiness of some varieties of grapevine cultivated in the viticultural area Plenita (Southwestern Romania)*. Annals of the University of Craiova - Agriculture, Montanology, Cadastre Series, vol. 46 (no.1): 62-67
- Coklar, H. (2017). *Antioxidant capacity and phenolic profile of berry, seed, and skin of Ekşikara (Vitis vinifera L.) grape: influence of harvest year and altitude*. International Journal of Food Properties 20(9).
- Costea Dorin Constantin, (2006). *Regimul hidric al viței de vie*- Ed Universitaria Craiova, 183 p
- Costea D., Daniela Doloris Cichi, Ramona Capruciu, Elena Genoiu, (2008). *The influence of the hydro-thermal regime over bioproductive parameters of Feteasca neagra variety cultivated at Banu Maracine viticultural centre*, Bulletin UASMV Horticulture, vol. 65(1):530,1
- Costea D.C, Căpruciu, Ramona, Cichi, Daniela Doloris, (2015). *The influence of the variation of climate conditions over the growth and fruit bearing of Cabernet Sauvignon variety*, Analele Universitatii din Craiova, Seria Biologie, Horticultura, Tehnologia Prelucrării Produselor Agricole, Ingineria mediului, vol XX, pp 107-112
- De Orduña, R. M. (2010). *Climate change associated effects on grape and wine quality and production*. Food Research International, vol 43, 1844–185
- Leeuwen, C.; Destrac-Irvine, A.; Dubernet, M.; Duchêne, E.; Gowdy, M.; Marguerit, E.; Pieri, P.; Parker, A.; De Rességuier, L.; Ollat, N. (2019). *An update on the impact of climate change in viticulture and potential adaptations*. Agronomy , 9, 514, pp 1-20.
- Radu V, Popa I, Dodocioiu Ana-Maria, Buzatu Gilda Diana, (2019). *The quality status of the reddish preluvosoil from ARDS Simnic*, Analele Universității din Craiova- Seria Biologie, Horticultură, Tehnologia Prelucrării Produselor Agricole, Ingineria Mediului, vol XXIV, pp 213-217
- Tissot, C., Rouan M., Barbeau G., Quenol H., Céline Le Coq, (2017). *Modeling environmental impacts on viticultural ecosystems: a first case study in a regulated wine producing area*. International Journal of Agricultural and Environmental Information Systems Volume 8 , Issue 3 ,
- Ubalde, J. M., Sort, X., Zayas, A., Poch, R.M. (2010). *Effects of soil and climatic conditions on grape ripening and wine quality of Cabernet Sauvignon*. Journal of Wine Resesearch, 21, (1), pp 1-17.
- Xenophon, V., Korkas, E., Nisiotou, A., Georgios G. (2020)., *Grapevine responses to heat stress and global warming*, Plants 2020 , 9 (12), pp17-54.

Resolution OIV/VITI 333/ (2010). Definition of vitivinicultural “terroir”. Retrieved from

<https://www.oiv.int/public/medias/379/viti-2010-1-en.pdf>  
<https://www.worldweatheronline.com>