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The Behavior of the Columna and Mamaia varieties, cultivated in ecological and conventional system at Murfatlar, in the specific climatic conditions of the wine year 2019-2020

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Abstract: *The cultivation of vines in a conventional, but also ecological system requires a favorable climate for the growth, development and maturation of grapes. The study carried out in the vineyards from the Research Station for Viticulture and Oenology Murfatlar showed that the wine year 2019 - 2020 was a year with an excessive heliothermal balance, especially during the vegetation period, but was extremely dry, with a pronounced water deficit during the phenophases of grape growth and maturation.*

Introduction

Climate is a major factor dividing the spatio-temporal distribution for most agricultural systems, due to the climate changes that occur during the year. Presently, viticulture faces new challenges and threats, among the most important being those related to climate change. Eco-pedoclimatic conditions affect the quality of grapes and wine, thus the relationship between soil and grape quality is the basis of the definition of the "terroir".

Material and method

The study included two varieties created at the Research Station for Viticulture and Oenology Murfatlar: Columna (white variety) and Mamaia (red variety), cultivated in both of the ecological and conventional systems, on which the evolution of phenological stages was noted, together with the quality and quantity of production per hectare. The varieties studied were grafted on the same rootstock, Opperheim Selection 4 clone 4, the adopted training system was semi-trunk Guyot, with 2-3 fruiting canes, with a load of 38 eyes per trunk, a planting distance of 2,2/1,2 m. The suitability of the vineyard regarding the cultivation of vines in ecological and conventional system was studied, analyzing the climatic data (temperature, precipitation, insolation) between November 2019 and October 2020. The monitoring and recording of weather data was performed by the automatic station owned by the institution. For each climatic factor, the data from the analyzed wine year is compared with the normal average values.

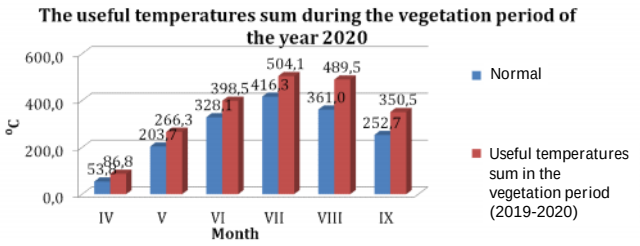
For each variety we followed all the phenological stages, from the weeping stage of the vine to full maturity, and we calculated the duration of the growing period from the moment of budding, until full maturity, and the quality of grapes at harvest: the mechanical composition of grapes, meaning the weight and the volume of one kilogram of grapes, the weight of 100 berries, the number of berries in 100 grams of grapes.

In the ecological farming system of 2018, 20 tons of decomposed sheep manure were administered per hectare, the equivalent of 170 kilograms of nitrogen (active substance), with a remanence of 4 years. In the conventional system, complex NPK fertilizers were administered (16:16:16) in the spring of 2020, in an amount of 160 kilograms per hectare, by subsoiling. Foliar fertilizers were applied on 50% of the surface, in two rounds: the first after the flowering phenophase, when 2L were used per hectare, and the second in the first part of June, during the period of berry growth and development, using the same amount per hectare.

Variety	Grape bunch Average weight	Average production		Weight of 100 berries	Physico-chemical characteristics of the must	
		Kg/ha	Kg/trunk		Sugars g/l	Total acidity g/l H_2SO_4
Columna-conventional	114g	5650	1,482	164g	193,86	4,9
Columna-ecological	109g	4985	1,316	138g	199,31	4,7
Mamaia-conventional	132g	6732	1,715	172g	213,5	3,8
Mamaia - ecological	116g	5464	1,392	152g	217,16	3,8

Results and discussions

The data regarding the thermal regime characteristic of the wine year 2019-2020 reveal that this year was rich in heliothermal resources, with an average temperature of 15,05°C, 3,55°C above the normal average temperature (11,5°C). Also, all of the twelve months of the year were warmer, compared to the normal average values for those months. The useful temperatures sum had a value of 2477,3 °C, of which 2095,7 °C were during the vegetation period. These very high values are a characteristic of a very warm wine year.



In the wine year 2019 - 2020, there was a water deficit of 147,3 mm. Analyzing the data in terms of rainfall, 2020 shows a significant decrease compared to the normal average rainfall. Thus, compared to an average of 436 mm of annual rainfall, the precipitation of 2020 accumulated 288,7 mm. The lack of precipitation was accompanied by insolation with values close to the normal during the vegetation period, (1568 hours - the normal average; 1594,7 hours - the value for 2020). This fact greatly increased the suitability of this year for the ecological system of grapevine culture for the Mamaia red grape variety, which needs high values of brightness for the synthesis of anthocyanins. The analysis of phenological data presents a synchronization of the phenological stages in the first part of the growth stage, for both of the cultivation systems. Regarding the duration of the budding-full maturity period of the grapes, it is observed that the Mamaia variety cultivated in the ecological system had a total of 138 days, two days less than the conventional system, whereas for the Columna variety the difference was insignificant. In the wine year 2019-2020, the studied varieties had a satisfactory tolerance to biotic factors, the attack of Plasmopara viticola and Uncinula necator being absent in the plantations of Columna and Mamaia.

The productions obtained in an ecological system for the Columna variety were 13% lower, compared to those of the conventional system, and for the Mamaia variety they were lower by 16%, compared to the conventional system. In the case of the weight of 100 berries, the value differences were significantly influenced by the treatment and by the climatic conditions specific to the wine year 2020. Heliothermal excess and water deficit favored the accumulation of sugar in higher concentrations in grapes: the Columna variety cultivated in the organic system had 5,45 g/L more than the conventional variant, and the Mamaia variety cultivated in the ecological system had 3,66 g/L more than the conventional variant.

Conclusions

The year 2020 was a contradictory one in terms of the favorability for the cultivation of vines in an ecological system in the Murfatlar wine-growing area. On the one hand, it was an extremely hot year, characterized by temperatures well above the average multiannual limit during the months of 2020, which is beneficial to the organic vine under certain conditions. This high temperature level was manifested especially during the summer and autumn months, from July to October, a period that coincides with the process of grapes ripening, from the veraison stage until harvest. On the other hand, it was a year with extremely low rainfall, which was not evenly distributed throughout the year. In 2020, the growth and development of trunks, productivity and production quality were influenced by abiotic stressors (drought and heat), manifested during the active vegetation of the grapevine. Climate change is expected to bring new challenges to the wine sector.