

Research on some biological and technological features of red wine varieties in conditions of “Minis Maderat” Vineyard

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Abstract Capacity analysis of vine varieties to harness the natural potential of “Miniș-Măderat” Vineyard under the variable annual environmental conditions established on longer periods of time, confer the possibility of knowing the wine types obtained, on varieties and the need of cantonment of varieties in order to improve specialization and diversification of all vine productions.

The study made upon the agrobiological features and the main technological features of red wine varieties cultivated in “Miniș-Măderat” vineyard has a purpose the observations made upon the behaviour of Cadarcă, Cabernet Sauvignon, Merlot and Oporto in the climate and soil conditions of this vineyard.

The varieties were grafted on *Berlandieri x Riparia Kober 5 BB* rootstock. The vine plantations have 19 years since establishment, and the stocks are pruned in semi-high system with bilateral canes, the vines being supported on an espalier with three wires.

Along the research period there were made numerous observations and determinations regarding; buds' viability, vegetative phenophases' development, grapes' production and must's quality.

The studied varieties from “Miniș-Măderat” vineyard can be remarked by good and quality productions, which maintain and recommend them for extension in culture.

Vine culture in Arad County area is practiced for a long time. “Miniș-Măderat” vineyard is established on a large surface of almost 60 km, between “Șoimoș” Hill and “Nadăș” Hill (4). “Miniș-Măderat” vineyard has soil and climate conditions which are favourable for vines' culture, the behaviour of different varieties being different concerning the phenology, production and quality, which are specific for each variety, and also influenced by the relief and the climatic factors of each year.

The main soil types in this vineyard are: associations of regosols 40%, lithosols 40% and eutricambosol, slightly eroded 20% (5). The climate is continental temperate, with Mediterranean influences, specific for the climate of Central Europe. Out of the climatic factors, the most important for the economical culture of grapevines are: the temperature, rainfall and light, which equally determine the growth, development and fructification (2, 3). The environmental climatic conditions of this vineyard are favourable in culture for a large number of grapevine varieties.

Red wine varieties have in their skin a large number of phenols (anthocyanin), which determine very coloured, dark red wines (Cabernet Sauvignon,

Key words

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Merlot, Alicante bouschet), but for other varieties the quantity of coloured pigments is lower (Băbească neagră, Cadarcă), and the wine obtained from them is less coloured (6).

In optimum culture conditions, most of the varieties belonging to the superior red wine group, assure high productions and grapes, at their full maturity, have high sugars content, from which, after the alcoholic fermentation, we get wines with an alcoholic strength exceeding 11% vol. In some years, by over-ripening, some varieties can give superior medium dry, medium and sweet wines (1).

Material and Methods

The observations and determinations were made during 2010 and 2011, for the following red wine varieties: Cadarcă, Cabernet Sauvignon, Merlot and Oporto.

Research was done on small plots in a private vineyard, on 25 vine stocks for each variety. The vine stocks were planted at a distance of 1.8 x 1.2 m.

All varieties were grafted on *Berlandieri* x *Riparia Kober 5 BB* rootstock. The vine plantations have 19 years since establishment, and the stocks are pruned in semi-high system with bilateral canes, the vines being supported on an espalier with three wires.

Along the research period there were made numerous observations and determinations regarding: buds' viability, vegetative phenophases' development, grapes' production and must's quality.

Results obtained

Based on the results obtained during 2010-2011, we could notice that the negative effect of frost is not uniform upon buds, being influenced by the level of minimum absolute temperature for buds' and tissues' stage status, by the morphological features of canes and buds. From table 1, we notice that the average live buds percentage is of 95.4 % for each variety and year, for the entire vineyard.

It proved to be more sensitive those varieties which had the wooden tissues less dense and larger buds (Cadarcă - 8,5 % and Oporto - 8 % frozen buds) and more resistant were those varieties with more dense wood and more compact buds.

Table 1

Buds' wintering situation of the studied varieties

Varieties	2010		2011		Media	
	Live buds %	Frozen buds %	Live buds %	Frozen buds %	Live buds %	Frozen buds %
Cadarcă	98	2	85	15	91,5	8,5
Cabernet Sauvignon	100	0	93	7	96,5	3,5
Merlot	99	1	95	5	97	3
Oporto	95	5	89	11	92	8
Average value	98,0	2,0	90,5	9,5	94,25	5,75

The observations made related the following: buds' opening takes place in April, from 12th to 28th (16 days). This phase happens earlier for Oporto variety (12 IV) and later for Cadarcă, Cabernet Sauvignon and Merlot varieties. Because of the similar temperature conditions, this phenophase started in the same period for all varieties in during both years of study. The dates show that the length of this phenophase is different from one year to another (11-20 days) and for each variety.

Flowering took place from 8th – 22nd May, earlier (2 VI- 20 VI) and for a longer period (18 days) in 2011, and later in 2010 (15 VI-23 VI), but with a normal period (8-9 days). Oporto variety bloomed earlier than the other varieties (2-12 VI) and later bloomed Cadarcă (4-18 VI), Cabernet Sauvignon and Merlot (6-17 VI) varieties.

Considering the period of development, shoots growing phenophase is influenced by the different periods of starting the ripening period of each variety. This happens earlier for Oporto variety (25 IV - 6 IX) and later for Cabernet Sauvignon variety (1 V-19 IX).

Shoots' growing period has a length of 108 days for Cabernet Sauvignon and Merlot varieties and 95 days for Oporto variety. In average, this period needs 102 days, but it can be different depending on the climate and other factors. During this period, the

shoots get to approximately 130 cm, varying from 120 cm for Cadarcă variety and 141 cm for Merlot variety.

Woods' maturity (table 1.2) was determined directly. This process usually takes place during the period 19 VIII - 9 X, but it starts earlier (14-15 VIII) for Oporto and Merlot varieties and later Cabernet Sauvignon variety (25 VIII), at the same time being independent of grapes maturation. This phenophase ends when the leaves turn into yellow, which marks the end of vegetative accumulation physiological processes, at some times being stopped accidentally by early autumn frosts. Concerning woods' maturation, this has to happen on more than 80% of shoots' length. Weaker maturation was observed for Merlot and Cadarcă varieties.

We can deduct the fact that all the conditions offered by the climatic potential of the vineyard and the varieties cultivated here assure the fruiting formations needed in vegetation, but with consequences more or less favourable upon the quantity and quality of grapes production.

Observations made in this phenophase showed that woods' maturity evolves rapidly covering large areas from shoots at the beginning of the phenophase and loses intensity by the time the process ends.

Phenological, grapes' maturity was observed in two distinct phases: *beginning of ripening*, which

includes grapes' soaking and *full maturity*, which marks the specific coloration of grapes and quality and production biochemical compounds accumulation.

Full maturity of grapes is presented in table 2, from where we can see that this phenophase develops in the interval 12 IX - 25 IX, lasting 13 days.

Analysing the data, we can conclude that the climatic conditions from "Miniş-Măderat" vineyard assured, in both studied years, assured full maturity of grapes in similar periods, with an advance of 4-5 days in 2010 compared to 2011.

Table 2

Buds' opening, flowering, shoots' growth, wood and grapes maturation phenophases development

Variety	Limits	Buds' opening-average	Flowering-average	Shoots' growth-average	Wood maturation-average	Grapes maturation-average
Oporto	Beginning	12.IV	7. VI	25.IV	24 VIII	06 IX
	End	25.IV	19. VI	06.IX	28 IX	18 IX
Merlot	Beginning	13.IV	11. VI	27.IV	26 VIII	14 IX
	End	26.IV	22. VI	14.IX	10 X	29 IX
Cadarcă	Beginning	17.IV	11. VI	01.V	21 VIII	14 IX
	End	30.IV	18. VI	14.IX	5 IX	28 IX
Cabernet Sauvignon	Beginning	14.IV	11. VI	01.V	31 VIII	19 IX
	End	01.V	22. VI	19.IX	16 X	03 X
Average	Beginning	15.IV	8. VI	28.IV	29 VIII	12 IX
	End	28.IV	22. VI	12.IX	13 X	25 IX

Absolute fertility coefficient (C f a) average value for each variety in the studied period was of 1.42, varying from 1.16 for Cadarcă variety and 1.61 Merlot variety (table 1.3 and figure 1.1). Higher values were registered in 2010, when there was also a higher production obtained.

Relative fertility coefficient (C f r) average value is 0.98 and varies from 0.84 for Cadarcă variety

and 1.10 for Merlot variety. We remarked that there were higher values for the relative fertility coefficients in 2010 compared to 2011 (table 3. and figure 1).

Analysing the date from table 3, we see that fertile buds represent in average 68.09%, from 63.9% in case of Cabernet Sauvignon variety and 71.62% for Oporto variety, being also correlated to fertility coefficients.

Table 3

The number of shoots and fertility elements, average values of the studied years

Variety	Total no.of shoots	No.of fertile shoots	No.of sterile shoots	Fertility %	C.f.a	C.f.r.
Oporto	28,90	20,70	8,20	71,62	1,53	1,09
Merlot	42,80	29,40	13,40	68,69	1,61	1,10
Cadarcă	23,70	16,70	7,00	70,5	1,16	0,84
Cabernet Sauvignon	44,10	28,20	15,90	63,9	1,39	0,89
Average	34,88	23,75	11,13	68,09	1,42	0,98

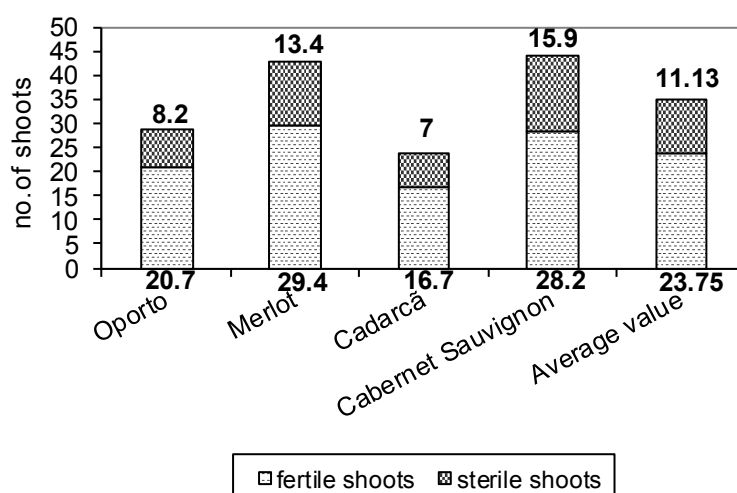


Fig. 1 Average number of shoots

Table 4

Productivity elements of the studied varieties

Variety	Absolute productivity index	Relative productivity index	Average weight of a grape, g
Oporto	175.95	125.35	115
Merlot	154.56	105.60	96
Cadarcă	147.32	106.68	127
Cabernet Sauvignon	87.57	56.07	63
Average	141.35	98.42	100.25

In table 4, we notice that absolute productivity index has the average value of 141.35 g, while the relative productivity index is 98.42 g.

On the basis of determining the productivity index could deduce that in addition to being generally influenced by complex factors are directly related to the degree of binding of flowers and of climatic

factors, the amount of rainfall in the range of early growth till their ripening and end on a high cumulative fund assets temperatures and hours of insolation.

Results concerning the calculated production during the period 2010-2011 (table 1.5.), show that the average value obtained was 3.75 kg/stock.

Table 5

Grapes' production during 2010-2011, for the studied varieties

Variety	Production kg/stock			Average production t/ha	Difference	Significance
	2010	2011	Average			
Oporto	3.01	2.65	2.85	13.10	+1.63	+++
Merlot	2.54	2.65	2.50	11.57	+0.10	-
Cadarcă	2.82	2.50	2.66	12.31	+0.84	+
Cabernet Sauvignon	2.08	1.90	1.99	9.21	-2.26	000
Average	2.56	2.42	2.49	11.47	-	-

DL= 0.34 kg/ha

DL= 0.87 kg/ha

DL= 1.12 kg/ha

We remark Merlot variety (4.5 kg/stock), which shows that varieties behave different in the same conditions of the vineyard, some of them being disadvantaged by the imbalanced action of a climatic factor (Cadarcă and Oporto), while others can have

normal behaviour regarding the production and its quality (Merlot).

A maximum of production was obtained from Oporto cu 3.01 kg/stock in 2010, and the minimum production was obtained from Cabernet Sauvignon in 2011 with 1.90 kg/stock.

Calculating for all varieties, there is an average production of 11.47 t/ha (figure 2), to which Cabernet Sauvignon variety has a significant negative difference.

One can see that best results gave Merlot and Oporto, followed by Cadarcă variety, while Cabernet Sauvignon gave a low production but of the best quality.

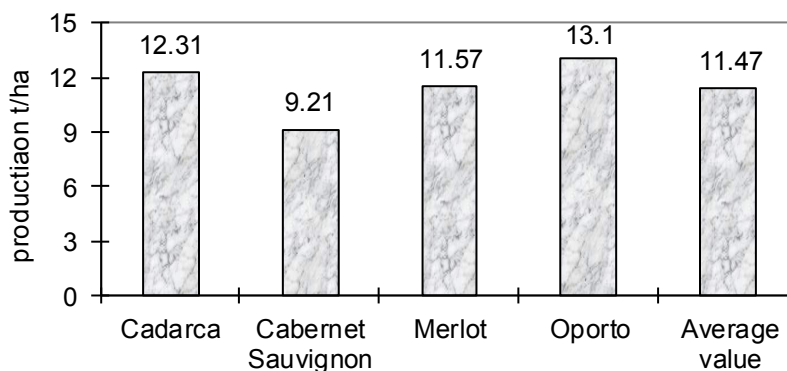


Fig. 2. Average grapes' production, t/ha (average value 2010-2011)

Considering all varieties, sugars reach 191g/l and an average acidity of de 6,06 g/l H₂SO₄ (table 6), which gives to Minis wines, together with other elements, corpulence and outstanding organoleptic features, being very appreciated by internal and external consumers.

During the two years of study, Merlot variety has a higher content of sugars, having a significant positive difference compared to the average value of all varieties, while Oporto has a significant negative difference compared to the same average.

Table 6

Must's quality when harvesting

variety	Sugars' content, g/l				Total acidity, average, g/l H ₂ SO ₄
	2010	2011	Average	Difference	
Oporto	183	196	189	-14.88	4.60
Merlot	201	232	216	+12.12	5.48
Cadarcă	182	201	191.5	-12.38	6.70
Cabernet Sauvignon	210	228	219	+15.12	5.73
Average	194	214	203.88	-	5.62

If the lateness of some of the varieties that make up the range of red wines from Minis influences the quantitative accumulation, the eco-climatic resources available ensure quality and perfection even over-ripening for some varieties.

We can see that Cadarcă and Oporto realized potential alcoholic wine quality, while Cabernet Sauvignon and Merlot falls within the designation of origin quality wines. This technological differentiation is determined by the fact that varieties Cadarcă and Oporto, with large grapes and thin skin make them susceptible to rotten in autumn, requiring their harvesting earlier, before being able to harness the potential of total quality. Cabernet Sauvignon and Merlot varieties with resistant skin grapes can be driven to over-ripening, ensuring quality wines.

Must's quality, in these varieties is given by the large amount of anthocyanin accumulation, which determines the colour intensity of red wines from Miniş.

Conclusions

Among the most important phenomena are reported completion of flowering under normal conditions in an average of 14 days on the variety and year.

Observing the main phenophases, it was noticed that the beginning, development and ending of some qualitative physiological processes need some

limits and cumulative effects between the climatic factors.

By the relationships established between varieties and environmental conditions, we noticed that the varieties from “Miniș-Măderat” vineyard behave different to the number of fertile shoots and flower groups, fertility coefficients and productivity index; and by considering all these; best results were obtained from Merlot and Cadarcă varieties.

Production and quality of red wine varieties from “Miniș-Măderat” vineyard vary due to the impact of annual climatic conditions and agro-technical factors.

The most productive varieties are: Merlot, Oporto and Cadarcă. Cabernet Sauvignon gave the lowest production, but considering it qualitatively it was the best quality production obtained, together with Merlot variety.

Analysing the experimental years, it was observed that sugars accumulation vary between large limits, so that the wines obtained belong to different quality types from superior quality to designation of origin quality wines.

The results of the analysis of the behaviour of varieties in terms of production particularise the current assortment of “Miniș-Măderat” vineyard for red wine production is made judiciously. Currently it only requires the proportion of crop varieties in order to provide an optimally report quantity / quality.

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