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AMPELOGRAPHIC AND BIOPRODUCTIVE CHARACTERISTICS OF CABERNET SAUVIGNON CLONES IN OLTENIA WINEGROWING REGION, SOUTH-WEST ROMANIA

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Abstract

Polyclonal vineyards are a useful technological alternative in the context of climate changes foreshadowed in the medium and long term, through the premises of ensuring a sustainable viticulture, but also the possibility of obtaining complex wines. In the last decade in Romania, various international clones of wine grape varieties have been introduced in vineyards, whose performance in terms of adaptation or their bioproductive and qualitative potential in Romanian vineyards is little known. In this context, the aim of this study was to evaluate and determine certain phenotypic characteristics, as well as the bioproductive and qualitative performance of five Cabernet Sauvignon clones: two of French origin (15 and 338 ENTAV) and three clones of Italian origin (ISV 105, ISV 117 and R5), in the pedoclimatic conditions of South-West Romania. Good fertility results are shown by clones R5 and 15 ENTAV, with ISV 117 and R5 clones being the most productives. All clones ensure the quality parameters required for Cabernet Sauvignon DOC wines produced in Oltenia winegrowing region.

***Key words**: Cabernet Sauvignon, clones, grape quality, phenotypic characteristics.*

INTRODUCTION

Satisfying consumer demands for the most diverse, typical wines with a high degree of naturalness is a permanent concern equally for producers and the scientific environment (Chivu-Draghia & Antoce, 2016; Monteiro et al., 2020; Schäufele & Hamm, 2017).

The evaluation and use of viticultural genetic diversity are intensively explored alternatives worldwide in the context of the challenges generated by climate change (Bigard et al., 2018; Carvalho et al., 2020; Romero et al., 2023; Tortosa et al., 2020) and meeting the diversified demands of consumers of grapes and wine (Töpfer & Trapp, 2022).

Recent studies that targeted the wine-growing areas in the S-W Romania region, indicated that the changes and trends detected (1961-2021 period) for a series of climatic indices can generate pressure regarding the obtaining of quality wines from certain varieties, against the background of the increased temperature and reduced amounts of precipitation during the growing season (Bucur & Babeș, 2016; Irimia et al., 2018; Vlăduț et al., 2023). Polyclonal grapevine plantations are a useful technological alternative in the context of climate changes foreshadowed in the medium and long term, through the premises of ensuring a sustainable viticulture ((Marković et al., 2017), but also the possibility of obtaining some complex wines (Cichi et al., 2022).

Obtaining quality wines, competitive on the domestic and foreign markets, is an important goal for Romanian wine producers (Mircea, 2020; Muntean et al., 2018).The strategies in the Romanian vine and wine sector during the last two decades has generated important qualitative leaps regarding the areas cultivated with *V. vinifera* L. varieties for wine (Cichi et al., 2021; Mălăescu et al., 2022). Of the approx. 95 thousand ha cultivated with *V. vinifera* L. varieties for wine in Romania, 61% represent the varieties for white wines and 29% the varieties for red wines. The top three varieties for red and rosé wines as vineyard area in Romania are represented by: 'Merlot'

(11.74%), ‘Cabernet Sauvignon’ (4.76%) and ‘Fetească neagră’ (3.36%).
Improving the vine-growing techniques and the qualitative grape composition of the ‘Cabernet Sauvignon’ cultivar for obtained of high quality wines is an important concern (Băducă Câmpeanu et al., 2020; Drenjančević et al., 2017; Nistor et al., 2022; Wang et al., 2019).
In the last decade in Romania, various international clones of wine grape varieties have been introduced in vineyards, whose performance in terms of adaptation or their bioproductive and qualitative potential in Romanian vineyards is little known. In this context, the aim of this study was to evaluate and determine certain phenotypic characterristics, as well as the bioproductive and qualitative performance of five ‘Cabernet Sauvignon’ clones cultivated in South-West Romania.

MATERIALS AND METHODS

Location and climatic characteristics. The study was conducted for two consecutive years (2022-2023) in wine grape vineyard, located in Didactic Research Station of the University of Craiova (Dealurile Craiovei vineyard, Hills of Muntenia and Oltenia winegrowing region), in the south-west part of Romania. The studied vineyard area is located between the parallels of 44°29' north latitude and 23°87' east longitude (190 m elevation). The main climatic characteristics during the study period are shown in Table 1. The climatic data were obtained from the following source Klein Tank et al, 2002 (data available at http://www.ecad.eu for the Craiova meteorological station-44°13' latitude and 23°52' longitude, 192 m altitude, Dolj County).

Plant material. Five ‘Cabernet Sauvignon’clones: two of French origin (clones 15 and 338) and three clones of Italian origin (ISV 105, ISV 117 and R5) grafted on SO4 rootstock were used. The study was conducted on 6-7-year-old vines. The vines were cultivated under the same growing conditions, on reddish-brown soil, with 2.2 x 1.2 m spaces, semi-tall shape of the stem (with a trunk of 0.8 m), Cordon spur pruned, 30 buds/vine, without irrigation. The viticultural management (fertilizer application, pest, diseases and weed control, etc.) was applied for all clones in the same way. The randomized experimental design was used. Ten vines per clones were selected for the study, in three replications.

Table 1. Main climatic indexes of the experimental site

Climatic Index	2022 Year	Class	2023 Year	Class
SAT (Sum of average daily temperature > 10°C, April 1st to September 30th)	3633	Normal for region	3585	Normal for region
Winkler Index (April 1st to October 31th)	2032	Temperate	2000	Temperate
Huglin`s heliothermal index (IH)	2583	IH5-Warm	2484	IH5-Warm
Annual Rainfall (mm)	473.5	Normal for region	575.2	Normal for region
Rainfall in the growing season (mm, April 1st to September 30th)	365.4	Normal for region	318.2	Normal for region
De Martonne Aridity Index (I_{DM}, year)	20.16	Semi-arid	24.52	Moderately-arid
De Martonne Aridity Index growing season (I_{DM}, April 1st to September 30th)	15.55	Semi-arid	10.69	Semi-arid
Nights cold Index CI (°C)	12.21	Cool nights	15.11	Temperate nights

Agrobiological, quantitative and qualitative characteristics. The phenotypic traits were defined and recorded in accordance with OIV standardized descriptors and methods (OIV, 2009) and the standard protocol for phenotyping established by Rustioni et al. (2014). Percentage of fertile shoots, absolute and relative fertility index (Afi and Rfi) were established and calculated according to Cichi et al., 2022.

Sampling measurement and analyses. Five bunches for each clone, 10 berries from the middle part of bunches, in 3 replicates, were used for measurements and analyses of bunch and berry traits, at full maturity/ harvest. For each clone studied, sugar content (°Brix values) was measured using Kruss Optronic Hand Refractometer Hrot 32. Total acidity of must (g/L H_2SO_4) was determined by the titration method, NaOH 0,1N until pH 7.0. Sugar content and total acidity of must measurements were done in three replicates. ***Statistical analysis***. Each variable was examined by analysis of variance (One-way ANOVA). The morphometric, biochemical and productive characteristics are presented as means and standard deviation of each variable. All variables that were significant in the F test were analysed by HSD Tukey`s test to means separation and to establish if there were significant differences among the clones.

RESULTS AND DISCUSSIONS

Climatic resources, along with other terroir factors, have a primary role in the growth and development of grapevine varieties (Gutiérrez-Gamboa et al., 2021), influencing their fruit set and biochemical compounds metabolism in grapes, with implications in the production and quality of grapes, the raw material for wine-making, and implicitly in the quality of wines. In terms of climatic resources, the studied years were favorable for the vine growing but, there is observe a semi-arid aspect during the 2022 year and growing seasons (2022 and 2023), based on De Martonne Aridity Index (Table 1).

Agrobiological characteristics. In what concerns the vegetative growth, among the French clones, the clone 338 ENTAV stands out with the highest number of shoots/vines, the differences being significant compared to clone 15 ENTAV ($p<0.01$); between the Italian clones there are no significant differences (Table 2). The R5 clone stands out for its good fertility, the differences were significant compared to the 338 ENTAV clone both in terms of the percentage of fertile shoots and the relative fertility index (number of grapes in relation to the total number of shoots/vine, R.f.i.). However, the French clone 15 ENTAV stands out by a higher number of grapes on fertile shoots (A.f.i.).

Table 2. The agrobiological characteristics (2022-2023)

'Cabernet Sauvignon' clones	Total number of shoots/vine	CV %	Percentage of fertile shoots (%)	CV %	R.f.i.	CV %	A.f.i.	CV %
15 ENTAV	25.89 ± 4.48^{c}	17.30	68.92 ± 8.57^{ab}	12.43	0.84 ± 0.14^{ab}	16.66	1.21 ± 0.06^{a}	4.96
338 ENTAV	40.27 ± 1.92^{a}	4.77	58.05 ± 6.93^{b}	11.94	0.61 ± 0.11^{b}	18.03	1.10 ± 0.04^{b}	3.63
ISV 105	35.39 ± 5.17^{ab}	14.61	67.77 ± 5.62^{ab}	8.29	0.77 ± 0.06^{ab}	7.79	1.14 ± 0.02^{ab}	1.75
ISV 117	34.35 ± 2.19^{abc}	6.38	68.56 ± 9.08^{ab}	13.24	0.79 ± 0.10^{ab}	12.65	1.16 ± 0.05^{ab}	4.31
R5	29.44 ± 2.37^{bc}	8.05	80.31 ± 4.13^{a}	5.14	0.93 ± 0.03^{a}	3.22	1.18 ± 0.03^{ab}	2.54

Note: Means± sample std. dev.; Means separation by HSD Tukey`s test at $p \leq 0.05$; CV%- Coefficient of variation; Means with the same superscript are not statistically significant. In the column: the small letters indicate the significance of the differences between the clones for the same variable and vintage; capital letters represent the significance of the differences between the vintages for the same clone.

Morphometric traits. The highest average length of the bunch was recorded in clone 15 ENTAV (162.28 mm) in 2023, the differences being significant compared to clones 338 ENTAV and clone R5. In 2022, all clones had clusters shorter in length compared to 2023, statistically significant differences between the two years being noted only in clones 15 ENTAV and ISV 117 (Table 3).

In terms of bunch width, no statistically significant differences were recorded between the five clones in any year. With the exception of clones ISV 105 and R 5, all clones have clusters uniform in length and width. In 2022, clone ISV 117 recorded the highest weight of a bunch, the differences being significant compared to clone 15 ENTAV, which recorded the lowest weight (106.82 g). In 2023, no statistically significant differences were recorded between clones regarding the clusters weight. Significantly positive differences in cluster weight were recorded in 2023 compared to 2022 only for clone 338 ENTAV (Table 3). The clones 338 ENTAV and ISV 117 also stand out in terms of clusters weight homogeneity (CV% < 10%).

Clusters and berries size is influenced by the genetic (Tello et al., 2015) and the metabolic particularities of grapevine cultivars (Pisciotta et al., 2018), but also can be influenced by others factors, such as thermal resources, water status and cultural practices (Costea et al., 2015; Holt et al., 2008; Stroe et al., 2020). Clone 15 ENTAV had the smallest berry length, however the differences are statistically significant only compared to clone R5 in year 2022 (Table 4). There were no significant differences between the two years for berry length in either clone. It can also be noted in all clones that both the length and the width of the berry are homogeneous in both years studied (CV% < 10%).

Table 3. Morphometric characteristics of bunch at full maturity

'Cabernet Sauvignon' clones	Vintage	Bunch length (mm)	CV %	Bunch Width (mm)	CV %	Bunch Weight (g)	CV %
15 ENTAV	2022	$112.10±11.78^{aB}$	10.5	$69.83±10.83^{aA}$	15.50	$106.82±13.04^{bA}$	12.20
	2023	$162.28±15.05^{aA}$	9.27	$81.20±9.52^{aA}$	11.72	$118.09±26.31^{aA}$	22.27
338 ENTAV	2022	$107.33±9.33^{aA}$	8.69	$77.33±10.44^{aA}$	13.50	$117.10±5.37^{abB}$	4.58
	2023	$127.00±19.87^{bA}$	9.27	$73.40±9.42^{aA}$	12.83	$139.94±6.15^{aA}$	4.39
ISV 105	2022	$115.00±23.84^{aA}$	20.73	$84.17±16.54^{aA}$	19.65	$121.43±13.10^{abA}$	10.79
	2023	$139.20±26.22^{abA}$	18.83	$78.20±5.54^{aA}$	7.08	$124.34±18.97^{aA}$	15.26
ISV 117	2022	$115.83±9.47^{aB}$	8.17	$76.00±10.13^{aA}$	13.33	$142.53±5.25^{aA}$	3.68
	2023	$134.00±4.16^{abA}$	3.10	$80.80±8.52^{aA}$	10.54	$134.58±9.76^{aA}$	7.25
R5	2022	$108.17±16.25^{aA}$	15.02	$86.00±19.27^{aA}$	22.40	$134.03±14.19^{abA}$	10.59
	2023	$123.20±21.80^{bA}$	17.69	$83.60±9.96^{aA}$	11.91	$148.18±14.96^{aA}$	10.10

Note: Means± sample std. dev.; Means separation by HSD Tukey`s test at p≤ 0.05; CV%- Coefficient of variation; Means with the same superscript are not statistically significant. In the column: the small letters indicate the significance of the differences between the clones for the same variable and vintage; capital letters represent the significance of the differences between the vintages for the same clone.

The berry width ranged from 10.47 mm (15 ENTAV, 2023 vintage) to 11.77 mm (338 ENTAV, 2023 vintage).

The berry length/width ratio represents a useful indicator in appreciating the shape of the berry. It shows values between 0.99 (338 ENTAV) and 1.05 (clones 15 ENTAV and ISV 105). Significant differences between clones, regarding the berry length/width ratio, were recorded in 2023 alone (Table 4), respectively clone 338 ENTAV compared to ISV 105 ($p < 0.05$) and ISV 117 ($p < 0.05$). Based on the length/width berry ratio it can be appreciated, however, that all clones have spherical berries in shape.

The berry weight was between 0.90 g (clone 15 ENTAV, 2023 vintage) and 1.19 g (R5 clone, 2022 vintage). Significantly negative differences regarding the berry weight were highlighted in clone 15 ENTAV in vintage 2023 (compared to the other clones, $p < 0.01$). Except for clone ISV 105, there were no significant differences in average berry weight between the two study years (Table 4).

Gil et al. (2015) reported that berry size influences the color of the Cabernet Sauvignon wines obtained from grapes from the same vineyard. Specifically, the smaller the berry size, the more intense the colour and the higher the concentration of anthocyanins and proanthocyanidins. Selecting grapes by size could be an interesting tool for the wine industry, especially to improve wine colour (Gil et al., 2015).

The number of seeds per berry was between 1.57 in clone 338 ENTAV (2023 vintage) and 2.43 in clone R5 (2023 vintage). Between the two study years no significant differences were noted for any of the clones regarding the number of seeds in the berry (Table 4). The highest number of seeds in the berry was recorded in clones R5 and ISV 117, the differences being significant compared to clone ISV 105 in 2022 vintage and to clone 338 ENTAV in 2023. If in clones 15 ENTAV, 338 ENTAV and ISV 105 the frequency of berries with 1-2 seeds is over 80%, in clones ISV 117 and R5 over 90% of berries had 2-3 seeds (Figure 1).

Seed number can influence berry size and calcium, potassium and magnesium contents, with effects on mineral must and wine composition (Boselli et al., 1995).

ISV clones 105 and R5 had the longest seeds, the differences being significant compared to ENTAV clones 15 and 338.

Clones 15 ENTAV and R5 have the lowest 100-seed weight, but relative to berry weight, seed weight expressed as a percentage is significantly higher in clones ISV 105, R5 and ISV 117 (Table 5).

Quantitative and qualitative characteristics. Of the two years, the year 2023 stands out for the highest productions (kg/vine) in all clones, the differences being significant compared to the year 2022.

Table 4. Morphometric characteristics of berries at full maturity

‘Cabernet Sauvignon’ clones	Vintage	Berry length (mm)	CV %	Berry Width (mm)	CV %	Lenght/ Widht berry	CV %	Number of seeds/berry	CV %	Berry Weight (g)	CV %
15 ENTAV	2022	10.87 ± 0.63^{bA}	5.80	10.82 ± 0.22^{aA}	2.03	1.05 ± 0.02^{aB}	1.90	1.88 ± 0.19^{abA}	10.11	0.99 ± 0.06^{aA}	6.06
	2023	10.77 ± 0.53^{aA}	4.92	10.47 ± 0.45^{bcA}	4.30	1.01 ± 0.02^{abA}	1.98	1.97 ± 0.25^{abA}	12.69	0.90 ± 0.20^{bA}	22.22
338 ENTAV	2022	11.25 ± 0.46^{abA}	4.09	11.12 ± 0.62^{aA}	5.58	1.00 ± 0.06^{aA}	6.00	1.85 ± 0.14^{abA}	7.56	1.16 ± 0.15^{aA}	12.93
	2023	11.87 ± 0.35^{aA}	2.95	11.77 ± 0.32^{aA}	2.72	0.99 ± 0.02^{bA}	2.02	1.57 ± 0.15^{bA}	9.55	1.06 ± 0.21^{aA}	19.81
ISV 105	2022	11.32 ± 0.40^{abA}	3.53	10.54 ± 0.08^{aB}	0.76	1.05 ± 0.01^{aA}	0.95	1.77 ± 0.15^{bA}	8.47	0.96 ± 0.02^{aB}	2.08
	2023	11.66 ± 0.57^{aA}	4.89	11.29 ± 0.29^{aA}	2.57	1.04 ± 0.02^{aA}	1.92	2.07 ± 0.32^{abA}	15.46	1.09 ± 0.18^{aA}	16.51
ISV 117	2022	11.60 ± 0.13^{abA}	1.12	11.19 ± 0.11^{aA}	0.98	1.03 ± 0.01^{aA}	0.97	2.30 ± 0.26^{aA}	11.30	1.12 ± 0.12^{aA}	10.71
	2023	11.08 ± 0.51^{aA}	4.60	10.94 ± 0.27^{bA}	2.47	1.03 ± 0.03^{aA}	2.91	2.33 ± 0.29^{aA}	12.44	1.14 ± 0.16^{aA}	14.03
R5	2022	11.75 ± 0.54^{aA}	4.60	11.13 ± 0.34^{aA}	3.05	1.03 ± 0.03^{aA}	2.91	2.30 ± 0.20^{aA}	8.69	1.19 ± 0.09^{aA}	7.56
	2023	11.62 ± 0.32^{aA}	2.75	11.75 ± 0.49^{aA}	4.17	1.01 ± 0.01^{abB}	0.99	2.43 ± 0.32^{aA}	13.17	1.12 ± 0.23^{aA}	20.54

Note: Means ± sample std. dev.; Means separation by HSD Tukey`s test at $p \leq 0.05$; CV % - Coefficient of variation; Means with the same superscript are not statistically significant. In the column: the small letters indicate the significance of the differences between the clones for the same variable and vintage; capital letters represent the significance of the differences between the vintages for the same clone.

Figure 1. Frequency of the number of seeds per berry in 'Cabernet Sauvignon' clones

Table 5. Morphometric characteristics of seeds at harvest (2023 vintage)

'Cabernet Sauvignon' clones	Seed Length (mm)	CV %	100 seeds Weight (g)	CV %	% Seeds in berry	CV %
15 ENTAV	5.68 ± 0.05^{b}	0.88	2.38 ± 0.22^{c}	9.24	4.78 ± 0.54^{ab}	11.30
338 ENTAV	5.67 ± 0.01^{bc}	0.18	2.42 ± 0.26^{b}	10.74	3.50 ± 0.49^{b}	14.00
ISV 105	5.97 ± 0.08^{a}	1.34	2.68 ± 0.22^{a}	8.21	5.52 ± 1.09^{a}	19.74
ISV 117	5.84 ± 0.03^{ab}	0.51	2.62 ± 0.21^{a}	8.02	5.28 ± 0.44^{a}	8.33
R5	5.93 ± 0.11^{a}	1.85	2.33 ± 0.22^{c}	9.44	5.34 ± 0.59^{a}	11.05

Note: Means± sample std. dev.; Means separation by HSD Tukey`s test at $p \leq 0.05$; CV% - Coefficient of variation;
In the column: means with the same superscript are not statistically significant.

The highest production (4.26 kg/vine) was recorded in the R5 clone. The lower productions in 2022 can also be explained by the effect of the prolonged drought in the growing season 2021 and late harvest (end of October 2021).

In 2022, among the Italian clones, the clone R5 stands out with the highest sugar accumulation potential (24.3°Brix), while the ISV 117 clone had the lowest sugar content among all clones studied (21.5°Brix). Under the conditions of the 2023 vintage, the Italian clone ISV 105 stood out with the highest accumulation potential in sugars (25.8°Brix), the differences being significant compared to the other clones. Significant differences between clones in 2023 are also noted in relation to the content of total acidity in the must, the French clone 15 ENTAV had the highest content in total acidity (5.94 g/L H_2SO_4), the differences being significant compared to the Italian clones ISV 105 and ISV 117 (Table 6).

The climatic conditions specific to the ripening period of the two viticultural years significantly influenced the content of sugars in must only in clones 15 ENTAV and ISV 105 (Table 6).

Table 6. Main quantitative and qualitative characteristics of Cabernet Sauvignon clones at harvest

'Cabernet Sauvignon' clones	Vintage	Yield (kg/vine)	CV %	Sugar content (° Brix)	CV %	Potential alcohol (% vol.)	CV %	Total acidity of must (g/L H_2SO_4)	CV %
15 ENTAV	2022	$1.89{\pm}0.27^{abB}$	14.28	$23.73{\pm}0.80^{abA}$	3.37	$14.04{\pm}0.28^{abA}$	1.99	$5.57{\pm}0.26^{aA}$	4.67
	2023	$3.18{\pm}0.25^{aA}$	7.86	$21.63{\pm}0.59^{bB}$	2.73	$12.77{\pm}0.40^{bB}$	3.13	$5.94{\pm}0.11^{aA}$	1.85
338 ENTAV	2022	$1.57{\pm}0.19^{bB}$	12.10	$23.50{\pm}0.80^{abA}$	3.40	$13.87{\pm}0.46^{abA}$	3.32	$5.42{\pm}0.28^{aA}$	5.17
	2023	$4.07{\pm}0.52^{aA}$	12.77	$23.27{\pm}0.50^{bA}$	2.15	$13.77{\pm}0.38^{abA}$	2.76	$5.38{\pm}0.35^{abA}$	6.5
ISV 105	2022	$1.75{\pm}0.09^{abB}$	5.14	$24.09{\pm}0.28^{aB}$	1.16	$14.26{\pm}0.26^{aB}$	1.82	$5.21{\pm}0.25^{aA}$	4.80
	2023	$3.52{\pm}0.62^{aA}$	17.61	$25.80{\pm}0.69^{aA}$	2.67	$15.33{\pm}0.46^{aA}$	3.00	$5.07{\pm}0.18^{bA}$	3.55
ISV 117	2022	$2.44{\pm}0.32^{aB}$	13.11	$21.50{\pm}0.31^{cA}$	1.44	$12.53{\pm}0.45^{cA}$	3.59	$4.68{\pm}0.44^{aA}$	9.4
	2023	$3.51{\pm}0.14^{aA}$	3.98	$21.87{\pm}0.76^{bA}$	3.47	$13.37{\pm}1.03^{bA}$	7.70	$4.37{\pm}0.31^{cA}$	7.09
R5	2022	$2.05{\pm}0.18^{abB}$	8.78	$24.30{\pm}0.23^{aA}$	0.95	$14.24{\pm}0.24^{aA}$	1.68	$4.81{\pm}0.52^{aA}$	10.81
	2023	$4.26{\pm}0.59^{aA}$	13.85	$23.40{\pm}1.22^{bA}$	5.21	$13.87{\pm}0.75^{abA}$	5.41	$5.48{\pm}0.07^{abA}$	12.77

Note: Means± sample std. dev.; Means separation by HSD Tukey`s test at $p \leq 0.05$; CV% - Coefficient of variation; Means with the same superscript are not statistically significant. In the column: the small letters indicate the significance of the differences between the clones for the same variable and vintage; capital letters represent the significance of the differences between the vintages for the same clone.

Although there are differences from one year to another in terms of the must acidity content of the five clones, they are not statistically significant.

CONCLUSIONS

Results showed that the clone had a significant influence on most of the analyzed ampelographic traits. The year significantly influenced bunch weight (in 338 ENTAV clone), bunch length (in clones 15 ENTAV and ISV 117), berry weight and width (in ISV 105 clone), yield (in all clones), sugar content and potential alcohol (in clones 15 ENTAV and ISV 105).

Good fertility results are shown by clones R5 and 15 ENTAV, with ISV 117 and R5 clones being the most productive.

Considering the compositional atributes of the grapes for each clone, it emerged that all clones are suitable for obtaining DOC/PDO top quality red and rose wines. Although the data presented by us are in the context of a young vineyard, the clones are of interest from the perspective of their productive and qualitative potential and must be further explored from the perspective of establishing an optimal viticultural technique for a quantity-quality balance, of their potential phenolic in climatic contexts specific and their ability to produce diverse wines types.

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