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THE LOCAL GRAPEVINE VARIETIES - A SOURCE OF TYPICITY, AUTHENTICITY, AND ADAPTABILITY, WITHIN THE FRAMEWORK OF SUSTAINABLE VITICULTURAL TECHNOLOGIES

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Abstract

The research was carried out over the 2020-2022 growing seasons and focused on specific local grape cultivars discovered in 2019 in the gardens or vineyards of amateur winegrowers in Alba County. Among these, 12 little-known or unknown local cultivars were studied, grouped based on grape quality and yield, and compared to well-known reference types widely distributed in the area. The local white wines were compared to the control 'Fetească regală', the red wine cultivars to 'Cabernet Sauvignon', and the fresh consumption cultivars to 'Chasselas dore'. The aim was to identifying the growth stages of local cultivars and identifies those that bud or bloom later, in order to mitigate risks associated with increasingly frequent climate variability. Additionally, the research focused on the main ampelographic characteristics, grape production quantity and quality, as well as disease and pest resistance, important indicators in the current context emphasizing cost and pollution reduction, and the production of healthier viticultural products. Most of the analysed cultivars displayed higher resilience against diseases and pests when compared to the control cultivars.

Key words: *adaptability, grapevine, local cultivars, technology, typicity.*

INTRODUCTION

Viticultural technologies remain an ongoing challenge for winegrowers, who are constantly looking for solutions to adapt to the changing landscape of viticulture and comply with current issues in viticultural (Palliotti et al., 2014). Climate challenges, labour shortages, rising input costs, competition, and the professional market's more severe criteria all call for efficient solutions (Cheng et al., 2014). Within these circumstances, local grape emerge as viable choices due to their resistance and flexibility to the pedoclimatic conditions of their particular viticultural regions (Brunori et al., 2015). Furthermore, they provide the essential characteristics of typicity and authenticity, which are required for success in the dynamic viticultural products market (Dobrei et al., 2015). In the overwhelming majority of cases, local grape varieties and biotypes are much more resistant to diseases and pests than their widely grown equivalents (De Lorenzis et al., 2013). Furthermore, they show higher adaptability to local environmental conditions while requiring significantly less technological input (Dobrei et al., 2019). Such varieties develop with basic farming techniques, requiring fewer disease and pest treatments (Parker et al., 2011). As a result, they have the potential to yield viticultural products that are naturally healthier for human consumption (Marques et al., 2023). Regardless of their benefits, most of the local varieties and biotypes are relatively unknown (Ibrahim & Bayir, 2010). They are primarily grown in their native yards and gardens and have not been tested using more advanced cultivation and winemaking technology (Maraš, et al., 2020). Local grape varieties and biotypes are suitable options for ecological grapevine farming, which is growing in popularity as the future of viticulture (Grigoriou et al., 2020). This trend has become especially reliable in European countries known for their advanced viticultural techniques, such as Spain, Italy, France, and Romania (Tardaguila et al., 2021). However, organic viticulture progresses slowly, because of its shortcomings in efficiently battling

diseases and pests using methods and products validated by ecological agricultural practices, particularly for the wide range of grape varietals planted (Wei et al., 2023).
The primary aim of research was to identify growth stages of local cultivars, particularly those exhibiting delayed bud break or flowering, in response to the increasingly climate variability. Consequently, the study aimed to contribute valuable insights into the suitability of local grape cultivar for ecological grapevine farming, aligning with the evolving landscape of viticulture towards sustainability and authenticity.

MATERIALS AND METHODS

This research was done between the 2020 and 2022 growing seasons and focused on several local grape cultivars from *Vitis vinifera* sp., found in the yards, gardens, or tiny vineyards of professional or amateur winegrowers in Alba County. Among the large number of local grapes cultivars identified, 12 cultivars native to the area, little or not at all known, were kept and were the subject of research. The local cultivars 'Pleoapă', 'Precupească', 'Butuc alb', 'Fragă', 'Aromat alb', 'Mare timpuriu' are located in Loman area, Săsciori village (45°51′27″N 23°33′11″E; 45°49′23″N 23°33′33″E). In Șard location with 46°07′13″N 23°31′57″E coordinates (Ighiu village) were identified 'Șard 1' and 'Roșu rezistent' local cultivars. In the same area of Ighiu village (46°09′42″N 23°28′59″E) were found 'Busuioacă de Ighiu', 'Izabelă de Ighiu' and 'Vechi de Ighiu' local cultivars. In Alba Iulia city area was identified 'Ruginiu de Alba' local cultivar (46°4′1″N, 23°34′12″E). For each local cultivar were sampling between 8-15 plants, depending of the vines available in each location. These local cultivars were grouped according to grape characteristics in three categories and analysed in relation *V. vinifera* cultivars (considered as control), widespread and well-known in Alba County's wine-growing areas. The local cultivars for white wines were compared with the control cultivar 'Fetească regală', those for red wines with the control 'Cabernet Sauvignon', and those suited for fresh consumption with the 'Chasselas dore' cultivar.

The study focused on several important characteristics of grapevine growing that are critical for establishing the best management strategy. A significant issue was following the progression of vegetative stages among local grape cultivars with a particular emphasis on identifying those with delayed bud break or flowering. This proactive strategy aims to reduce the risks associated with more common climate changes. The BBCH classification served as the basis for assessing vegetative stages. The study monitored indicators related to winter temperature adaptability, such as the percentage of maturated wood or the proportion of viable buds.
Additional research objectives included fertility and productivity characteristics. These consisted of monitoring the rate of fertile shoots, assessing the number of inflorescences per vine, analysing berry size and bunch weight, evaluating bunch size, the number of bunches per vine and grape yield. Furthermore, the study evaluated the photosynthetic efficiency of local grape cultivars, as well as their disease and pest resistance. The amount of leaf area needed to produce one kilogram of grapes was used to measure photosynthetic efficiency. Meanwhile, local cultivars' resistance to disease and pest was assessed using O.I.V. descriptors.
The statistical analysis was conducted using XLSTAT (by Addinsoft, 2018), a software solution for statistical and data analysis (Version 2018.7.5). The one-way analysis of variance (ANOVA) method was employed to analyse the data. By t-calculation was determined the significance of the difference between the samples mean. Results are expressed as mean and a p-value less than 0.05 ($p < 0.05$) was considered statistically significant.

RESULTS AND DISCUSSIONS

The progression and length of the growing stages are usually controlled by both the genetics of the variety and the environmental conditions in each growing season and location (Simeonov, 2016). Shoot and inflorescence damage caused by extreme temperatures is becoming more likely in today's unstable climate (Schumacher et al., 2024). As a result, biotypes with late budding or delayed flowering are preferred because they are better adapted to manage the risks associated with late spring frost (Linares Torres et al., 2015). Conversely, grape biotypes that reach maturation more quickly are also of importance, as they require fewer sunlight hours and lower temperatures to avoid excessive sugar accumulation, which may result in wines with an excessive alcohol concentration (Rafique et al., 2023).

Regarding the red wine cultivars, none of the local cultivars exhibited delayed bud break compared to the control cultivar 'Cabernet Sauvignon' (Table 1). The only cultivar that showed a bud break similar to the control was 'Roșu rezistent', while the other cultivars commenced bud break 8-10 days earlier than the control. A similar pattern was observed for the phenological stages of shoot emergence and flowering, with local varieties generally preceding the control. Conversely, local grape cultivars tended to achieve full grape maturity earlier than the control, with the 'Pleoapă' notably maturing approximately a week ahead of the control.

Concerning the local grape cultivars used for white wines, bud breaks occurred 4-8 days later compared to the control cultivar except for the 'Busuioacă de Ighiu'. Cultivars with delayed bud break are less susceptible to frost damage during the early stages of growth. However, the flowering stage occurred 1-6 days earlier in local cultivars compared to the control, posing a higher risk of flower damage due to potential low temperatures during this phase. Despite this, all local cultivars in this category reached full grape maturity 2-6 days before the control cultivar. The sugar accumulation was adequate in these cultivars to produce high-quality wines classified as superior wines while also mitigating the risk of excessively high alcohol content.

Table 1. Local wine grape cultivars phenology (2020-2022)

Local cultivars	Year	Growing stage – BBCH code					
		Budburst BBCH 02	Shoots emerge BBCH 13-14	Flowering BBCH 65-68	Bunch density BBCH 77-79	Veraison BBCH 83-85	Full maturation BBCH 89
Local grape cultivars for red wines							
'Pleoapă'	2020	14.IV	28.IV	2.VI	19.VII	19.VIII	30.IX
	2021	11.IV	24.IV	29.V	12.VII	12.VIII	23.IX
	2022	13.IV	26.IV	30.V	14.VII	15.VIII	25.IX
'Vechi de Ighiu'	2020	14.IV	29.IV	5.VI	22.VII	23.VIII	1.X
	2021	12.IV	26.IV	1.VI	18.VII	17.VIII	25.IX
	2022	13 IV	28.IV	4.VI	21.VII	20VII	28.IX
'Izabelă de Ighiu'	2020	15.IV	29.IV	4.VI	25.VII	22VIII	4.X
	2021	13.IV	26.IV	1.VI	20.VII	18.VIII	26.IX
	2022	14.IV	27.IV	2.VI	22.VII	20VII	28.IX
'Roșu rezistent'	2020	27.IV	2.V	12.VI	29.VI	24VIII	2.X
	2021	24.IV	30.IV	10.VI	25.VII	20.VIII	28.IX
	2022	25.IV	30.IV	11.VI	26.VII	21.VIII	30.IX
'Cabernet Sauvignon' (Control)	2020	29.IV	4.V	16.VI	1.VII	26.VIII	5.X
	2021	27.IV	2.V	14.VI	28.VII	24.VIII	30.IX
	2022	27.IV	2.V	14.VI	29.VII	24.VIII	1.X
Local grape cultivars for white wines							
'Șard I'	2020	21.IV	3.V	6.VI	25.VII	23.VIII	28.IX
	2021	18.IV	30.IV	3.VI	22.VII	18.VIII	23.IX
	2022	19.IV	1.V	4.VI	23.VII	20.VIII	24.IX
'Ruginiu de Alba'	2020	23.IV	2.V	8.VI	29.VII	26.VIII	3.X
	2021	20.IV	30.IV	5.VI	25.VII	21.VIII	28.IX
	2022	21.IV	1.V	6.VI	26.VII	22.VIII	30.IX
'Busuioacă de Ighiu'	2020	15.IV	27.IV	3.VI	26.VII	21.VIII	1.X
	2021	12.IV	23.IV	29.V	22.VII	17.VIII	26.IX
	2022	13.IV	24.IV	1.VI	23.VII	18.VIII	28.IX
'Aromat alb'	2020	21.IV	3.V	7.VI	27.VII	25.VIII	2.X
	2021	17.IV	30.IV	4.VI	24.VII	20.VIII	28.IX
	2022	18.IV	2.V	5.VI	24.VII	21.VIII	30.IX
‘Fetească regală’ (Control)	2020	15.IV	27.IV	9.VI	26.VII	21.VII	30.IX
	2021	12.IV	22.IV	6.VI	22.VII	15.VIII	23.IX
	2022	14.IV	23.IV	7.VI	23.VII	17.VIII	25.IX

Grape varieties grown for fresh consumption are more sensitive to climate variability, enabling the dynamics of growing stages more important in their growing (Dry et al., 2022). Bud break in these cultivars lasted about 10 days. Notably, local cultivars like as 'Precupească' and 'Mare timpuriu' had a delayed bud break compared to the control variety, allowing vines to tolerate or even avoid damage from late spring frosts in some years (Table 2). Conversely, the local cultivars 'Fragă' and 'Butuc alb' bloomed one to four days before the control cultivar 'Chasselas doré. Shoot growing in all local cultivars started 1-7 days later than in the control variety, which is a positive trait that minimises the danger of shoot vulnerability to potentially lower temperatures towards the end of April. The flowering phenophase showed significant differences amongst the investigated cultivars. Some local cultivars, such as 'Fragă' and 'Butuc alb ', flower several days before the control variety, while others, such as 'Mare timpuriu' and 'Precupească', flower after the control. Varieties with delayed flowering have a lesser risk of inflorescence injury from potentially damaging temperatures at the end of May. In regards to reaching full maturity, the local cultivars for fresh consumption showed variable behaviour, with this phenophase lasting around 20 days from the third to second decade of August to September. This extended time is advantageous since it allows for the availability of fresh grapes for consumption for at least 30-40 days, given the grapes' storage durability on the vine. 'Mare timpuriu' was the only local cultivar to mature before the control variety, while the other biotypes matured after the control.

Table 2. Local table grape cultivars phenology (2020-2022)

Local cultivars	Year	Growing stage-code BBCH					
		Budburst BBCH 02	Shoots emerge BBCH 13-14	Flowering BBCH 65-68	Bunch density BBCH 77-79	Veraison BBCH 83-85	Full maturity BBCH 89
'Mare timpuriu'	2020	20.IV	2.V	8.IV	19.VII	3.VIII	3.IX
	2021	15.IV	29.IV	4.VI	14.VII	29.VII	28.VIII
	2022	17.IV	30.IV	5.VI	15.VII	30.VII	30.VIII
'Precupească'	2020	23.IV	2.V	11.VI	20.VII	6.VIII	18.IX
	2021	18.IV	30.IV	7.VI	16.VII	1.VIII	12.IX
	2022	19.IV	30.IV	8.VI	17.VII	2.VIII	14.IX
'Butuc alb'	2020	16.IV	26.IV	29.V	16.VII	6.VIII	23.IX
	2021	11.IV	22.IV	26.V	11.VII	2.VIII	16.IX
	2022	12.IV	23.IV	26.VI	12.VII	3.VIII	18.IX
'Fragă'	2020	14.IV	27.IV	30.V	16.VII	9.VIII	22.IX
	2021	10.IV	22.IV	26.V	11.VII	4.VIII	16.IX
	2022	11.IV	23.IV	27.VI	13.VII	5.VIII	18.IX
'Chasselas doré' (Control)	2020	17.IV	25.IV	6.VI	23.VII	6.VIII	15.IX
	2021	13.IV	21.IV	2.VI	18.VII	1.VIII	9.IX
	2022	14.IV	21.IV	3.VI	20.VII	2.VIII	11.IX

Table 3. Indicators of winter temperature resistance in local grape cultivars for winemaking (mean for 2020-2022 growing seasons)

Local cultivars	Percentage of wood maturation (%)	Viable buds (%)	
		%	Difference to control
Local grape cultivars for red wines			
'Pleoapă'	89.21	89.71	5.46*
'Vechi de Ighiu'	81.35	79.32	-4.93^{NS}
'Izabelă de Ighiu'	72.61	71.63	-12.62**
'Roșu rezistent'	80.29	73.42	-10.83**
'Cabernet Sauvignon' (Control)	82.33	84.25	-
Local grape cultivars for white wines			
'Șard I'	83.64	86.59	6.33*
'Ruginiu de Alba'	73.61	75.11	-5.15*
'Busuioacă de Ighiu'	75.12	76.28	-3.98^{NS}
'Aromat alb'	76.72	78.11	-2.15^{NS}
'Fetească regală' (Control)	78.53	80.26	-

*t significant at p<.05; **t significant at p<.01; ***t significant at p<.001; NS - not significant

Despite the overall rise in average temperatures observed in many wine-growing regions in recent years, climate variability has resulted in brief intervals of low temperatures, especially during nighttime (-19°C and -20°C). These temperatures fall below the frost resistance threshold of certain local grape varieties. Consequently, it is critical for grapevine cultivars to have fast wood maturity at the beginning of winter, enabling them to resist these cold-weather periods successfully.

In local grape cultivar for red wines, the canes wood maturation percentage yielded positive results. Several biotypes outperformed the control standard in this category, despite 'Cabernet Sauvignon's' reputation for strong wood maturity and frost resistance. The local cultivar 'Pleoapă' performed particularly well, with the highest percentage of wood maturation among the examined cultivars. Furthermore, 'Vechi de Ighiu' and 'Roșu rezistent' demonstrated wood maturation percentages that were nearly identical to the control cultivar whereas 'Izabelă de Ighiu' achieved a satisfactory level, but lower than the control. In terms of bud viability, all local cultivars showed high values, eliminating the need for compensatory measures to control crop load. Notably, 'Pleoapă' appeared as the only native local grape cultivar that recorded higher values than the control.

The local grape cultivars and control cultivar for white wine, recorded notable percentages of wood maturation and viable buds, more than enough to apply a standard winter pruning (Table 3). Compared to 'Cabernet Sauvignon' (Control), a popular cultivar in Romania, the results for these characteristics were comparable or even better than the control, especially for the 'Șard 1' local cultivar. The degree of wood maturation observed was affected by pruning techniques, environmental conditions, and grape variety, whereas the viability of buds was influenced by their location on the vine, the quality of pruning, and the management of diseases and pests.

Tabel 4. The variables for tolerance to low temperatures in local cultivars of grapes for fresh consumption (mean 2020-2022 growing seasons)

Local cultivars	Percentage of wood maturation %	Viable buds (%)	
		%	Difference to control
'Mare timpuriu'	80.13	82.12	7.86*
'Precupească'	70.63	72.19	-2.07^{NS}
'Butuc alb'	63.53	69.28	-4.28^{NS}
'Fragă'	66.12	71.11	-3.15^{NS}
'Chasselas doré' (Control)	71.34	74.26	-

*t significant at p<.05; **t significant at p<.01; ***t significant at p<.001; NS - not significant

Although the local cultivars of grapes for fresh consumption are considered to be less resistant to frost compared to the grape varieties for wine, these vines exhibit sufficient accumulation of reserve substances in the canes (Table 4). This accumulation facilitates adequate maturation of the canes and ensures correspondding viability of the buds. Within this category, a renowned control cultivar ('Chasselas doré') known for its robust wood maturation and tolerance to low temperatures was selected for comparison. Nevertheless, local grape cultivars demonstrated values for these indicators that were relatively close to the control cultivar. The 'Mare timpuriu' notably surpassed the control in both the percentage of matured wood and viable buds, with statistical significance validating these differences. Fertility is critical for the vine, but the advantage is that there are relatively few varieties that were negatively influenced from this viewpoint. Local red wine cultivars had higher percentage of fertile shoots than the control in any variety (Table 5). The 'Roșu rezistent' and 'Pleoapă' cultivars achieved the highest ratings in this respect. In regards to the number of inflorescences per vine, 'Izabelă de Ighiu' was the only cultivar with lower values than the control. In exchange, all of the local white wine grape cultivars recorded lower fertile shoot level than the control, despite the fact that the recorded levels are considered extremely quite favourable. None of the local wine grape cultivars presented issues regarding fertility indicators.

As regards the percentage of fertile shoots, the local grape cultivars for fresh consumption had provided values close to or even superior to the control ('Chasselas doré'), which is regarded one of the most fertile table grape cultivar (Table 6). From this perspective, was observed that cultivars 'Mare timpuriu' and 'Butuc alb', had higher values than the control.

Table 5. Fertility components in local red and white wine cultivars (mean 2020-2022 growing seasons)

Local cultivars	Rate of fertile shoots (%)	Inflorescence per vine	Difference to control (Inflorescence per vine)
Red wine local cultivars			
'Pleoapă'	75.21	20.82	4.17*
'Vechi de Ighiu'	73.14	17.37	0.72NS
'Izabelă de Ighiu'	70.76	14.22	-2.43NS
'Roșu rezistent'	75.94	21.32	4.67*
'Cabernet Sauvignon' (Control)	64.88	16.65	-
White wine local cultivars			
'Șard I'	72.87	12.75	-6.22**
'Ruginiu de Alba'	77.11	13.12	-5.85*
'Busuioacă de Ighiu'	71.89	17.84	-1.13NS
'Aromat alb'	75.32	20.23	1.26NS
'Fetească Regală' (Control)	79.23	18.97	-

*t significant at p<.05; **t significant at p<.01; ***t significant at p<.001;NS - not significant

The number of inflorescences per plant varies significantly; with the exception of the early 'Mare timpuriu', all of the local cultivars outperformed the control in this regard.

Table 6. Fertility components in local table grape cultivars (mean for 2020-2022 growing seasons)

Local cultivars	Rate of fertile shoots	Inflorescence per vine	Difference to control (Inflorescence per vine)
'Mare timpuriu'	79.11	11.43	-2.32NS
'Precupească'	69.43	31.87	18.12***
'Butuc alb'	77.65	30.34	16.59***
'Fragă'	67.21	28.32	14.57***
'Chasselas doré' (C)	73.41	13.75	-

*t significant at p<.05; **t significant at p<.01; ***t significant at p<.001; NS-not significant

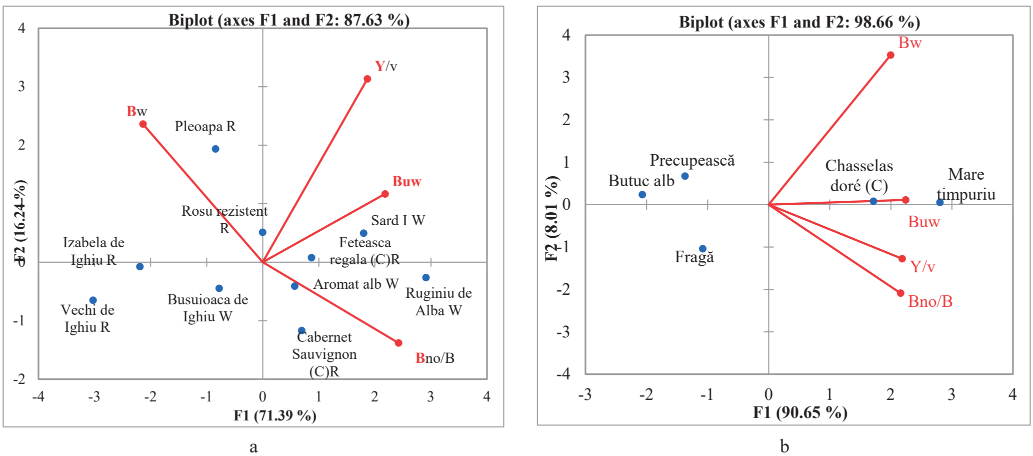

Figure 1. PCA diagram for grape yield components in wine grape cultivars (a) and grapes for fresh consumption (b); Bw - berry weight; Bno/B - berry number per bunch; Buw - Bunch weight; Y/v (g) - grape yield/vine (kg)

The PCA diagram presented in Figure 1 1a illustrates the qualitative characteristics of local cultivars and control cultivars for white and red wine. The principal component F1 contributes significantly to the variability, accounting for 71.39% of the total variability observed in the data. Upon examining the data, it is evident that certain local grape cultivars stand out in terms of berry weight. Specifically, the red wine local cultivars 'Pleopă' and 'Roșu rezistent' exhibited the highest berry weight among the studied cultivars. In contrast, the white wine local cultivars 'Aromat alb' and 'Ruginiu de Alba' displayed the lowest berry weight.

As regards the yield per vine, differences were observed among the studied cultivars. The red wine local cultivars 'Izabelă de Ighiu' and 'Vechi de Ighiu' were found to have the lowest yield per vine. Therefore, the white wine local cultivar 'Sard 1' exhibited the highest weight of bunches, resulting in the highest yield per vine among the studied varieties.

The PCA diagram in Figure 1b compares the qualitative characteristics of table local grape cultivars to the control cultivar 'Chasselas doré'. Additionally, the 'Mare timpuriu' local grape cultivar and the control 'Chasselas doré' cultivar performed significantly better in terms of berry and bunch weight. Therefore a result, they had a higher yield per vine, which was most likely due to the larger amount of berries in each bunch. In contrast, the 'Fragă' local grape cultivar had the lowest values across all of the qualitative parameters evaluated during the study. This analysis emphasises the variability in qualitative characteristics observed across table grapes local cultivars and the control cultivar. The distinctive performance of the 'Mare timpuriu' local cultivar and 'Chasselas doré' in terms of berry and bunch weight indicates that they may be suitable for table grape cultivation. In contrast, the 'Fragă' local cultivar's poor performance emphasizes the need of taking certain qualitative qualities into account when choosing grape types for growing. Such findings are invaluable in guiding viticultural activities and increasing yield and quality in grape production.

The photosynthetic efficiency reflects the variety's adaptation to the sunlight resources of the growing area, and it was calculated using the amount of leaf area required to yield one kilogram of grapes (Domingues Neto et al., 2023). Although the control cultivars 'Cabernet Sauvignon' and ‘Fetească regală’ have long been included in the varietal assortment in the studied locations, the local cultivars tested approached or even exceeded their photosynthetic efficiency (Table 7).

With the exception of the 'Vechi de Ighiu' cultivar, all other local red wine grape cultivars required smaller leaf areas to produce one kilogram of grapes compared with the control cultivar. 'Pleoapă' was the most efficient local cultivar, followed by 'Roșu rezistent' and 'Izabelă de Ighiu', with differences from the control statistically significant. In the group of white wine cultivars, the situation was different, with the control variety outperforming all of the local cultivars in terms of photosynthetic efficiency, with the exception of 'Ruginiu de Alba'.

Table 7. Parameters of photosynthetic efficiency in local grape cultivars for wine (mean 2020-2022 growing seasons)

Local cultivars	Leaf area (m^2/vine)	Grape yield (kg/vine)	Leaf area (m^2/kg grapes)	Difference to control Leaf area (m^2/kg grapes)
Red wine local cultivars				
Pleoapă	8.21	1.92	4.27	-1.02*
Vechi de Ighiu	6.18	1.04	5.94	0.65*
Izabelă de Ighiu	5.35	1.18	4.53	-0.76*
Roșu rezistent	7.95	1.82	4.36	-0.93*
'Cabernet Sauvignon' (C)	7.89	1.49	5.29	-
White wine local cultivars				
Șard I	6.75	1.76	3.83	0.01^{NS}
Ruginiu de Alba	6.43	1.79	3.59	-0.23^{NS}
Busuioacă de Ighiu	5.85	1.44	4.06	0.24^{NS}
Aromat alb	7.36	1.71	4.3	0.48*
'Fetească Regală' (C)	6.93	1.81	3.82	-

*t significant at p<.05; **t significant at p<.01; ***t significant at p<.001; NS - not significant

Photosynthetic efficiencies observed were generally higher in the group of local grape cultivars for fresh consumption than in wine grape cultivars, which are assuming the higher sugar accumulation in wine grape cultivars (Table 8). When compared to the control cultivar, the local cultivars 'Fragă' and 'Precupească' required less leaf area to produce a kilogram of grapes. However, 'Butuc alb' and 'Mare timpuriu' local cultivars necessitated a larger leaf area for the same purpose.

The local red wine cultivars displayed good disease resistance, with only the 'Vechi de Ighiu' and 'Pleoapă' exhibiting moderate resistance to Botrytis (Table 9).

Table 8. Parameters of photosynthetic efficiency in local table grape cultivars (mean 2020-2022 growing seasons)

Local cultivars	Leaf area (m^2/vine)	Grape yield (kg/vine)	Leaf area (m^2/kg grapes)	Difference to control Leaf area (m^2/kg grapes)
'Mare timpuriu'	9.05	2.34	3.86	0.04^{NS}
'Precupească'	6.53	1.75	3.73	-0.09^{NS}
'Butuc alb'	7.15	1.52	4.70	0.88*
'Fragă'	6.75	1.90	3.55	-0.27*
'Chasselas doré' (C)	8.45	2.21	3.82	-

*t significant at p<.05; **t significant at p<.01; ***t significant at p<.001

Table 9. Disease resistance among local grape cultivars for winemaking

Local cultivars	Disease	O.I.V. Code	Local cultivars resistance	Level of resistance
Resistance to biotic factors				
Local cultivars for red wines				
'Pleoapă'	Downy mildew (*Plasmopara viticola*)	451	good	8
	Powdery mildew (*Erysiphe necator*)	454	good	8
	Botrytis cinerea (*Gray mold)*	457	medium	6
'Vechi de Ighiu'	Downy mildew (*Plasmopara viticola*)	451	good	8
	Powdery mildew (*Erysiphe necator*)	454	good	7
	Botrytis cinerea (*Gray mold)*	457	medium	6
'Izabelă de Ighiu'	Downy mildew (*Plasmopara viticola*)	451	good	8
	Powdery mildew (*Erysiphe necator*)	454	good	8
	Botrytis cinerea (*Gray mold)*	457	good	7
'Roșu rezistent'	Downy mildew (*Plasmopara viticola*)	451	good	8
	Powdery mildew (*Erysiphe necator*)	454	good	8
	Botrytis cinerea (*Gray mold)*	457	good	8
'Cabernet Sauvignon' (Control)	Downy mildew (*Plasmopara viticola*)	451	weak	2
	Powdery mildew (*Erysiphe necator*)	454	medium	5
	Botrytis cinerea (*Gray mold)*	457	good	7
Local cultivars for red wines				
'Șard I'	Downy mildew (*Plasmopara viticola*)	451	good	7
	Powdery mildew (*Erysiphe necator*)	454	medium	6
	Botrytis cinerea (*Gray mold)*	457	weak	2
'Ruginiu de Alba	Downy mildew (*Plasmopara viticola*)	451	very good	9
	Powdery mildew (*Erysiphe necator*)	454	good	7
	Botrytis cinerea (*Gray mold)*	457	good	7
'Busuioacă de Ighiu'	Downy mildew (*Plasmopara viticola*)	451	good	7
	Powdery mildew (*Erysiphe necator*)	454	good	7
	Botrytis cinerea (*Gray mold)*	457	medium	5
'Aromat alb'	Downy mildew (*Plasmopara viticola*)	451	good	8
	Powdery mildew (*Erysiphe necator*)	454	good	8
	Botrytis cinerea (*Gray mold)*	457	medium	6
'Fetească regală' (Control)	Downy mildew (*Plasmopara viticola*)	451	medium	7
	Powdery mildew (*Erysiphe necator*)	454	medium	7
	Botrytis cinerea (*Gray mold)*	457	weak	2

This susceptibility was largely attributed to the exceptionally rainy conditions that characterized the 2020 growing season. Following the application of the standard treatment regimen, disease resistance was markedly elevated in local white wine grape cultivars compared to the 'Fetească regală' control cultivar, which underwent a conventional treatment protocol. Among the local cultivars, 'Șard 1' demonstrated the highest sensitivity to Botrytis, particularly evident during the 2020 growing season.

Table 10. Disease resistance among local table grape cultivars

Local cultivars	Disease	O.I.V. Code	Local cultivars resistance	Level of resistance
Resistance to biotic factors				
'Mare timpuriu'	Downy mildew (*Plasmopara viticola*)	451	medium	6
	Powdery mildew (*Erysiphe necator*)	454	good	7
	Botrytis cinerea (*Gray mold)*	457	medium	5
'Precupească'	Downy mildew (*Plasmopara viticola*)	451	medium	6
	Powdery mildew (*Erysiphe necator*)	454	medium	6
	Botrytis cinerea (*Gray mold)*	457	weak	2
'Butuc alb'	Downy mildew (*Plasmopara viticola*)	451	medium	5
	Powdery mildew (*Erysiphe necator*)	454	medium	6
	Botrytis cinerea (*Gray mold)*	457	medium	5
'Fragă'	Downy mildew (*Plasmopara viticola*)	451	medium	6
	Powdery mildew (*Erysiphe necator*)	454	good	8
	Botrytis cinerea (*Gray mold)*	457	good	7
'Chasselas doré' (Control)	Downy mildew (*Plasmopara viticola*)	451	very weak	1
	Powdery mildew (*Erysiphe necator*)	454	medium	6
	Botrytis cinerea (*Gray mold)*	457	medium	6

Although table grape varieties are thought to be more vulnerable to disease attack, the local grape cultivars showed relatively strong resilience, even if disease attacks were more visible compared to the wine grape cultivars (Table 10). 'Precupească' was the only native cultivar with higher vulnerability to the Botrytis attack.

CONCLUSIONS

The unfavourable climatic circumstances of 2020 had a detrimental impact on grape quality and yield, since outputs were very low due to the significant precipitation in June, July, and August, deviating substantially from the previous two years of research. The local cultivars performed similarly to the control varieties in all indicators, despite the fact that the chosen controls were some of the most valuable and cultivated cultivars from Alba County's wine-growing areas. A significant number of the local cultivars registered delays of a few days compared to the control for the budburst and flowering ('Șard 1', 'Ruginiu de Alba', 'Aromat alb', and 'Precupească'), which is an advantage especially in unfavourable years, with climate variability, when late spring frosts can significantly damage the shoots or even the inflorescences. The resistance to disease was notably superior in local cultivars compared to the control, with significantly fewer signs of disease attack evident even in the absence of complex treatment. In local table grapes cultivars, due to the fresh consumption, it is considered that good resistance to diseases is a major advantage, so that consumers can benefit from healthy grapes, with minimal exposure to phytosanitary treatments, which fall under in the standards of sustainable viticulture. Although, there were very few local grapes cultivars ('Pleoapă', 'Roșu rezistent', 'Mare timpuriu') that surpassed the controls for grape yield, due to their rusticity and the possibilities of offering authentic wine products, these local grapes cultivars need more researched and some of them, introduced either in the varietal assortments or in the improvement programs.

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