ANNALS OF THE UNIVERSITY OF CRAIOVA

Series: ✓*Biology*
✓*Horticulture*
✓*Food products processing technology*
✓*Environmental engineering*

Vol. XXIX (LXV) – 2024

PERFORMANCE EVALUATION OF OLD VINE VARIETIES IN THE CONTEXT OF ECOPEDOCLIMATIC CHALLENGES AT INCDBH ȘTEFĂNEȘTI, ARGEȘ

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Keywords*: autochthonous varieties, ecopedoclimatic adaptability, fertility and productivity*

ABSTRACT

This scientific paper analyzes the agrobiological and technological characteristics of the old autochthonous ancestral grapevine varieties, focusing on the specific ecopedoclimatic conditions of the Ștefănești vineyard, Argeș, in the context of contemporary climate challenges. The study conducted in 2024 at INCDBH Ștefănești examined five distinct varieties: Ardeleanca, Coada oilor, Galbenă uriașă, Gordan, and Coarnă neagră. Advanced analytical techniques were applied to assess fertility, facilitating a thorough understanding of agrobiological dynamics. Additionally, technological variables reflecting productivity, yield, and the biochemical traits of the grapes were investigated. The results obtained highlight a significant variability in phenotypic responses, emphasizing the resilience of these ancestral varieties in the face of climatic stress. The correlations identified between analytical characteristics and sensory traits emphasize their relevance in shaping effective strategies for sustainable viticulture. This paper aims not only to rejuvenate interest in the native viticultural heritage but also to promote the integration of these ancestral varieties into the contemporary viticultural landscape, thereby contributing to the development of viable solutions that meet the sustainability requirements of the wine industry.

INTRODUCTION

Viticulture, as an essential branch of agriculture, plays a fundamental role in the economy and culture of many regions worldwide, including Romania. Native grapevine varieties, especially the ancestral ones, constitute a valuable genetic resource with significant potential for adapting to local ecopedoclimatic conditions. In the context of global climate change, these varieties are becoming increasingly important, offering not only adaptation solutions, but also opportunities for the development of sustainable viticulture strategies.

In the Ștefănești vineyard, Argeș, ecopedoclimatic conditions vary significantly, influencing the development and quality of grapevines. The study of the agrobiological and technological characteristics of old autochthonous varieties in this specific framework is essential for understanding how these varieties can respond to climatic challenges and contribute to efficient viticultural resource management strategies.

Previous research has demonstrated that native varieties exhibit significant genetic variability, which confers resilience to climatic stress as well as the capacity to adapt to environmental changes. Thus, the evaluation of the fertility and productivity characteristics of these varieties becomes a necessity not only for the preservation of the viticultural heritage, but also for ensuring a sustainable future for viticulture in Romania.

The purpose of this paper is to explore these characteristics in detail, using advanced analytical techniques in order to obtain a comprehensive overview of the agricultural potential of ancestral grapevine varieties of the Ștefănești vineyard. The results obtained will not only contribute to a better understanding of the adaptability of these varieties, but also to the promotion of a viticulture that meets current requirements of sustainability and efficiency.

Thus, this research aligns with broader efforts to revitalize the native viticultural heritage, aiming not only to preserve but also to integrate traditional varieties into the contemporary viticultural landscape, responding to global challenges and ensuring them an active role in the future development of the viticultural industry.

MATERIAL AND METHODS

STUDY AREA

The Ștefănești-Argeș vineyard is located in the contact area of the Cândești Plateau with the Romanian Plain, extending over a length of more than 40 km, in the form of a strip with variable widths. The vineyard is arranged parallel to the Argeș River, between the municipality of Pitești in the western extremity and the city of Găești in the southeastern part (Giurescu C., 1957).

The Ștefănești-Argeș vineyard includes three distinct viticultural centers: two on the territory of Argeş county - Ştefăneşti and Topoloveni, and the third - Valea Mare - on the territory of Dâmbovița County. The Ștefănești viticultural center overlaps most of the western part of the vineyard, stretching for almost 16 km from the Doamnei River to the Gârcinov River. This center is characterized by a highly fragmented relief, with higher hills and clayey soils, moderated summer heat, and the highest precipitation regime in the area. It includes the commune of Ștefănești with the following villages: Valea Mare-Podgoria, Valea Popii, Enculeștii, Ploscaru, Lecșoare on Coasta-Câmpului, Izvorani, Ștefănești, Ștefăneștii Noi, Târgul Dealului, Valea Boerească, Viișoara, and Golești; and the commune of Călinești with the villages: Ciocănești, Văleni-Podgoria, Radu Negru, Vrănești, Drăghicești, Udeni, Gorganu, Călinești, Râncăciov, Cristieni, Urlucea, and Glodu.

This viticultural center predominantly features grape varieties for white wines, with the primary viticultural profile aimed at producing high-quality dry white wines. Additionally, aromatic wines of superior quality and high-quality distilled wines each account for 8-10% of total production. The wines produced annually in this center, especially the dry superior whites, have a moderate alcohol content and have special characteristics of taste harmony, fruitiness, and smoothness, which make them so drinkable and so appreciated and sought after. (Popescu et al., 1989).

Current viticulture in Argeș is primarily concentrated in the area of the Ștefănești-Argeș vineyard, located in the central-southern part of the Muntenia Subcarpathians. According to the climatic, geomorphological, and lithological conditions, a multitude of soil types can be found in the Ștefănești-Argeș vineyard (Dumitru et al., 1989).

The largest area (28%) is occupied by anthropic non-compacted soils, with favorable characteristics and sufficient useful physiological thickness for grapevines. This is followed by brown eumezobasic soils (13%) spread on the piedmont hills, on moderately sloped slopes, and in glacis areas, with a relatively light texture that confers favorable properties. Alluvial soils, located towards the Argeș plain or in the valleys of the tributaries, occupy 11% of the surface, having very favorable characteristics for grapevines (Rădulescu et al., 1989).

The study was carried out in the ex situ germplasm collection located at the NRDIBH Stefanesti, Arges county. The wine-growing area is characterized by a humid temperate continental climate, according to the multiannual averages (period 1979-2021), with an average annual temperature (Tmean) of 11.06°C and the amount of precipitation of 781.5 mm per year. From 1979 to 2010, there was a continuous record of weather data with instruments read by a meteorologist four times a day. Since 2010, all measurements were recorded by an IMETOS automated weather station at Spectrum. The weather station is equipped with sensors Watermark Soil Moisture Sensors 6450WD, sensors to read temperature, relative air humidity, wind speed, solar radiation. The main meteorological indicators in our study, such as minimum and maximum average temperatures, precipitation during the vegetative years, were recorded with the Meteorological Station located in the experimental field (Sumedrea et al., 2023).

STUDIED VARIETIES

1. *ARDELEANCA*

Synonyms: Also known as *Bacator alb, Erdeie, Feher bacator*.

Origin: An ancient Romanian variety with origins in Transylvania.

Distribution Area: Found in Romania (North-West Transylvania) and Hungary (Constantinescu et al., Ampelografia RPR, 1959, Vol. II, pp. 15-126).

Ampelographic Characterization

Morphological Traits:

At the beginning of the growth phase, the shoot tip is pubescent and greenish-yellow (Fig. 1). The mature leaf is elongated, dark green, slightly wrinkled, glabrous on the upper side, and fluffy on the underside, with dense hairs along the veins, of medium size (Fig. 2 a, b).

Fig. 1. Young shoot

Fig. 2 a. Mature leaf Upper side

Fig. 2 b. Mature leaf Lower side

The berry is medium-sized and round, with a diameter of 13-15.5 mm, green- yellowish in color, with an apparent pistil point. It has a juicy core, unflavored, with colorless must. The pedicel is slender and measures 5-8 mm in length. The

inflorescence is yellowish-white, measuring 2-5 mm in length. The skin is thick with small black-rust dots (Fig. 3). The grapes are cylindrical-conical in shape, with a medium size (Fig. 4).

Fig. 3. Berry appearance

Fig. 4. Grape appearance

2. *COADA OILOR*

Synonym in Ampelografia RPR: OVIS

First name in VIVC: JUHFARK

The *Coada oilor*, or Ovis, is an native variety cultivated long before the phylloxera invasion. It belongs to the Proles pontica - subproles balcanica (Constantinescu et al., Ampelografia RPR, 1962, Vol. V, pp. 363-375).

Ampelographic Characterization

Morphological Traits

The shoot tip and the first leaf are pubescent and have a whitish-yellowish color (Fig. 5). The mature leaf is of medium size, with 3 or 5 lobes, measuring 17-20 cm in length and 17.5-21.5 cm in width. The blade is slightly wrinkled, glabrous on the upper side, and features short hairs and sparse scales on the underside (Fig. 6 a, b). The teeth are short, with slightly rounded edges and yellowish mucronate tips. The veins are light green and prominent on the underside.

Fig. 5. Young shoot

Fig. 6 a. Mature leaf
Upper side

Fig. 6 b. Mature leaf
Lower side

The berry is spherical, slightly ovoid, with diameters of 20/19 mm, greenish-yellow in color, translucent, with a golden hue on the sun-exposed side, and finely dotted. The pulp is soft, juicy, and near-aromatic. The skin is of medium thickness, with a large, visible pistil point. The pedicel is thick, averaging 7-8 mm in length, with lenticels (Fig. 7). The grapes are uniaxial, cylindrical or cylindrical-conical, sometimes winged, measuring 12-17 cm in length, and contain dense berries (Fig. 8).

Fig. 7. Berry appearance

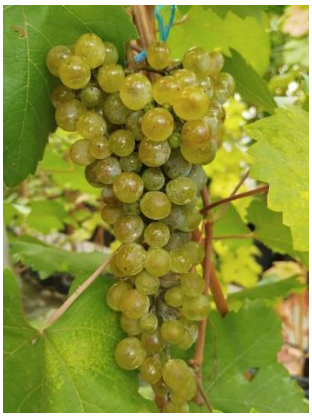

Fig. 8. Grape appearance

3. *GALBENĂ URIAȘĂ*

Origin: Galbenă uriaşă is a native grape variety originally from Moldova, cited by Gheorghe Nicoleanu as a variation of ***Galbenă de Odobeşti*** variety. It is part of Proles pontica - subproles balcanica (Constantinescu et al., Ampelografia RPR, 1961, Vol. IV, pp. 513-523).

Ampelographic Characterization

Morphological Traits:

The shoot tip and the first two leaves are pubescent, pale greenish-white, with a slight lilac tint (Fig. 9). The mature leaf is large, dark green, measuring 21-24 cm in length and 19-23 cm in width, with three lobes. The blade is dark green, blistered, with traces of down on the upper side and dense hairs and down on the underside (Fig. 10 a.b). The berry is spherical, greenish-yellow, sometimes with a golden hue on the sunny side, semi-transparent, with a diameter of 15-17 mm. It has a soft, juicy pulp with a pleasant taste and no flavor. The skin is of medium thickness, with visible veins. The pedicel is 10-13 mm long, thin, light green, with sparse lenticels and a small swelling (Fig. 11). The grapes are uniaxial, cylindrical-conical, often winged, measuring 18-22 cm in length, with densely packed and unevenly sized berries (Fig. 12).

Fig. 9. Young shoot

Fig. 10 a. Mature leaf
Upper side

Fig. 10 b. Mature leaf
Lower side

Fig. 11. Berry appearance

Fig. 12. Grape appearance

4. *GORDAN*

The *Gordan* variety has been known in our country long before the phylloxera invasion. Initially, this name was attributed to the Gordin variety as a synonym; over time, it turned out that the *Gordan* variety belongs to the same group as the Iordan variety and may even be synonymous. It is part of Proles pontica - subproles balcanica. This variety can also be found in some centers in the Argeș and Bucharest regions. (Constantinescu şi colab., Ampelografia RPR, 1961, Vol. IV, pag. 681- 684).

Ampelographic Characterization

Morphological Traits:

The shoot tip with the first leaves are pubescent, greenish-white, with a slight brownish tint towards the edges (Fig. 13). The mature leaf is either entire or slightly trilobed, measuring 18-21 cm in length and 17-19.5 cm in width. The blade is thick, dark green, blistered, glabrous on the upper side, and covered with dense, yellowish down on the underside (Fig. 14 a.b.). The berry is spherical, 15-17 mm in diameter, yellowish-green, beautifully reddened on the sun-exposed side, and covered with persistent bloom. The pulp is unflavored, sweet-sour, juicy, and slightly adherent to the seeds when not well ripe.

The skin is thin and non-resistant, with an apparent pistil point (Fig. 15). The grapes are cylindrical or cylindrical-conical, measuring 15-18 cm in length, often short-winged, with densely packed and unevenly sized berries (Fig. 16).

Fig. 13. Young shoot

Fig. 14 a. Mature leaf
Upper side

Fig. 14 b. Mature leaf
Lower side

Fig. 15. Berry appearance

Fig. 16. Grape appearance

5. *COARNĂ NEAGRĂ*

Origin - An old oriental variety, considered a native variety due to its spread in the South Carpathian vineyards before the appearance of phylloxera. It belongs to the Coarnă sortogroup, which is heterogeneous, with various characteristics. The three varieties that make up this sortogroup (white *Coarnă*, black *Coarnă*, and red *Coarnă*) are morphologically very different, which leads to the hypothesis that they do not share a common origin. However, the fact that all three have functionally female hermaphrodite flowers proves, that they are much more evolved varieties, according to academician Gherasim Constantinescu, their origin being of a hybrid nature.

Synonyms - *Moldavskii, Cerna razachia, Ciornâi crâmskii*

Ampelographic Characterization

Morphological Traits:

The shoot tip is reddish-green in color, and the shoot is slightly pubescent, with an anthocyanic green coloration (Fig. 17). The adult leaf is medium-sized, slightly elongated, with a smooth and glabrous mesophyll, trilobate or pentalobate (Fig. 18 a,b).

Fig. 17. Young shoot

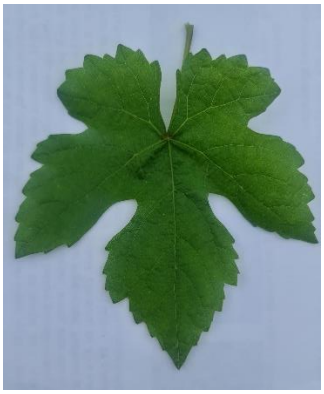

Fig. 18 a. Mature leaf Upper side

Fig. 18 b. Mature leaf Lower side

The berry is oval-elongated, with a flat tip, of medium to large size. The skin is reddish-black in color, suitably thin, covered with bloom. The pulp is fleshy, crunchy,

with a specific cornel taste (Fig. 19). The cluster is medium-sized, cylindrical or cylindro-conical in shape, with a dense arrangement of the berries (Fig. 20).

Fig. 19. Berry appearance

Fig. 20. Grape appearance

RESEARCH METHODOLOGY DESCRIPTION OF THE ANALYTICAL TECHNIQUES USED

THE AGRO-BIOLOGICAL POTENTIAL OF THE STUDIED GENOTYPES

Main Fertility Characteristics of the Studied Genotypes

The evaluation of grapevine variety fertility is conducted by analyzing the number of developed inflorescences, fertile shoots, and calculating the absolute fertility coefficient (AFC) and relative fertility coefficient (RFC). The fertile shoot coefficient (FS%) and the two fertility coefficients provide a measure of the production potential and adaptability of the varieties according to ecopedoclimatic conditions.

THE TECHNOLOGICAL POTENTIAL OF THE STUDIED GENOTYPES

Production Elements of the Studied Varieties

The initial productivity of grapevines refers to the number of grapes formed after fruit set, while the real productivity indicates the number of grapes that reach full maturity. The evaluation is conducted through the absolute (API) and relative (RPI) productivity indices, calculated based on the average weight of the grapes and the fertility coefficients. Monitoring grape ripening begins at véraison and involves periodic sampling to assess the physico-chemical and mechanical parameters, determining the optimal time for harvest.

Physicochemical Composition of Grapes

The determination of the physical and chemical composition of grapes involves analyzing 100 berries to assess their weight, volume, skin weight, number and weight of seeds, as well as pulp weight.

These parameters influence the quality of the must and the organoleptic profile of the wine. The concentration of sugars and total acidity are important indicators of grape maturity and the potential alcoholic content of the wine, while the glucoacidometric index and pH provide an assessment of quality and aromatic balance.

Mechanical Evaluation of Grapes at Harvest

The mechanical evaluation of grapes at harvest includes analyzing the mass, volume, average number of berries, and their weight to determine the uniformity and quality of the production.

Technological Indices of Grapes at Harvest

Technological indices, such as the berry index and composition index, provide a synthesis of the structure and quality of the grapes, which are essential for the technological viability of the harvest. This integrated approach facilitates the monitoring of grape maturation and supports decisions regarding the optimal harvest timing, thereby maximizing the qualitative and quantitative potential of the production (Cichi, D. D. 2015. *Ghid Ampelografic*. Edit. Ceres, Bucharest, pp. 1-300).

In the continuation of the analytical approach, suggestive images will be attached to illustrate the procedural steps specific to each parameter followed in the study. These visual representations will contribute to a better understanding of the dynamics of evaluating the technological potential of grapes, facilitating a rigorous correlation between the empirical data and the morphological, structural, and biochemical variables analyzed. From the five grape varieties studied, a single representative white wine grape variety, namely "*Ardeleanca*," was selected. These illustrations will highlight the complex relationship between productivity indices, physicochemical composition, and the sensory characteristics of the wines, thus providing an integrated framework for interpreting the results and optimizing the technological processes of winemaking. This visual approach will significantly support future research efforts in viticulture and oenology, serving as a valuable tool for deepening the understanding of ecopedoclimatic interactions and their impact on wine quality.

Illustrative images will be inserted to demonstrate the step-by-step procedural approach, showcasing the methods and stages through which the results from the tables “Grape Ripening Dynamics for the Genotypes Studied in the 2023-2024 Growing Season,” “Physico-Chemical Composition of 100 Berries,” “Mechanical Analysis of Grapes at Harvest,” and “Technological Indices of Grapes at Harvest” were obtained. These visual representations will provide a clear understanding of how the data were analyzed and the results achieved, ensuring a comprehensive interpretation.

Fig. 21. Grape weight

Fig. 22. Grape volume (ml)

Fig. 23. Berry index

Fig. 24. Average berry weight

Fig. 25. Weight of a berry (g)

Fig. 26. Weight of 100 berries (g)

Fig. 27. Volume of 100 grains (cm³)

Fig. 28. Weight of skin (g)

Fig. 29. Weight of Seeds (g)

Fig. 30. Basic analytical parameters

Fig. 31. Sugars (Brix)

Fig. 32. Tartaric Acid (g/l)

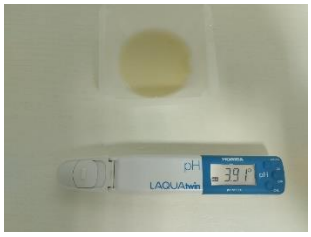

Fig. 33. pH

RESULTS AND DISCUSSIONS

The data obtained from the evaluation of the fertility characteristics of the grapevine varieties, including the absolute fertility coefficient (AFC), the relative fertility coefficient (RFC), and the percentage of fertile shoots (FS%), will be presented in the form of a comprehensive table.

This table will highlight significant differences between the studied genotypes, facilitating a clear interpretation of the phenotypic and agrobiological variations, thus emphasizing the distinct potential of each variety in relation to the specific ecopedoclimatic conditions of the Ștefănești Vineyard.

Additionally, the differences between the values obtained for these parameters will be graphically represented in the form of a chart, providing supplementary visualization that will allow for a more detailed comparative analysis of the agricultural potential of each variety.

The results obtained in the table above highlight a notable variability among the studied varieties regarding fertility parameters. Thus, *Galbenă uriașă* stands out

by a high total number of shoots (16 shoots per vine) and a percentage of fertile shoots of 87%, giving it an absolute fertility coefficient (AFC) of 1.71.

Table 1

MAIN FERTILITY CHARACTERISTICS OF THE STUDIED GENOTYPES

Genotype Variety	Total Number of Shoots per Vine	Number of Fertile Shoots per Vine	Fertile Shoot Coefficient (FS) %	Number of Inflorescences	Fertility Coefficients	
					RFC	AFC
1. Ardeleaca	12	11	91	18	1.5	1.6
2. Coada oilor	12	10	83	14	1.16	1.4
3. Galbenă uriașă	16	14	87	24	1.5	1.71
4. Gordan	11	8	72	13	1.18	1.62
5. Coarnă neagră	14	8	57	10	0.71	1.25

This suggests a superior productive potential and an excellent adaptability to the ecopedoclimatic conditions of the Ștefănești Vineyard. On the other hand, *Coarnă neagră* shows the lowest fertile shoot coefficient (57%) and a relative fertility coefficient (RFC) of 0.71, reflecting more modest productivity. This may indicate that this variety is optimally suited for producing grapes intended for fresh consumption rather than for intensive viticulture.

In the continuation of the paper, Table 2 will be included to clearly highlight the relative and absolute productivity indices (RPI and API), providing a synthetic representation of the correlations between fertility coefficients and the average weight of grapes at full maturity, according to the described methodology.

Table 2

PRODUCTION ELEMENTS OF THE STUDIED VARIETIES

Genotype/ Variety	Average grape weight (g)	Productivity indices		Number of grapes/ vine
		RPI	API	
1. Ardeleaca	299.60	449.40	479.36	17
2. Coada oilor	219.33	254.42	307.06	11
3. Galbenă uriașă	622.19	933.28	1063.94	20
4. Gordan	242.14	285.72	392.27	12
5. Coarnă neagră	311.83	221.39	389.79	10

The results analyzed in Table 2 reveal that the *Galbenă uriașă* variety stands out with a notably higher average grape weight (622.19 g), coupled with notably high relative and absolute productivity indices (RPI: 933.28; API: 1063.94), as well as a maximum number of clusters per vine (20). This indicates exceptional agronomic potential and optimal adaptability to the ecopedoclimatic conditions of the Ștefănești Vineyard. In contrast, the Coada oilor and Gordan varieties, while exhibiting more modest average weights and productivity indices, reflect moderate viability. The Coarnă neagră variety, with an average weight of 311.83 g and 10 grapes per vine, highlights limited productivity but with potential for fresh consumption due to distinctive organoleptic characteristics.

In the continuation of the paper, the detailed content related to the evaluation of the technological potential of the grapes, which includes the analysis of ripening dynamics, physicochemical composition, mechanical assessment, and technological indices of the grapes at harvest, is systematically presented in the following tables.

Table 3

DYNAMICS OF GRAPE RIPENING IN THE STUDIED GENOTYPES DURING THE 2023-2024 GROWING SEASON

Genotype/ Variety	Sample Collection Date	Sample	Basic Analytical Parameters					
			Average Weight of 100 Berries (g)	Must Temperature (ºC)	Sugars (g/l)	Tartaric Acid (g/l)	Gluco-Acidity Index	pH
1. Ardeleaca	02/09/2024	1	134.71	27.30	125.80	9	13.98	3.33
	16/09/2024	2	127.91	27.00	138.55	8.3	16.69	3.40
	23/09/2024	3	147.34	27.00	154.48	7.1	21.76	3.41
2. Coada oilor	02/09/2024	1	134.26	26.80	155.54	5.9	26.36	3.81
	16/09/2024	2	157.70	27.00	183.15	5.9	31.04	3.84
	23/09/202	3	126.23	26.90	193.77	5.3	36.56	3.91
3. Galbenă uriașă	02/09/2024	1	300.93	25.80	55.71	6.4	8.70	3.76
	16/09/2024	2	281.08	25.70	108.81	6.2	17.55	3.77
	23/09/2024	3	261.72	26.20	147.04	5.7	25.80	3.86
4. Gordan	02/09/2024	1	285.00	27.00	132.18	7.6	17.39	3.34
	16/09/2024	2	139.85	27.00	147.04	7.5	19.61	3.40
	23/09/2024	3	131.78	27.00	187.40	6.7	27.97	3.77
5. Coarnă neagră	02/09/2024	1	280.27	26.10	135.36	5.4	25.07	3.89
	16/09/2024	2	244.80	26.20	151.29	5.2	29.09	4.02
	23/09/2024	3	263.27	26.10	154.48	5.1	30.29	4.10

These provide a clear and concise representation of the data obtained for the studied genotypes during the 2023-2024 growing season. In this regard, the following tables are included: “Dynamics of Grape Ripening in the Studied Genotypes during the 2023-2024 Growing Season,” “Physicochemical Composition of 100 Berries,” “Mechanical Analysis of Grapes at Harvest,” and “Technological Indices of Grapes at Harvest.” These tables synthesize the essential parameters that contribute to a comprehensive evaluation of the maturation stage and technological potential of the analyzed varieties.

The interpretation of the data in Table and Figure 3 illustrates the dynamics of grape ripening for five native varieties, sampled at three stages. The varieties "Galbenă uriașă" and "Coarnă neagră" show the highest initial weight values, although this decreases slightly throughout the ripening process. The sugar content consistently increases for all varieties, with "Coada-oilor" having the fastest accumulation, indicating a high potential for alcoholic wines. Acidity, measured by tartaric acid, decreases as the grapes mature, with "Coarnă neagră" and "Coada-oilor" recording the lowest final values. The gluco-acidity index and pH increase steadily, indicating favorable ripening conditions for vinification. The varieties "Coada-oilor" and "Galbenă uriașă" stand out for their quality wines, while "Ardeleanca" and "Gordan" provide technological consistency.

Table 4

PHYSICOCHEMICAL COMPOSITION OF 100 BERRIES

Genotype/ Variety	Sample	Weight of 100 Berries (g)	Volume (cm^3)	Number of Seeds	Weight of Seeds (g)	Weight of Skins (g)	Weight of Pulp (g)
1.Ardeleaca	1	134.71	1.25	210	5.75	9.45	119.51
	2	127.91	1.20	190	5.82	13.86	108.23
	3	147.34	1.40	270	7.50	12.50	127.34
	Average	136.65	1.28	223	6.36	11.94	118.36
2.Coada oilor	1	134.26	1.25	220	6.40	11.00	116.86
	2	157.70	1.45	230	6.90	10.90	139.90
	3	126.23	1.20	200	5.80	6.80	113.63
	Average	139.40	1.30	216	6.37	9.57	123.46
3.Galbenă uriașă	1	300.93	3.10	210	8.50	8.70	283.73
	2	281.08	2.90	220	7.60	11.30	262.18
	3	261.72	2.50	130	5.20	11.20	245.32
	Average	281.24	2.83	186	7.10	10.40	263.74
4.Gordan	1	285.00	1.55	160	5.90	9.20	269.90
	2	139.85	1.30	230	6.20	14.00	119.65
	3	131.78	1.25	210	6.00	11.90	113.88
	Average	185.54	1.37	200	6.03	11.70	167.81
5.Coarnă neagră	1	280.27	2.70	290	9.10	8.20	262.97
	2	244.80	2.35	270	8.70	8.00	228.10
	3	263.27	2.55	232	7.70	8.45	247.12
	Average	262.78	2.53	264	8.50	8.22	246.06

The interpretation of the data in Table 4 reveals a detailed analysis of five grapevine varieties, focusing on the evaluation of morphological and structural parameters, with an emphasis on berry weight, their volume, the number and weight of seeds, as well as the proportion of different structural components (skins and pulp).

The "*Galbenă uriașă"* and "*Coarnă neagră*" varieties are distinguished by their large berry sizes, with average weights of 100 berries at 281.24 g and 262.78

g, respectively, indicating a high potential productivity. In contrast, the "*Ardeleanca*" and "*Coada oilor"* varieties have lower but relatively constant average weights, suggesting production stability.

Structurally, "*Galbenă uriașă*" shows a high proportion of pulp (263.74 g), suggesting an increased yield in winemaking processes, while "*Coarnă neagră*" balances pulp weight (246.06 g) with a higher number of seeds, which may influence the sensory characteristics of the wine. "*Gordan*" has a significant variability in berry sizes and a lower pulp content, suggesting a possible different adaptation to ecopedoclimatic conditions. Overall, the dynamics of these parameters reflect the adaptability of the varieties to local conditions, providing valuable insights for optimizing the production and quality of wine obtained from these native varieties.

The results presented in Table 5 indicate a significant variability among the analyzed grapevine varieties, both in terms of grape structure and berry composition. The "*Galbenă uriașă*" variety stands out by the highest weight and volume of grapes, associated with a high proportion of berries and a substantial pulp content, suggesting a high yield and increased efficiency in must production. In contrast, "*Coarnă neagră*" has a moderate grape weight but a remarkably high berry proportion (90.15%), providing it with a superior balance between structural components and a high enological potential due to the considerable weight of both the pulp and the skin.

The "*Ardeleanca*" and "*Coada oilor*" varieties demonstrate lower average grape weights; however, they offer good consistency between the structure of the berries and the clusters, indicating a stable adaptability to climatic conditions. The "Gordan" variety, although having a smaller grape weight, shows a similar balance in berry composition, maintaining a consistent proportion of pulp and seeds, suggesting a steady potential for wine production.

In conclusion, the observed differences between varieties reflect the adaptability and distinct potential of each genotype for viticulture, with "*Galbenă uriașă*" and "*Coarnă neagră"* being notable for their high yields, while "*Ardeleanca*" and "*Gordan*" are recognized for their structural stability.

The results presented in Table 6 indicate marked differences between genotypes, highlighting the adaptability of each variety to the production of specific wines. *Ardeleanca* and *Gordan* demonstrate a balance between grapes and berries, indicating a stable and uniform structure, ideal for balanced wines. *Coada-oilor* stands out with a higher composition index, suggesting a greater accumulation of pulp, suitable for aromatic and rich wines. *Galbenă uriașă* and *Coarnă neagră* are distinguished by high berry composition index values, reflecting a significant accumulation of both pulp and skin, making these varieties ideal for concentrated wines with an intense sensory profile.

The obtained results confirm the hypothesis formulated in the introduction, demonstrating a differentiated adaptability of the native grapevine varieties to the specific ecopedoclimatic challenges of the Ștefănești Vineyard, Argeș. The Galbenă uriașă and Coarnă neagră varieties stand out for their superior productivity, manifested by high grape weights and favorable composition indices, suggesting an excellent capacity to adapt to climatic variability.

Table 5

MECHANICAL ANALYSIS OF GRAPES AT HARVEST

Genotype/ Variety	Sample	Grape		Grape Structure					Weight of a Berry (g)	Weight of Pulp (g)	Weight of Skin (g)	Weight of Seeds (g)
				Berries			Clusters (Rachis)					
		Grape Weight (g)	Grape Volume (ml)	Weight (g)	Number	%	Weight (g)	%				
1. Ardeleanca	1	285.89	250.00	266.06	242	93	19.83	6.94	1.27	229.29	22.86	13.91
	2	373.27	320.00	333.01	296	89	40.26	10.79	1.32	274.77	41.02	17.22
	3	239.64	200.00	212.78	171	88	26.86	11.21	1.31	178.61	21.37	12.8
	Average	299.60	256.67	270.62	236	90.09	28.98	9.64	1.30	227.56	28.42	14.64
2. Coada oilor	1	222.64	200.00	196.11	155	88	26.53	11.92	1.40	169.14	17.05	9.92
	2	223.50	180.00	200.32	133	90	23.18	10.37	1.56	176.66	14.49	9.17
	3	211.84	190.00	188.50	159	89	23.34	11.02	1.46	168.47	10.81	9.22
	Average	219.33	190.00	194.98	149	89.00	24.35	11.10	1.47	171.42	14.12	9.44
3. Galbenă uriașă	1	719.10	500.00	596.43	241	82.94	122.67	17.06	2.68	554.99	20.96	20.48
	2	668.94	555.00	469.30	190	70.16	199.64	29.84	2.91	433.39	21.47	14.44
	3	478.52	450.00	412.84	179	86.27	65.68	13.73	2.60	383.50	20.04	9.30
	Average	622.19	501.67	492.86	203	79.79	129.33	20.21	2.73	457.29	20.82	14.74
4. Gordan	1	270.90	250.00	243.46	176	89.87	27.44	10.13	2.01	216.89	16.19	10.38
	2	266.39	270.00	242.75	202	91.13	23.64	8.87	1.55	201.95	28.28	12.52
	3	189.13	170.00	167.75	137	88.70	21.38	11.30	1.34	143.23	16.30	8.22
	Average	242.14	230.00	217.99	171	89.90	24.15	10.10	1.63	187.36	20.26	10.37
5. Coarnă neagră	1	339.42	305.00	312.08	116	91.95	27.34	8.05	2.89	292.02	9.51	10.55
	2	319.24	300.00	266.26	112	83.40	52.98	16.60	2.86	247.56	8.96	9.74
	3	276.82	255.00	263.27	100	95.11	13.55	4.89	3.04	247.12	8.45	7.70
	Average	311.83	286.67	280.54	109	90.15	31.29	9.85	2.93	262.23	8.97	9.33

Table 6

TECHNOLOGICAL INDICES OF GRAPES AT HARVEST

Genotype/ Variety	Sample	Grape Cluster Composition Index	Berry Index	Berry Composition Index
1. Ardeleaca	1	13.42	79.00	6.24
	2	8.27	98.00	4.72
	3	7.92	65.00	5.23
	Average	9.87	80.67	5.39
2. Coada oilor	1	7.39	74.00	6.27
	2	8.64	70.00	7.47
	3	8.08	73.00	8.41
	Average	8.04	72.33	7.38
3. Galbenă uriașă	1	4.86	38.00	13.39
	2	2.35	32.00	12.07
	3	6.29	36.00	13.07
	Average	4.50	35.33	12.84
4. Gordan	1	8.87	61.00	8.16
	2	10.27	83.00	4.95
	3	7.85	79.00	5.84
	Average	9.00	74.33	6.32
5. Coarnă neagră	1	11.41	35.00	14.56
	2	5.03	39.00	13.24
	3	19.43	39.00	15.30
	Average	11.96	37.67	14.37

These genotypes show a significant accumulation of pulp and skin, indicating a high enological potential and optimal yield for the production of concentrated wines. In contrast, Ardeleanca and Gordan demonstrate structural stability and technological consistency, reflected in a balance between the components of the grape and berry, providing them with moderate resilience against climatic changes.

The Coada oilor variety is distinguished by a higher composition index, indicating good adaptability for producing wines with a pronounced aromatic content, although with a slightly lower yield compared to other varieties. Thus, the genetic variability of these ancestral varieties offers a wide range of options for sustainable viticulture in the context of climate change, demonstrating their ability to effectively respond to local ecopedoclimatic challenges and can contribute significantly to the development of modern viticulture in Romania.

CONCLUSIONS

The summary of the main findings highlights the significant variability among the studied native grapevine varieties in the Ștefănești Vineyard, emphasizing their agrobiological and technological performances. The *Galbenă uriașă* variety stands out for its exceptional productivity, exhibiting the highest average grape weight and favorable fertility indices, making it ideal for the production of concentrated wines. Although *Coarnă neagră* displays moderate productivity, it possesses distinctive organoleptic characteristics that recommend it for fresh consumption. In contrast, the *Ardeleanca* and *Gordan* varieties have demonstrated structural stability, providing them with consistent potential under varying environmental conditions,

making them suitable for organic viticulture. For viticulturists interested in cultivating traditional varieties in a challenging climatic environment, it is recommended to select locally adapted varieties, such as *Galbenă uriașă* and *Coarnă neagră*, which have demonstrated good resilience and quality.

Resource management practices should focus on employing sustainable technologies, limiting chemical inputs, and promoting ecological cultivation methods. Furthermore, it is essential for viticulturists to closely monitor climatic conditions and adjust vine care techniques accordingly to their evolution.

Future research directions should include expanding studies on these varieties in other viticultural regions of Romania, considering the existing ecopedoclimatic diversity. Additionally, exploring other native varieties could provide further insights into the agronomic and qualitative potential of Romanian viticulture, contributing to the conservation of the genetic heritage and the development of innovative viticultural strategies.

ACKNOWLEDGMENT

We wish to express our profound gratitude to all those who contributed to the realization of this research. First and foremost, we extend our thanks to the co-authors, whose valuable contributions and collaboration have been essential in enhancing the quality and rigor of this work.We are especially grateful to Dr. Marioara Pușcalău, Project Director Ader 6.3.12, for her support and for facilitating the obtaining of the necessary funding for conducting this study. Additionally, we thank Dr. Dorin Ioan Sumedrea, General Director of the National Research and Development Institute for Biotechnologies in Horticultural Ștefănești, Argeș, for his continuous encouragement and contribution to the advancement of research in the field of viticulture. We also appreciate the efforts and dedication of the technical and research staff at INCDBH Ștefănești, whose work has been crucial in carrying out the experiments and collecting the data.

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