Scientific Papers. Series B, Horticulture. Vol. LXX, No. 1, 2026
Print ISSN 2285-5653, CD-ROM ISSN 2285-5661, Online ISSN 2286-1580, ISSN-L 2285-5653

FRUIT QUALITY OF SOME SWEET CHERRY (*PRUNUS AVIUM* L.) CULTIVARS IN THE CONDITIONS OF NORTH-EAST ROMANIA

Iulia MINEAȚĂ, Ionuț Vasile UNGUREANU, Iuliana Elena GOLACHE, Sorina SÎRBU, Ionel PERJU

Research Station for Fruit Growing Iași, 3 Ion Vodă cel Viteaz Str., Miroslava, Iași, Romania

Corresponding author email: ungureanu_ionut91@yahoo.ro

Abstract

The sweet cherry (Prunus avium L.) is one of the most appreciated fruit crops worldwide due to the taste, color, and nutritional value of the fruits. The present study was conducted during 2022-2024 and involved five native sweet cherry cultivars ('Alexus', 'Iașirom', 'Bucium', 'Mihailis', and 'Ștefan'), created within the Research Station for Fruit Growing (RSFG) Iași. The aim of the study was to evaluate multiple fruit quality indicators, both physical: fruit weight, length, thickness, width, fruit geometric diameter, sphericity, flesh weight and stone weight, peduncle length, firmness, and biochemical (total soluble solids, titratable acidity, and sugar-acidity ratio). If the cv. 'Andreiaș' stood out with the largest fruits in flesh weight (FlW=9.82 g), the cv. 'Ștefan' had the highest values in terms of fruit firmness (F=7.2 N), while the cv. 'Mihailis' . had the highest soluble sugar content (TSS=22.87 °Brix). All the five analyzed cultivars represent valuable phenotypic resources, with an average weight of 9.4 g and a soluble dry matter content of 21.23 °Brix.

Key words*: Prunus avium L., fruit quality, traits, physical, biochemical.*

INTRODUCTION

Among the cultivated fruit tree species, the sweet cherry (*Prunus avium* L.) finds optimal conditions in Romania to manifest its agrobiological potential. The precocity of the species, the production yield, and the lack of fruiting alternation give this fruit species a priority place in the cultivated area, holding an average area of 3,600 ha and an average production of 37,500 tons in the period 2020-2023 (FAO, 2025).

The biochemical composition, as well as the physical properties of the fruit (dimensions, color, firmness of the pulp, size of the stone) are the main criteria according to which the destination of valorization is established. The values of the physical properties, but also the biochemical composition, can fluctuate depending on the cultivar, the annual climatic conditions, and the agrotechnical measures applied (Quero-Garcia et al., 2017; Corneanu et al., 2020). The unique properties of sweet cherries influence consumer acceptance of these fruits and lead to an increased demand for them in both global and European markets, which has led to continuously increasing production (Sen et al., 2014; Szpadzik et al., 2019).

In recent years, fluctuations in the fruit production of this fruit species have been observed; new cultivars have appeared with an increase in the season, and modern cultivation techniques have been implemented (Schuster et al., 2014). However, as highlighted in similar research, currently, special interest should be given to the quality of the fruit to the detriment of the quantity, because this is a main factor, in addition to the regularity of the production yield, that determines the profitability of sweet cherry cultivation (Vignati et al., 2022). Thus, external attributes such as dimensions or caliber and color determine the category in which each fruit is classified and, consequently, its price, while nutritional and gustatory parameters emphasize the consumer's perception of high quality (Ballistreri et al., 2013; Ricardo-Rodrigues et al., 2023).

The chemical composition of sweet cherries also greatly affects the sensory quality of the fruit (Fazzari et al., 2008). The sugar and other acid content, as well as the color, influence consumer acceptance of sweet cherry cultivars, as do the weight, diameter, and firmness (Serrano et al., 2009).

The objective of this study was to analyze and compare some sweet cherry cultivars of Romanian autochthonous origin regarding the fruit quality parameters, both physical and biochemical, and consequently, to identify the

most valuable ones. These sweet cherry cultivars can also serve as a basis for further research on improving sweet cherry quality in the climatic conditions of North-Eastern Romania and beyond.

MATERIALS AND METHODS

The study was conducted over three years, between 2022-2024, using as plant material five sweet cherry cultivars: 'Alexus', 'Iașirom', 'Bucium', 'Mihailis' and 'Ștefan' created and registered at the Research Station for Fruit Growing (RSFG) Iași, Romania (47°20′ N; 27°60′ E). The orchard that included the studied cultivars was established in 2010 and is organized in variants of three repetitions, with the placement of the variants in randomized blocks. The trees were grafted onto a high-vigor rootstock (*Prunus mahaleb* L.) and managed in the form of an improved vase-type crown. The experimental plantation was carried out in a semi-intensive culture system, with a planting distance of 4 × 5 m without a support and irrigation system.

The general growing conditions in the experimental area include predominantly cambic chernozem soils with good natural drainage, a pronounced temperate-continental climate, with an average annual temperature over the last 20 years of +10.2°C and total precipitation of 568.7 mm.

Meteorological conditions during the study were monitored using the FieldClimate system, a specialized equipment for monitoring the microclimate in the crop area and consisting of a set of meteorological indicators for measuring and transmitting data from the crop areas served to the central receiving station. The average values were compared with a database of the unit, as a multi-annual reference value for the period 1970-2020.

Sweet cherry samples were collected at full maturity from several areas of the crown. For each cultivar, 3 replicates (30 fruits each) were performed annually (n=3) and used for physicochemical analyses.

The following physical parameters were studied: fruit weight (FW), fruit length (FL), fruit width (FWD), fruit thickness (FT), fruit geometric diameter (FGD), stone weight (SW), sphericity (Ø), flesh weight (FlW), peduncle length (LP) and firmness.

Geometric diameter (mm) = $[(FL \times FWD \times FT)^{0.333}]$

Sphericity (mm^2) = (FGD/FL)

Flesh weight (g) = (FW − SW)

Physical parameters regarding fruit and stone weight (g), diameter (mm) and peduncle dimensions (mm) were determined by weighing using an analytical balance with an accuracy of 0.01 g Radwag WLC C/2 (RADWAG Development Studio, Radom, Poland) and a 0.02 mm digital caliper Luumytools LT15240 (LUMY TOOLS TRANS SRL, Suceava, Romania).

Fruit firmness (F) was determined using the Fruit Hardness Tester ML-41050 (STEP Systems GmbH, Nuremberg, Germany) as the force required to deform the fruit by 3 mm. The determinations were performed twice on each fruit, in the horizontal and vertical planes, and the resulting fruit firmness value was expressed in newtons.

Total soluble solids (TSS) were determined refractometrically using a Hanna Instruments model HI96800 digital refractometer (Woonsocket, RI, USA). The results were expressed in Brix and reflect the sugar content of the fruits, along with other soluble organic acids, minerals, and amino acids. (Ricardo Rodrigues et al., 2023). Titratable acidity (TA) was determined by homogenizing the samples with distilled water and titrating with 0.1 N NaOH until reaching a pH of 8.1. The results were obtained using the formula and expressed in g malic acid 100 g^{-1}.

TA (%malic acid) = (V × N × 100 ×0.0067)/m, where N is the normality of NaOH, V is the volume of NaOH (mL) used in the titration, m is the sample weight (g), and 0.0067 is the conversion factor for malic acid. The values are expressed in g malic acid 100 g^{-1} (Hayaloglu and Demir, 2016).

The TSS/TA ratio, expressed as Brix/g malic acid per 100 g^{-1} is a good indicator of the sweetness and, consequently, the degree of ripeness of the fruit for consumption (Chockchaisawasdee et al., 2016).

The data were interpreted and statistically processed using the Duncan multiple range test at $p \leq 0.05$ and to estimate the relationship between the analyzed and monitored indices, the Pearson correlation coefficient (r^2) was also calculated at $p \leq 0.05$. Depending on the mean value of the results, the standard deviation

(STDEV) and the coefficient of variation (COVAR) were also calculated.

RESULTS AND DISCUSSIONS

Weather conditions are extremely important for fruit crops, especially from a production perspective (Blanco et al., 2020).

The climatic data obtained during the study years are presented in Table 1 as average values and frame the climatic regime in the NE area of Romania in the context of global warming through the increase in the average annual temperature and an abnormal distribution of precipitation and/or major deficit (Chmielewski and Götz, 2016).

Table 1. Monthly temperature (°C) and precipitation (mm) in the studied years (RSFG, 2022-2024)

Period	Air temperature (℃)			Precipitation (mm)		
	av.	M.a	Dev	sum	M.a	Dev.
I	1.1	-3.3	4.4	13.9	28.9	-15.0
II	4.2	-1.5	5.7	14.8	27.4	-12.6
III	4.8	3.1	1.7	44.8	28.1	16.7
IV	10.9	10.3	0.6	46.8	40.3	6.5
V	16.3	16.1	0.2	46.0	52.5	-6.5
VI	21.6	19.4	2.2	45.7	75.1	-29.4
VII	23.5	21.3	2.2	55.7	69.2	-13.5
VIII	23.2	20.5	2.7	59.6	57.6	2.0
IX	16.3	16.3	0.0	60.1	40.8	19.3
X	12.4	10.1	2.3	25.3	34.4	-9.1
XI	5.1	4.0	1.1	48.5	34.6	13.9
XII	1.8	-0.9	2.7	22.8	28.9	-6.1
Av./ Sum	11.8	9.6	+2.2	484.0	517.8	-33.8

The evolution of air temperature was similar in the study years but increasing as an average compared to the multiannual average in all months, by +2.2°C.

Although the total amount of precipitation was sufficient in terms of the annual average, with a deficit of -33.8 mm, its distribution was uneven throughout the growing season, with abundant amounts recorded at phenological stages when they represent a risk for the cherry crop in achieving pollination (March and April).

The physical characteristics of the fruit, stone, and peduncle length are given in Table 2. Fruit weight depends on the crop load (Goncalves et al., 2006; Usenik et al., 2010) and the stage of fruit maturity (Usenik et al., 2008; Serrano et al.,2009).

In the study, the average fruit weight ranged from 8.7 g ('Mihailis') to 10.2 g ('Alexus'), and a length from 20.06 mm ('Mihailis') to 27.99 mm ('Ștefan').

Research carried out on cherry cultivars from NE Romania (Corneanu et al., 2020; Perju et al., 2024) highlights smaller fruit sizes belonging to the local assortment created within RSFG Iași, ranging between 6.1 g and 8.7 g.

The 'Iașirom' and 'Ștefan' cultivars are found in the study conducted by Corneanu et al., 2020, where, under the climatic conditions of 2015-2018, they recorded an average weight of 6.4 g ('Iașirom') and 8.2 g ('Ștefan'), lower values compared to the present study.

Sphericity ranged between 0.8 ('Ștefan') and 1.03 mm^2 ('Mihailis') in the studied cultivars, and the weight of the pulp, the edible part of the sweet cherries, was on average 9.07 g.

Firmness is also an important attribute that influences the quality of a fruit (Table 3), and for the cherry cultivars in this case, it had values ranging from 3.67 ('Mihailis') to 7.23 N ('Ștefan'). A large study conducted on 24 sweet cherry cultivars grown in Italy (Ballistreri et al., 2013) notes that firmness in cherries can range from 3.25 ('Bigarreau Moreau') to 27.00 N ('Minnulara'). According to Pereira et al., 2020 the firmer and larger the fruits, the more they are affected by cracking than smaller fruits with soft pulp.

The biochemical properties of total soluble solids content and acidity are presented in Table 3. The TSS content exceeded the value of 20°Brix in all cultivars, with a maximum of 22.87°Brix in the 'Mihailis' cultivar, while TA values ranged from 0.65 ('Iașirom') to 1.06 mg/100 g^{-1} malic acid ('Mihailis').

Table 2. The physical parameters of the fruits in the studied sweet cherry cultivars (RSFG, 2022-2024)

Cultivar	FW	FL	FT	FWD	FGD	ø	FlW	SW	LP
	(g)	(mm)	(mm)	(mm)	(mm)	(mm^2)	(g)	(g)	(mm)
Alexus	10.19 [a]	26.55 [b]	25.28 [a]	21.93 [a]	24.42 [a]	0.92 [bc]	9.82 [a]	0.37 [a]	36.00 [a]
Iașirom	9.47 [ab]	25.34 [b]	23.95 [a]	22.36 [a]	23.77 [b]	0.94 [ab]	9.13 [ab]	0.33 [a]	34.67 [a]
Bucium	9.07 [b]	26.66 [b]	25.34 [a]	20.31 [b]	23.86 [b]	0.90 [bc]	8.73 [b]	0.34 [a]	37.33 [a]
Mihailis	8.73 [b]	20.06 [c]	20.41 [b]	21.72 [a]	20.65 [c]	1.03 [a]	8.40 [b]	0.33 [a]	36.33 [a]
Ștefan	9.62 [ab]	27.99 [a]	24.45 [a]	22.07 [a]	24.64 [a]	0.88 [c]	9.29 [ab]	0.33 [a]	38.33 [a]
Average	9.41	25.32	23.88	21.68	23.47	0.93	9.07	0.34	36.53
Min	8.73	20.06	20.41	20.31	20.65	0.88	8.40	0.33	34.67
Max	10.19	27.99	25.34	22.36	24.64	1.03	9.82	0.37	38.33
STDEV	0.55	3.09	2.03	0.80	1.62	0.06	0.54	0.02	1.39
COVAR	5.88	12.19	8.50	3.69	6.88	6.29	5.97	4.86	3.80

[1]fruit weight (FW); fruit length (FL); fruit thickness (FT); fruit width (FWD); fruit geometric diameter (FGD); sphericity (Ø); flesh weight (FlW); stone weight (SW); peduncle length (LP).
[2]different letters after the number correspond with statistically significant differences for p 5% - Duncan test.

The biochemical properties of the total soluble substances content and acidity are presented in Table 3. The TSS content exceeded the value of 20.0°Brix in all cultivars, with a maximum of 22.87°Brix in the Mihailis cultivar, while TA values ranged from 0.65 ('Iașirom') to 1.06 mg /100 g^{-1} malic acid ('Mihailis').
The TSS/TA ratio of the Romanian studied cultivars had values ranging between 21.56 ('Mihailis') and 31.02°Brix/mg/100 g^{-1} ('Iașirom'), a standard deviation of 3.98 and a coefficient of variation COVAR of 14.89. All fruit quality parameters analyzed in the study were correlated to establish the degree of interdependence between them (Table 4). The Pearson correlation values of the quality profile of the analyzed cherries reflect a predominantly strong correlation ($p < 0.05$) with more than 18 statistically significant values.

Table 3. Fruit quality of the studied sweet cherry depending on the cultivar (RSFG, 2022-2024)

Cultivar	Firmness	TSS	TA	TSS/TA
	(N)	(°Brix)	(mg /100 g^{-1})	(°Brix/ mg /100 g^{-1})
Alexus	5.70 [b]	21.27 [bc]	0.72 [cd]	29.89 [ab]
Iașirom	5.73 [b]	20.13 [c]	0.65 [d]	31.02 [a]
Bucium	5.93 [b]	20.17 [c]	0.74 [c]	27.18 [b]
Mihailis	3.67 [c]	22.87 [a]	1.06 [a]	21.56 [d]
Ștefan	7.23 [a]	21.73 [ab]	0.91 [b]	23.91 [cd]
Average	5.65	21.23	0.82	26.71
Min	3.67	20.13	0.65	21.56
Max	7.23	22.87	1.06	31.02
STDEV	1.28	1.15	0.17	3.98
COVAR	22.60	5.40	20.62	14.89

[1]total soluble solids (TSS); titrable acidity (TA); sugar-acidity ratio (TSS/TA).
[2]different letters after the number correspond with statistically significant differences for p 5% - Duncan test.

Total insignificant correlations were obtained predominantly between the physical dimensions of length, width, geometric diameter, and sphericity.

Table 4. Correlation matrix between the sweet cherry fruits characteristics

	FL	FT	FWD	FGD	Ø	FlW	SW	F	TSS	TA
FW	0.674*	0.680*	0.426ns	0.774**	-0.564*	1.000***	0.723**	0.571*	-0.265ns	-0.571*
FL		0.936***	-0.071ns	0.984***	-0.989***	0.683*	0.198ns	0.958***	-0.612*	-0.614*
FT			-0.238ns	0.942***	-0.921***	0.682*	0.402ns	0.798**	-0.749**	-0.782**
FWD				0.046ns	0.190ns	0.434ns	0.064ns	0.051ns	0.269ns	0.021ns
FGD					-0.948***	0.782**	0.302ns	0.922***	-0.638*	-0.700**
Ø						-0.573*	-0.106ns	-0.955***	0.614*	0.559*
FlW							0.708**	0.585*	-0.269ns	-0.572*
SW								-0.031ns	-0.053ns	-0.397ns
F									-0.484ns	-0.439ns
TSS										0.914***

[1]fruit weight (FW); fruit length (FL); fruit width (FWD); fruit thickness (FT); fruit geometric diameter (FGD); flesh weight (FlW); stone weight (SW) sphericity (Ø); firmness (F); total soluble solids (TSS); titrable acidity (TA);
[2]***: high significant correlation; **: distinct significant correlation; *: significant correlation at $p < 0.05$; ns: not significant correlation;

CONCLUSIONS

In the research conducted between 2022–2024, the five native sweet cherry genotypes created at RSFG Iași presented significant variability from a biometric and biochemical point of view.

In this study, fruit quality parameters and chemical attributes of the sweet cherry cultivars (*P. avium* L.) created and cultivated at RSFG Iași (Romania) were evaluated. The research results showed variability between cultivars in terms of their physico-chemical characteristics.

Quantitatively, the 'Mihailis' cv. was found to have the highest amounts of the main compounds of total soluble solids (22.87°Brix) and titratable acidity (1.06 g malic acid·100 g^{-1}) being suitable for industrial processing.

The 'Alexus' cv. stood out for its large fruit mass (10.19 g) and high pulp content, being valuable for fresh consumption, and 'Ștefan' presented the highest pulp firmness (7.23 N), which gives it superior resistance to handling and transport.

The results confirm the high potential of native sweet cherry creations for the production of high-quality fruits, adapted to current climatic conditions characterized by increasing average annual temperatures.

ACKNOWLEDGEMENTS

This research work was carried out with the support of the Thematic Plan on the Implementation of the 'A.S.A.S. Strategy on Research-Development-Innovation in Fruit Growing' for the period 2021–2027, research topic: 1.1. Maintaining and exploiting fruit biodiversity.

REFERENCES

Ballistreri, G., Continella, A., Gentile, A., Amenta, M., Fabroni, S., & Rapisarda, P. (2013). Fruit quality and bioactive compounds relevant to human health of sweet cherry (*Prunus avium* L.) cultivars grown in Italy. *Food Chemistry*, *140*(4), 630-638.

Blanco, V., Blaya-Ros, P. J., Torres-Sánchez, R., & Domingo, R. (2020). Influence of regulated deficit irrigation and environmental conditions on reproductive response of sweet cherry trees. *Plants*, *9* (1), 94. https://doi.org/10.3390/plants9010094 .

Chmielewski, F. M., & Götz, K. P. (2016). Performance of models for the beginning of sweet cherry blossom under current and changed climate conditions. *Agricultural and Forest Meteorology*, *218*, 85-91.

Chockchaisawasdee, S., Golding, J. B., Vuong, Q. V., Papoutsis, K., & Stathopoulos, C. E. (2016). Sweet cherry: Composition, postharvest preservation, processing and trends for its future use. *Trends in Food Science & Technology*, *55*, 72-83.

Corneanu, M., Iurea, E., & Sîrbu, S. (2020). Biological properties and fruit quality of sweet cherry (*Prunus avium* L.) cultivars from Romanian assortment. *Agronomy Research*, *18*(4), 2353–2364. https://doi.org/10.15159/ar.20.231.

Fazzari, M., Fukumoto, L., Mazza, G., Livrea, M.A., Tesoriere, L., & Marco, L.D. (2008). In Vitro Bioavailability of Phenolic Compounds from Five Cultivars of Frozen Sweet Cherries (*Prunus avium* L.)'. *Journal of Agricultural and Food Chemistry-American Chemical Society 56* (10) (ACS), pp. 3561–3568, http://dx.doi.org/10.1021/jf073506a .

Gonçalves, A. C., Campos, G., Alves, G., Garcia-Viguera, C., Moreno, D. A., & Silva, L. R. (2021). Physical and phytochemical composition of 23 Portuguese sweet cherries as conditioned by variety (or genotype). *Food Chemistry*, *335*, 127637. https://doi.org/10.1016/j.foodchem.2020.127637.

Goncalves, B., Moutinho-Pereira, J., Santos, A., Silva, A. P., Bacelar, E., Correia, C., & Rosa, E. (2006). Scion-rootstock interaction affects the physiology and fruit quality of sweet cherry. *Tree Physiology*, *26*(1), 93–104. https://doi.org/10.1093/treephys/26.1.9.

Hayaloglu, A., A., & Demir, N. (2016). Phenolic compounds, volatiles, and sensory characteristics of twelve sweet cherry (*Prunus avium* L.) cultivars grown in Turkey. *Journal of Food Science*, *81*(1), C7-C18. https://doi.org/10.1111/1750-3841.13175.

Pereira, S., Silva, V., Bacelar, E., Guedes, F., Silva, A. P., Ribeiro, C., & Gonçalves, B. (2020). Cracking in Sweet Cherry Cultivars Early Bigi and Lapins: Correlation with Quality Attributes. *Plants*, *9*(11), 1557. https://doi.org/10.3390/plants9111557.

Perju, I., Mineaţă, I., Ungureanu, I. V., Sîrbu, S., Golache, I. E., & Iurea, E. (2024). Agroproductive Evaluation Of Some Sweet Cherry Cultivars In The Pedoclimatic Conditions Of Ne Romania. *Scientific Papers. Series B. Horticulture*, *68*(1).

Quero-Garcia, J., Iezzoni, A., Pulawska, J.A., & Lang G. (2017). *Cherries: Botany, Production and Uses*. Boston, USA: CABI, Boston.

Ricardo-Rodrigues, S., Laranjo, M., & Agulheiro-Santos, A. C. (2023). Methods for quality evaluation of sweet cherry. *Journal of the Science of Food and Agriculture*, *103*(2), 463-478. https://doi.org/10.1002/jsfa.12144.

Schuster, M., Gfare, C., & Wolfram, B. (2014). New results of sour cherry breeding in Germany. *Acta Hortic*., 1020, 71–75. https://doi.org/10.17660/actahortic.2014.1020.7.

Sen, F., Oksar, R.E., Golkarian, M., & Yaldiz, S. (2014). Quality changes of different sweet cherry cultivars at various stages of the supply chain. *Notulae Botanicae Horti Agrobotanici Cluj-Napoca*, *42*(2), 501-506. https://doi.org/10.15835/nbha4229596.

Serrano, M., Díaz-Mula, H. M., Zapata, P. J., Castillo, S., Guillén, F., Martínez-Romero, D., Valverde, J. M., & Valero, D. (2009). Maturity Stage at Harvest Determines the Fruit Quality and Antioxidant Potential after Storage of Sweet Cherry Cultivars. *Journal of Agricultural and Food Chemistry*, *57*(8), 3240–3246. https://doi.org/10.1021/jf803949k.

Szpadzik, E., Krupa, T., Niemiec, W., & Jadczuk-Tobjasz, E. (2019). Yielding and fruit quality of selected sweet cherry (*Prunus avium*) cultivars in the conditions of central Poland. *Acta Scientiarum Polonorum Hortorum Cultus*, *18*(3), 117-126. https://doi.org/10.24326/asphc.2019.3.11.

Usenik, V., Fabčič, J., & Štampar, F. (2008). Sugars, organic acids, phenolic composition and antioxidant activity of sweet cherry (*Prunus avium* L.). *Food Chemistry*, *107*(1), 185–192. https://doi.org/10.1016/j.foodchem.2007.08.004.

Usenik, V., Fajt, N., Mikulic-Petkovsek, M., Slatnar, A., Stampar, F., & Veberic, R. (2010). Sweet Cherry Pomological and Biochemical Characteristics Influenced by Rootstock. *Journal of Agricultural and Food Chemistry*, *58*(8), 4928–4933. https://doi.org/10.1021/jf903755b.

Vignati, E., Lipska, M., Dunwell, J. M., Caccamo, M., & Simkin, A. J. (2022). Fruit Development in Sweet Cherry. *Plants*, *11*(12), 1531.

*** 2025, https://www.fao.org/faostat/en/#data/QCL (accesed at 15.09.2025).