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INFLUENCE OF SOIL AND CLIMATE CONDITIONS ON SOME QUALITATIVE INDICES IN SOME CULTIVARS OF *PRUNUS CERASUS*

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Abstract

The paper presents aspects related to the soil and climate conditions specific to Giarmata, Timiș County, Romania, and their influence on the main qualitative indices of five cultivars of sour cherry (Prunus cerasus): Mari timpurii, Târgu-Jiu 505, Oblacinska, Grecia 2, and Meteor. The research was carried out during 2021-2022 in a family-type plantation on a preluvosol soil type. The main indices studied were: tree vigour, fruit set degree, production, biometric elements, and fruit chemical composition. The results highlighted the following aspects: the diameter of the trunk was between 125.2-170.5 mm, the diameter of the crown was between 3.5-4.6 m per row and between 3.1-4.3 m between rows, the height of the trees was between 3.5-4.9 m, and the height of the crown was between 3.0-4.2 m. Fruit production ranged between 9.41 t/ha and 14.07 t/ha. Biometrics consisted of major diameter, minor diameter, tree height, tree size index and peduncle length. The chemical composition of the fruits was influenced by the soil and climate conditions, differing from one cultivar to another during the two study years.

Key words*: biometrics, cultivars, fruit chemical composition, Prunus cerasus, soil and climate conditions.*

INTRODUCTION

Most sour cherry cultivars originated from the species *Cerasus vulgaria* Mill. (common sour cherry) or from its hybrids with *Cerasus avium* (wild sour cherry) and *Cerasus fructicosa* Pall. (steppe sour cherry) (Mihuț, 2000; Ganopoulos et al., 2016; Rodrigues et al., 2008).

Sour cherry is a tree species of great economic importance due to the nutritional, technological, and commercial properties of its fruits, as well as the biological properties of the trees that can be used in various pedoclimatic conditions, from plain areas to submontane areas (Mihuț, 2002; Mihuț et al., 2022; Țărău et al., 2007; Radulov, 2007). In the western part of Romania, this species has adapted very well, thanks to favourable pedoclimatic conditions (Mihuț & Niță, 2018; Ianoș et al., 1997; OSPA Timișoara, 2021, 2022; Brady & Weil, 2003; Cresser, 1993). This species is found on about 6,000 ha, mostly in intensive system.

Compared to cherry, sour cherry has a greater ecological plasticity (Hillig & Iezzoni, 1988). It has low temperature requirements, and the biological threshold for bud swelling is 8ºC. Sour cherry is one of the most frost-resistant species among prunoids (-30ºC). It does well both in dry (400-500 mm of water annually) and humid regions (700-800 mm of water annually) (Parnaia et al., 1985). Having low light requirements, it can also be cultivated in north-west or north-east expositions (Mihuț & Drăgănescu, 2003).

Sour cherry, like the other fruit species, is extremely sensitive to both soil moisture excess an soil moisture lack. It bears fruit after about 3-4 years from planting, but the productivity is different, depending on the cultivar (Perez-Sanchez et al., 2008; Popescu et al., 1982).

In 1968, Olden & Nybom crossed *P. fruticosa* with *P. avium* and the resulting hybrid was very similar to *P. cerasus*, suggesting that they could be considered as the parents of the cultivated sour cherry (Beaver & Iezzoni, 1993; Hilling et al., 1988; Rodrigues et al., 2008).

Sour cherries are highly valued for consumption both fresh and in culinary preparations (Popescu et al., 1982). Research carried out over time has shown that the fruits have a beneficial effect on the human body, by regulating the acid-base balance, improving blood composition, in kidney, liver, and cardiovascular diseases, etc. (Nazari et al., 2012; Popescu, 1982). The energy value of sour cherries is about 63 kcal/100 g.

Sour cherry is commercially important, especially in the temperate climate zone (Toydemir et al., 2013). Furthermore, this culture helped develop new commercial cultivars of cherry, used as rootstocks, providing low vigour and resistant plants (Kappel et al., 2012). Many studies have been carried out to characterize genebank collections of *Cerasus* germplasm (Khadivi-Khub et al., 2012; Krahl et al., 1991; Nazari et al., 2012; Perez-Sanchez, 2010; Sánchez et al., 2008).

In many countries, the breeding material of sour cherry cultivars and traditional cultivars are compared, as they assess their performance under different climate conditions (Grafe & Schuster, 2014; Schuster et al., 2009, 2014; Siddiq et al., 2011).

Recently, some cultivars of Hungarian sour cherries were found to have functional properties that enhance the health benefits of the fruits (Papp et al., 2010; Veres et al., 2006).

On the world level, there is a tendency to increase the production of sour cherry fruits through the introduction into culture of cultivars with weaker vigour and with a higher potential (Parnaia, 1985).

FAO data (2021, 2022, 2023) show that Europe holds the largest share in world sour cherry production with 63.3%, followed by North America with 20.8%, Asia with 8.6%, and South America with about 0.6%. The major sour cherry producing countries are: Germany with 22.4%, Yugoslavia with 12.7%, Poland with 8%, and Hungary with 7.2%.

The annual production of sour cherries in our country is 6% of that of Europe, Romania ranging sixth among sour cherry producing countries (Mihuț, 2000).

The largest producer of sour cherries in Romania is Iasi County with 6,239 t, followed by the counties of Botoșani with 4,361 t, Bacău with 3,161 t, Argeș with 1,945 t, Buzău with 1,764 t, Cluj with 1,506 t, Dolj with 3,161 t, and Vâlcea with 741 t (Mihuț & Drăgănescu, 2003).

The assortment of sour cherries has continuously narrowed in recent decades, keeping a limited number of cultivars in culture, somewhat richer in Europe and poorer on other continents.

Currently, the promotion of some cultivars with small trees is being pursued to ease the work of tree care and fruit harvesting (Schuster et al., 2014). In general, the plain area of Banat, where the researched territory also falls, is part of Zone I of sour cherry distribution in Romania (Mihuț, 2000; Popescu et al., 1982).

MATERIALS AND METHODS

The researches were carried out on a family-type plantation located in the town of Giarmata (45°83' north latitude and 21°32' east longitude), Timiș County, during 2021-2022.

As part of the experiment, five cultivars of sour cherry with different periods of vegetation were researched:

- early cultivars: Mari timpurii, Târgu-Jiu 505, and Meteor;
- medium cultivars: G 2 (Grecia 2);
- late cultivars: Oblacinska.

1. The Mari timpurii cultivar is a very widespread cultivar in Romania, with medium vigour and good resistance to diseases and pests. Mocăneşti 16 is used as a pollinator.

The time of ripening of the fruits is in the middle of June.

2. The Târgu-Jiu cultivar, an autochthonous cultivar, is widespread in culture especially in the south of the country (Oltenia), which, however, has also adapted very well in Western Romania. The tree has medium vigour, it is resistant to frost and to the main sour cherry diseases: *Cocomyces hiemalis* and *Monilia*.

The ripening period is in the middle of June.

3. The Oblacinska cultivar comes from Serbia, being a self-fertile cultivar, resistant to frost and *Cocomyces* and sensitive to *Monilia.* Ripening period July 1-5.

4. The Grecia 2 (G2) cultivar, a cultivar originating in Grecia. The tree has medium vigour, and is resistant to frost and diseases.

5. The Meteor cultivar is a cultivar from the USA (the state of Minnesota) obtained in 1935 by hybridizing the Montmorency x Vladimirskaia x Subinka cultivars. It is a self-fertile cultivar, resistant to frost and cryptogamic diseases.

The ripening period is between July 12-15.

Location of the trial

The trees were planted in the spring of 2014, at 4 x 3 m, with a density of 883 trees/ha. The rootstock of the sour cherry was the frank sour cherry.

The variants of the trial are represented by five cultivars:
V1 – Mari timpurii;
V2 – Oblacinska;
V3 – Târgu-Jiu;
V4 – Meteor;
V5 – Grecia 2 (G2).
The maintenance works were those recommended by the technology in force. The formation cuts were made with few interventions, the crown being led in an improved vessel system and low bush. Phytosanitary treatments were done at the warning.
The data taken from the plantation were entered in the observation book and, based on them, the results presented in the paper were obtained.

Working Method
The progress of the fruiting phenophases was followed in the orchard, noting the moment of the beginning of each phenological phase.
The frost resistance of the flower buds was determined by the anatomical method, that is, by longitudinal sectioning of the flower buds and observing the tissues under a microscope.
Fruit production was determined by weighing the fruits per tree, then calculated for each cultivar. To calculate production per ha, it was multiplied by the density of 833 trees/ha.
Fruit biometrics was determined by detailed measurements regarding: the large diameter, the small diameter, the height, and the length of the peduncle. Within each cultivar, 50 fruits were measured, then averages were calculated for each cultivar.
Fruit acidity was determined by titration with NaOH 0.1 N, in the presence of phenolphthalein, expressed as a percentage (%) by multiplying g/kg by 0.067 malic acid equivalent.
The size index (Si) was calculated according to the formula:

$$Im = \frac{D + d + H}{3},$$

where: Im - Size index; D - large diameter; D - small diameter; H - fruit height.
% = (N x 4.25)/4-2.5,
where: N - number on the refractometer (in oBrix); 4.25 - juice density; 4 - stability coefficient; 2.5 - % of dry matter of an unsweetened nature (Scedei et al., 2021, 2023; Drăgunescu et al., 2021).
Total carbohydrate content was calculated based on soluble dry matter.
To characterize the climate conditions, the climatic data recorded and interpreted by the discipline of Agrometeorology, within the Faculty of Agriculture in Timişoara, were used (Mircov et al., 2022).

RESULTS AND DISCUSSIONS

1. Results Regarding the Pedological Conditions

The Commune of Giarmata is located on the south-eastern end of the Vinga plain, with a general northeast to southwest orientation. The Vinga plain has average altitudes between 100 and 150 m, very wide interfluves, sprinkled with depression areas, weak fragmentation, and less relief energy (Mircov et al., 2022)
From a geomorphological point of view, the town of Giarmata is in the Banato-Crişană Plain, part of the Western Plain.
From a hydrographic point of view, the researched territory is part of the Bega river basin, the Bega-Beregsău basin.
The territorial soil unit on which the experiment was carried out is of cambic chernozem, batigleyc, clay loam/clay loam type, on fine medium loessoid deposits (Munteanu & Florea, 2009; Posea, 2009).
The morphological properties of this soil indicate a moderate stage of development, characteristic of a relatively young soil, towards a soil with a certain degree of maturity (Mihuț & Niță, 2018). This soil has a slightly acidic to neutral reaction (pH of 6.4-6.8), a humus content of 3.6%, a degree of saturation in bases over 84%, and a water table at 2.5 m. Carbonates occur at more than 80 cm depth (Cca horizon), in amounts of 0.16% to 15%.
In conclusion, the soil on which the plantation is located has a medium fertility. To increase its fertility potential, agrotechnical and agrochemical measures are required to improve its physical and chemical properties.
From the wide range of soil types and subtypes in Banat, the sour cherry tree finds favourable conditions due to the favourable properties of this type of soil Mihuț et al., 2022.

2. Results Regarding Climate Conditions

Giarmata benefits from the same moderate temperate continental climate as most of Timiş County. From September to February, there were frequent intrusions of continental polar air masses coming from the east. The multiannual average temperature is 10.2ºC. The thermal characteristics of the hot season highlight the early onset and persistence of the western anticyclone, which makes the summer season start from May and continue until September. Periods of unstable weather are caused by the intermittent superimposition of colder north-westerly air masses over warm subtropical air masses. Multiannual average summer temperatures frequently exceed 20ºC.

The multiannual average temperature values, in the 5-10 cm layer, are higher by 2-4ºC, compared to those in the air.

Table 1 presents the temperatures recorded during the two years of research (2021 and 2022).

Table 1. Average monthly and annual temperatures recorded at the Timişoara Meteorological Station during 2021-2022 (Average monthly temperature ºC)

Year	Months												Mean (Sum)
	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	
2021	-0.1	-2.0	6.7	10.9	15.7	20.1	23.6	20.5	18.3	13.1	5.7	2.6	135.1
2022	-0.9	2.9	7.2	10.8	16.9	19.7	21.1	21.2	20.2	11.3	2.8	1.6	129
Multi-annual Mean	-0.5	-2.45	6.95	10.85	16.3	19.9	22.35	20.85	19.25	12.2	4.25	2.1	132.05

The absolute minimum temperature was -27.2°C on February 16, 2021, the maximum winter temperature was 17°C, and the minimum summer temperature was 9°C.

The first frost date was October 23, 2021, and the last frost date was May 12.

The sum of the temperature degrees during the researched period was: 129ºC in 2022 and 135.1ºC in 2021.

The multiannual average of temperatures during the studied period was 132.05ºC.

Table 2 shows the average temperatures for the four seasons.

Table 2. Annual average at the Timişoara Meteorological Station in the period 2021-2022

Timişoara Meteorological Station	Annual mean during2021-2022			
	Spring	Summer	Fall	Winter
	12.02	21.35	11.32	0.83

The number of sunny days over the year was 29; average annual insolation fraction is 0.4; maximum monthly insolation fraction was in July, 0.80; minimum monthly insolation fraction, in January, was 12; fraction of insolation during the vegetation period (1.III – 31.X) was 0.52. The sum of the multiannual average of the researched period was 2,195.7 hours.

The average annual precipitation recorded in the period 2021-2022 was 630.6 mm according to the data presented in Table 3.

Table 3. Amount of precipitation (mm)

Year	Months												Mean (Sum)
	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	
2021	18.1	27.7	52.2	45.5	34.9	49.8	33.8	34.5	41.0	33.2	60.8	70.5	502
2022	57.8	38.0	29.4	74.5	61.5	65.9	78.7	104.2	81.7	57.0	60.7	75.8	785.2
Multi-annual Mean	37.95	32.85	40.8	60.0	48.2	57.85	56.25	69.35	61.35	45.1	60.75	73.15	643.6

The total amount of precipitation for the period 2021-2022 was 502.0 mm in 2021, and 785.2 mm in 2022, with a multi-year average of 643.6 mm.

Regarding the relative humidity of the air, the data presented in Table 4 highlight the fact that, during the summer, there is a humidity deficit, which needs to be reduced by appropriate agrotechnical measures or supplemented by irrigation.

Table 4. Relative air humidity (%)

Year	Months												Mean
	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	
2021	82	85	82	69	60	61	62	62	88	76	81	81	74.0
2022	85	80	73	66	70	74	67	69	82	80	85	87	75.7
Multi-annual Mean	83.5	82.5	77.5	67.5	65.0	67.5	64.5	65.5	85.0	78.0	83.0	83.0	74.85

The frequency and average speed of the wind in the main directions highlight the highest share of the north-west winds (21.2%) and of those from the west (15.6%), followed by those from the south (15.1%) and from the north (12.0%).

The annual average number of days with wind speeds greater than 11 m/s was 26.8, and of those with wind speeds greater than 16 m/s was 2.6. The period of calm characterised about 20.9% of the time, the average annual frequency of calm being 40.1%.

3. Results regarding the main qualitative indices

The data were statistically analyzed by the Duncan method, the IBM SPSS statistical software was used.

Tree vigour

The vigour of the trees is given by a complex of internal and external factors, namely: the hereditary characteristics of the cultivar, the rootstock, the favourable soil, and climate conditions and, finally, the agricultural techniques applied. Figure 1 and 2 shows the results of the measurements for the five cultivars studied.

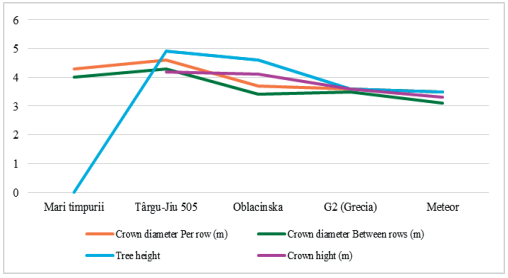

Figure 1. Crown diameter, Tree height and Crown height depending on variety

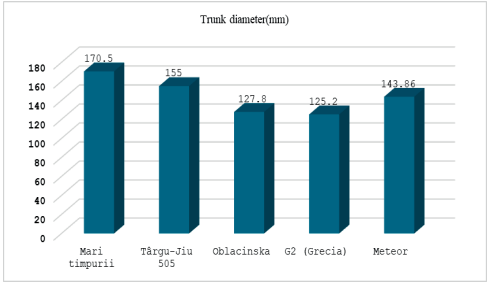

Figure 2. Trunk diameter according to variety

From the data in Figures 1 and 2, the diameter of the trunk is between 125.2 mm for the Meteor cultivar and 170.5 mm for the Mari timpurii cultivar, which confirms the fact that the rootstock used gives each cultivar a different vigour, but which is also influenced by the genetic characteristics of the respective cultivars, a fact that can also be observed following the performance of the other measurements. Thus, the diameter of the crown varies between 3.5 m per row and 3.1 m between rows for the Meteor cultivar and between 4.6 m per row and 4.3 m between rows for the Târgu-Jiu cultivar.

Fuit setting

In sour cherry, in the interval between the swelling of the buds and flowering, a series of biochemical processes and physiological transformations of an anatomical order take place inside the buds that lead to the formation of pollen grains, ovule and embryo sac. The formation of pollen grains takes place in the spring from the beginning of the swelling of the fruit buds and it lasts until the full debudding and the appearance of buds.

Flowering and setting of fruits, in sour cherry, takes place simultaneously with the leafing and is done based on reserve substances accumulated in the previous year.

For the partially self-fertile and self-sterile cultivars, it is necessary to plant them together with the pollinating cultivars.

Limiting ourselves only to the climate factor (temperature, precipitation, atmospheric humidity, and insolation) is directly related to the phenophases of development and fruiting, being largely responsible for the normal course of the annual cycle (Table 5).

Table 5. Degree of fruit setting (%)

No. crt.	Variety	2021	2022	Mediate 2021-2022
1.	Mari timpurii	25,91^{a}	28,60^{a}	27.25^{a}
2.	Târgu-Jiu 505	24,86^{a}	26,52^{a}	25.69^{a}
3.	Oblacinska	35,5^{ab}	35,8^{b}	35,65^{b}
4.	G2 (Grecia)	43,5^{b}	44,7^{c}	44,1^{b}
5.	Meteor	31^{ab}	33,5^{b}	32,25^{a}
Average		**32.15**	**33.8**	**32.98**

Means followed by the same letter do not differ statistically (Duncan test).

The research results presented in Table 5 show differences regarding this biological process. Thus, the weakest cultivar that sets the fruits (below 35%) is the Târgu-Jiu 505 cultivar, and the cultivars that set the fruits well (over 35%) are the Oblacinska, Grecia, and Meteor cultivars. In both research years, the Grecia cultivar set fruits the best, with 43.5% in the year 2021, respectively 44.7% in the year 2022. The weakest cultivar that set the fruits was the Târgu-Jiu cultivar, with 24.86% in 2021, respectively 26.52% in 2022.

The average fruit setting of cultivars was 30.01% in 2021 and 32.5% in 2022.

Sour cherry pollination is entomophilous, the pollen being difficult to release from the anthers; therefore, it is recommended to introduce beehives in the orchard.

Production

Fruit production was recorded per tree and then production per ha was calculated.

The average production per tree varied from one cultivar to another, as can be seen from Table 6.

Table 6. Fruit production (2021-2022)

Nr. crt.	The researched variety	2021		2022		Mediate 2021-2022
		kg/tree	kg/ha	kg/tree	kg/ha	
1.	Mari timpurii	16,5^{c}	13744,5^{c}	17,3^{c}	14410,^{c}9	14077,7
2.	Târgu-Jiu 505	13,7^{b}	11412,1^{b}	12,5^{a}	10412,5^{a}	11120,5
3.	Oblacinska	14,2^{b}	11828,6^{b}	14^{b}	11662^{b}	17493
4.	G2 (Grecia)	13,8^{b}	11495,4^{b}	13,4^{b}	1162,2^{b}	11328,8
5.	Meteor	11,6^{a}	9662,8^{a}	11^{a}	9163^{a}	9412,9
Mean of varieties		13.96	11,628.683	13.64	9,362.12	12,686.58

Means followed by the same letter do not differ statistically (Duncan test).

Sour cherry fruit production is between 11.0 kg/tree for the Meteor cultivar and 17.3 kg/tree for the Mari timpurii cultivar, productions that were recorded in 2022. The most productive cultivar was the Mari timpurii cultivar and the least productive, the Meteor cultivar.

The average of the cultivars over the two years was between 11.6 kg/tree in 2021 and 17.3 kg/tree in 2022. The average production over the two years was 12,686.58 kg/ha.

Fruits Biometrics

The size of the fruits, the intensity of the colour, and the length of the peduncle are elements that are of interest both for the recognition of the cultivars and for establishing their commercial and industrial processing value.

In general, above-medium to large-sized fruits are preferred, suitable for fresh consumption, and the cultivars with smaller fruits are mainly used for industrialization.

Thus, biometrics were made on more than 25 fruits of each cultivar. Following these measurements, the following were determined: the large diameter, the small diameter, and the height and thelength of the peduncle (Table 7).

From the data in Table 7, the fruits of the researched cultivars are of medium size. The large diameter being between 20.5 mm for the Mari timpurii cultivar and 17.7 mm for the Grecia 2 cultivar, and the small diameter between 19.8 mm for the Mari timpurii cultivar and 16.3 mm for the Oblacinska cultivar.

Table 7. Biometric elements of fruits (mm)

Nr. crt.	Cultivar	Diam. big mm	Diam. small mm	H. fruits mm	Size index	Long. peduncle	Quantities for consumption 1- consumption 2-industry
1.	Mari timpurii	20,5^{b}	19,8^{b}	19^{b}	19,7^{b}	15,5^{a}	1 2
2.	Târgu-Jiu 505	19,7^{b}	17,4^{a}	16,5^{a}	17,8^{ab}	49,4^{c}	1 2
3.	Oblacinska	17,9^{a}	16,3^{a}	15,5^{a}	16,5^{a}	32,3^{b}	2
4.	G2 (Grecia)	17,7^{a}	16,5^{a}	16^{a}	16,7^{a}	39,5^{b}	1 2
5.	Meteor	20^{b}	18^{a}	17,5^{b}	18,5^{b}	35,5^{b}	1 2
Cultivar Mean		19.16	17.6	16.9	17.84	34.44	-

Means followed by the same letter do not differ statistically (Duncan test).

The size index, which represents the size of the fruits, is between 19.7 mm for the Mari timpurii cultivar and 16.5 mm for the Oblacinska cultivar.

The length of the peduncle is between 49.4 mm for the Târgu-Jiu 505 cultivar and 15.5 mm for the Mari timpurii cultivar.

Chemical Composition of Fruits

The content of the fruits in various chemical substances differs from one cultivar to another, depending on the soil conditions, climate and applied agrotechnics.

From Table 8 on average over the two years of research, the dry matter is between 15.42 mg% for the Târgu-Jiu cultivar and 11.50 mg% for the Mari timpurii cultivar, with an average of 14.54 mg% in the year 2021, and 14.46 mg% in 2022, respectively.

Table 8. Chemical composition of sour cherry fruits (2021-2022)

Cultivar	Year	Dry matter (%)		Total Sugars (%)		Acidity		Sugars / Acidity
		Mean/year	Mean 2021-2022	Mean/year	Mean 2021-2022	Mean/year	Mean 2021-2022	Mean 2021-2022
Mari timpurii	2021	11.50	13.05	9.72	11.36	1.02	1.13	10.05
	2022	14.60		13.01		1.25		
Târgu-Jiu 505	2021	15.42	14.52	13.88	11.93	1.34	1.41	8.46
	2022	13.63		11.98		1.48		
Oblacinska	2021	14.92	14.71	14.35	13.63	1.53	1.64	8.31
	2022	14.50		12.91		1.75		
G2 (Grecia)	2021	14.32	14.71	12.71	13.12	1.40	1.32	9.94
	2022	15.10		13.54		1.25		
Meteor	2021	14.72	14.61	13.14	13.03	1.30	1.25	10.42
	2022	14.50		12.91		1.20		
Cultivar Mean	2021	14.54	14.56	12.95	12.90	1.25	1.35	9.56
	2022	14.46		12.86		1.45		

The content in total carbohydrates calculated based on soluble dry matter is between 11.36% in the Mari timpurii cultivar and 13.63% in the Oblacinska cultivar, the average of the cultivars being 14.59%.
The carbohydrate/acidity ratio is between 10.42% for the Meteor cultivar, 10.05% for the Mari timpurii cultivar, 8.46% for the Târgu-Jiu% cultivar, and 9.94% for the Grecia 2 cultivar, the average of the investigated cultivars being 9.56%. Cultivars with a carbohydrate/acidity ratio below 10% are less suitable for fresh consumption, as they have high acidity.
Correlating this ratio with the size and quality of the pulp, it was found that the best fruits for fresh consumption are the cultivars Mari timpurii and Târgu-Jiu 505.

CONCLUSIONS

Located in the central-northern area of Timiş county (45°83' north latitude and 21°32' east longitude), Giarmata is 11 km from Timişoara and 1.3 km from Timişoara International Airport.
From a geomorphological point of view, the area of the commune falls within the Banato-Crişană Plain, part of the Western Plain of Romania, the eastern extremity of the Tisa Plain.
The climate is moderately temperate-continental with warm summers and mild winters due to both the influences of oceanic (from the W) and Mediterranean (from the S and SW) air masses. The thermal characteristics of the hot season highlight the early onset and persistence of the western anticyclone, which makes the summer season start in May and continue until September. Periods of unstable weather are caused by the intermittent superimposition of colder north-westerly air masses over warm subtropical air masses. Multiannual average summer temperatures frequently exceed 20ºC.
The date of the first frost recorded during this period was on October 23, 2021. The date of the last frost was on May 12, 2021.
The sum of the temperature degrees during the researched period was 129ºC in 2022 and 135.1ºC in 2021.
The multi-year average of temperatures during 2021-2022 was 132.05ºC.
Regarding precipitation, the annual average was 649 l/m^2, but it is unevenly distributed. Abundant precipitations and excess moisture in the spring period, in the crop-open field system prevent seasonal work from being carried out in good conditions and at the same time hinder the processes of germination and emergence, at the same time favouring phytopathogenic attack, especially in cucumbers.
The prevailing winds are those from the northwest sector, determined by the Azores Anticyclone, with an average speed of 3.4-3.5 m/s. It is a warm and humid wind that brings the precipitations of May and June. Throughout the year, the Austrul blowing from the southwest, from the Adriatic Sea, is felt. The predominant air movement at high altitude is from west to east.
Winds blow from the north at a rate of 15.7%, from the east around 15.6%, and from the south with a frequency of 20.6%.
The wind intensity is low, and the monthly average, according to the Beaufort scale, is 2.5 m/second.
The annual average number of days with speeds greater than 11 m/s was 26.8, and with speeds greater than 16 m/s was 2.6. The calm period occupies about 20.9% of the time.
The climatic conditions and the soil in the plantation located in Giarmata commune are quite favourable for sour cherry culture.
The limiting factors that slow down the biological and physiological processes are the uneven distribution of precipitation during the year, the soil with a high clay content and the climate accidents represented by late spring frosts.
However, sour cherry cultivars have proven to be quite resistant to these conditions compared to other fruit tree species.
Regarding the vigour of the trees in the researched cultivars, they are divided into three groups:
- High vigour: Timpurii de Cluj, Mari timpurii;
- Medium vigour: Târgu-Jiu 505, Oblacinska;
- Low vigour: Meteor.

Fruit setting varies greatly from one cultivar to another. The cultivars Meteor and Gloria stand out for their good bonding.

The cultivar with a low fruit setting percentage is Târgu-Jiu 505.
Significant differences are noted between cultivars in terms of fruit production. Cultivars with good production are: Mari timpurii, Oblacinska, and Meteor.
The size of the fruit differs depending on the cultivar. It can be said that the researched cultivars have medium-sized fruits, except for the Mari timpurii cultivar, which has a large fruit.
The physico-mechanical analysis highlighted cultivars with a high proportion of pulp: Oblacinska, Mari timpurii.
In the chemical composition of the fruits, a carbohydrate/acidity ratio of over 10% was noted in the Mari timpurii and Meteor cultivars and under 10% in the Oblacinska cultivar.

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