CERCETĂRI PRIVIND EVALUAREA UNOR PARAMETRI POMOLOGICI VEGETATIVI LA UNELE SOIURI DE VIȘIN ÎN CONDITIILE ZONEI DE NORD – EST A ROMÂNIEI

ASSESSMENT OF SOME VEGETATIVE POMOLOGICAL PARAMETERS OF SOUR CHERRY CULTIVARS UNDER NORTH – EAST ROMANIAN CONDITIONS

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Abstract

The paper introduces aspects about the influence of environmental factors in 2019 – 2021 period on vegetative parameters of some sour cherry cvs. Analysing the time window between April and July (for each of the three years of study), 2019 and 2020 recorded a precipitations deficit of -71.6 mm (2019) and -86.0 mm (in 2020) in comparison with 270.0 mm representing the multiannual sum for this period, while 2021 recorded normal quantities of precipitations of 272.0 mm. The values of the trunk's section area based on the average of three years of study were between 4.6 cm² ('Erdi Ipari' cv.) and 16.3 cm² ('Erdi Bibor' cv.). The highest values for the volume of the crown were recorded in 'Dukat' (3.23 m³/tree) and 'Erdi Kordi' (2.88 m³/tree) cvs. while the lowest values were recorded in 'Erdi Bibor' (2.19 m³/tree), 'Erdi Ipari' (1.56 m³/tree) and 'Erdi Kedves' (1.55 m³/tree) cvs. The density of the trees' crown had values between 4.74 cm²/m³ ('Erdi Ipari' cv.) and 12.13 cm²/m³ ('Erdi Kedves' cv.). The estimates of the young shoots per tree and their average length over the three years of study have shown values superior than control for 'Erdi Bibor' (41 young shoots with 70.5 cm), 'Erdi Kordi' (32 young shoots with 63 cm) and 'Dukat' (18 young shoots with 85.4 cm) cvs.

Cuvinte cheie: creșteri anuale, determinări, soiuri, vișin.

Keywords: annual shoots, determinations, cultivars, sour cherry.

1. Introduction

The development of the sour cherry crop as a highly important economic fruit-growing tree species thanks to its nutritive, technological and commercial traits of the fruits and also due to its high resistance to the vegetative factors represents an important weight for fruit growing (Istrate, 2007).

Sour cherry is a fruit growing species with high ecological plasticity that is grown in all the fruit-growing areas of the country. The pedoclimatic conditions in the Iași county are favourable for sour cherry crop, except for a few years when natural disasters occurred (Grădinariu and Istrate, 2003; Sestraș, 2004).

During the vegetation period, the fruit-growing plants' water consumption is variable. Thus, the critical stages over the vegetation period when the water consumption is maximum are: tree sprouts growth, bloom and fruits growth (Milică et al., 1982; Toma and Robu, 2000; Ghena and Braniște, 2003).

The paper introduces aspects about the influence of the environment factors on the vegetative parameters of the trees belonging to the sour cherry species in 2019 – 2021 period.

2. Material and methods

The studies were performed using as research material five sour cherry cvs. from Hungary ('Erdi Ipari', 'Erdi Kedves', 'Erdi Bibor', 'Erdi Kordi', 'Dukat') planted 5 years prior to the study. The trees are grafted on mahaleb and trained as free flattened palmette. The plantation is linearly positioned, in three repetitions of 2 trees each at a distance of 3.5 x 4.0 m, resulting in 714 trees per ha. The land where the plantation can be found is in the Jijia-Bahlui Valley, where the annual average temperature was 11.4 °C in 2019, 12.1 °C in 2020 and 9.9 °C in 2021 (between January-July 2021 only) (Table1). The pruning for shaping and fructification took place during the rest period. On the row with trees, the soil was prepared with the rotary orchard tiller and between the rows, the soil is grassed. The control of diseases and pests was performed in accordance with the received warnings, using phytosanitary treatments.

Over the three years, the meteorological factors were analysed, along with tree measurements and biometric determinations (trunk's section area, tree's height, crown volume, annual twigs length and the amount of twigs on the tree, crown density).

The tree's height (H) and the length of annual twigs (LAT) were determined with the tape measure, the trunk's section area (TSA) was determined by measuring the thickness of the trunk with a calliper on two perpendicular directions 30 cm high from the grafting point (the collected data being converted in cm^2). The average volume (m^3) of the trees' crown was calculated using the Sarger method with the following formula: $V = (D + d/2)^2 \times H \times 0.416$, where: V – crown volume, D – crown diameter on the direction of the row with trees, d – average diameter of the espalier's thickness, H – trees height, 0.416 – correction coefficient (Lamureanu et al., 2013), crown density was calculated with the formula: TSA (cm^2)/volume of the crown (m^3) (Parnia and Mladin, 1995).

The experimental data was interpreted statistically by analysing the variance and using the method of multiple comparisons (Duncan test, with P 5%).

2. Results and discussions

The hereditary traits of the sour cherry species along with the climate and technology elements act simultaneously on the biological processes. The studied sour cherry cvs. showed differences in behaviour under the existing conditions. Phenologically, over the three years of study, the vegetation start (buds-swelling) took place in the first two decades of March and the budburst took place at the end of March – beginning of April. In terms of temperature, in March and the beginning of April 2019 and 2020 late spring frosts occurred when the sour cherry tree was going through the buds-swelling, budburst and bloom phenophases.

The years 2019 (451.0 mm), 2020 (448.4 mm) and 2021 (371.8 mm in the first seven months of the year) recorded a rainfall quantity below the multiannual limits (562.6 mm), resulting a deficit of 111.6 mm in 2019, 114.2 mm in 2020 and 37.1 mm between January-July 2021 (Table 1).

During the first years, the sour cherry cvs. presented a slow level of growth because of the slow restoration of the roots system after plantation. Starting with the 3rd year after the trees were planted, the growth of the aerial parts accelerated. The trunk's section area in the 5th year after the trees were planted (2021) was between 7.4 cm^2 ('Erdi Ipari' cv.) and 28.2 cm^2 ('Erdi Kordi' cv.). Analysing this parameter in comparison with the average of the three years of study, statistically, the cvs. that recorded negative differences in comparison with the variants average (12.1 cm^2) were 'Erdi Ipari' cv. (7.5 cm^2) with a significant negative difference and 'Dukat' cv. (12.0 cm^2) with a non-significant negative difference. The cvs. 'Erdi Bibor' (16.3 cm^2), 'Erdi Kordi' (15.4 cm^2) and 'Erdi Kedves' (12.2 cm^2) recorded non-significant positive differences in comparison with the variants average (Table 2).

The highest values recorded for the crown volume (V) were 3.23 m^3/tree and 2306.2 m^3/ha for 'Dukat' cv. and 2.88 m^3/tree and 2056.3 m^3/ha for 'Erdi Kordi' cv. and the lowest values were recorded in 'Erdi Bibor' (2.19 m^3/tree and 1563.7 m^3/ha), 'Erdi Ipari' (1.56 m^3/tree and 1113.8 m^3/ha) and 'Erdi Kedves' (1.55 m^3/tree and 1,106.7 m^3/ha) cvs. (Table 2, Fig. 2). It was noticed that a positive correlation does not always exist between the trunk's section area (cm^2) and the crown volume (cm^3), explained by the particularity of looser or tighter growth of the crowns. This is the case for the 'Dukat' and 'Erdi Ipari' cvs., where rather small values of the trunk's section area correspond to high values of the crown volume (Fig. 1, 2).

The density of the crown of the trees was between 4.74 cm^2/m^3 ('Erdi Ipari' cv.) and 12.13 cm^2/m^3 ('Erdi Kedves' cv.). Generally, in the trees with a lower potential of growth, the crowns were more dense due to the high number of short twigs (fruit bud twigs, frequent and short tree sprouts grown along the skeleton branches), except only for the 'Erdi Kedves' and 'Erdi Bibor' cvs. (Table 2).

In August, when the tree sprouts growth stopped (on the top of the tree sprouts the apical bud is shaped), annual shoots were counted and their length was measured for all the studied sour cherry cvs.

Analysing the time window between April and July when the tree sprouts grow (for each of the three years of study), 2019 and 2020 recorded a precipitations deficit of -71.6 mm (2019) and -86.0 mm (in 2020) in comparison with 270.0 mm representing the multiannual sum for this period, while 2021 recorded normal quantities of precipitations of 272.0 mm (Table 1).

It is well known that the lack of water reduces the number and the growth process of the annual tree sprouts, reduces the photosynthesis, the transport of the substances in plant and the cells turgor (Toma and Robu, 2000).

Due to having enough rainfall in 2021 throughout the time window of intensive growth of the tree sprouts, this year recorded the highest number of annual twigs per tree and the highest values of twig length growth (Table 3, Fig. 4).

Estimating the amount of annual twigs per tree in average terms for the three years of study, statistically, 'Erdi Bibor' cv. (41 twigs) recorded significant positive differences in comparison with the cvs. average (27 twigs) and 'Erdi Kordi' cv. (32 twigs) recorded non-significant positive difference (Table 3).

Analysing the average length of the annual twigs over three years, this parameter oscillated between 52.1 cm ('Erdi Ipari' cv.) and 85.4 cm ('Dukat' cv.) and statistically, 'Dukat' cv. recorded

significant positive differences in comparison with the cultivars average (67.2 cm) and 'Erdi Bibor' cv. (70.5 cm) recorded non-significant positive differences (Table 3).

1. Conclusions

Analysing the recorded values for all the determined parameters, it was noticed that the five sour cherry cvs., in their 5th year since being planted, had a significantly different growth potential.

The crown volume recorded the lowest values in the 'Erdi Bibor' (2.19 m³), 'Erdi Ipari' (1.56 m³) and 'Erdi Kedves' (1.55 m³) cvs., all of them presenting a tight growth of the crown.

Under the conditions of 2019 and 2020, droughty years, the cvs. that got highlighted as the most resistant to drought (with a high number of annual twigs per tree and high values of the twig length) were 'Erdi Bibor', 'Erdi Kordi' and 'Erdi Kedves' and the most sensitive cvs. were 'Dukat' and 'Erdi Ipari'.

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Tables and figures

Table 1. The climatic characteristics of 2019 – 2021 period

Year/Month			January	February	March	April	May	June	July	August	September	October	November	December	Annual sum (mm)	Annual average (°C)
Monthly sum of rainfall (mm)	Multiannual average		35.5	32.1	71.2	51.4	71.1	82.9	64.7	50.8	36.5	2.4	33.4	30.6	562.6	X
	2019	Monthly sum	47.6	28.2	7.2	43.6	86.6	53.2	15.0	56.6	65.4	28.6	6.8	12.2	451.0	x
		Deviation	12.1	-3.9	-64.0	-7.8	15.5	-29.7	-49.7	5.8	28.9	26.2	-26.6	-18.4	-111.6	x
	2020	Monthly sum	3.6	40.4	17.4	0.8	67.8	82.6	32.8	13.4	30.2	85.2	17.8	56.4	448.4	x
		Deviation	-31.9	8.3	-53.8	-50.6	-3.3	-0.3	-31.9	-37.4	-6.3	82.8	-15.6	26.2	-114.2	x
	2021*	Monthly sum	24.0	23.6	52.2	46.6	70.4	99.6	55.4	-	-	-	-	-	371.8	x
		Deviation	-11.5	-8.5	-19.0	-4.8	-0.7	16.7	-9.3	-	-	-	-	-	-37.1	x
	Air average temperature (°C)	Multiannual average		-1.9	-1.2	4.7	11.4	17.0	20.5	22.4	21.9	16.3	5.4	5.4	0.1	x
2019		Monthly average	-3.0	1.9	7.3	10.5	15.8	21.6	20.9	21.8	16.9	11.5	8.3	2.7	x	+11.4
		Deviation	-1.1	3.1	2.7	-0.9	-1.2	1.1	14.5	-0.1	0.1	1.2	2.9	2.6	x	+1.2
2020		Monthly average	0.9	4.2	7.6	11.5	14.0	20.9	22.6	23.6	19.6	13.9	4.5	2.0	x	+12.1
		Deviation	-1.0	-3.0	2.9	0.1	-3.0	0.4	0.2	1.2	3.3	8.5	-0.9	1.9	x	+1.9
2021*		Monthly average	0.1	-0.6	3.4	8.2	15.1	19.6	23.2	-	-	-	-	-	x	+9.9
		Deviation	-1.8	-0.6	-0.3	-3.2	-1.9	-0.9	0.8	-	-	-	-	-	x	-0.5

*2021 has data only for the first seven months of the year (January – July)

Table 2. The growth vigour of the trees and the crown volume of sour cherry cultivars

Cultivar	Trunk's section area (cm ²)		Crown volume (m ³)		Crown density cm ² /m ³
	year V*	years III-V average	per tree*	per ha	
Erdi Kordi	28.2 ^a	15.4	2.88 ^{ab}	2056.3	9.79 ^{bc}
Erdi Bibor	24.9 ^{ab}	16.3	2.19 ^b	1563.7	11.37 ^{ab}
Dukat	20.0 ^b	12.0	3.23 ^a	2306.2	6.19 ^{cd}
Erdi Kedves	18.8 ^b	12.2	1.55 ^c	1106.7	12.13 ^a
Erdi Ipari	7.4 ^{bc}	4.6 ^d	1.56 ^{bc}	1113.8	4.74 ^d
Average (x)	19.9	12.1	2.28	1627.9	8.84
DL 5% DL 1% DL 0.1%	DL 5% = 1.85	6.0 cm 8.8 cm 13.2 cm	DL 5% = 0.02		DL 5% = 0.07

*different letters correspond with the significant statistical difference for $P \leq 5\%$, Duncan test.

Table 3. Data about the amount of annual twigs per tree and the twig average length of sour cherry cvs.

Cultivar	The average amount of annual shoots/tree				The shoot average length (cm)			
	year III	year IV	year V*	Years III-V average	year III	year IV	year V*	Years III-V average
Erdi Kordi	25	17	55 ^a	32	79.8	25.0	91.3 ^{bc}	63.0
Erdi Bibor	25	28	59 ^a	41 ⁺	82.0	45.3	84.2 ^c	70.5
Dukat	12	15	27 ^b	18	98.4	37.7	120.0 ^a	85.4 ⁺
Erdi Kedves	19	18	36 ^b	24	75.0	21.2	92.7 ^{ab}	63.0
Erdi Ipari	15	14	37 ^{ab}	22	60.5	20.7	75.0 ^c	52.1
Average (x)	19	20	43	27	79.1	30.0	92.6	6.2
DL 5%			DL 5% = 3.49	11.3			DL 5% = 4.93	16.2 cm
DL 1%				16.4				23.4 cm
DL 0.1%				24.6				35.1 cm

*different letters correspond with the significant statistical difference for $P \leq 5\%$, Duncan test.

Fig. 1. Trunk section area (cm²)

Fig. 2. Crown volume (cm³)

Fig. 3. Crown density (cm²/cm³)

Fig. 4. Amount of annual twigs/tree and twig average length