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EVALUATION OF SOME GROWTH PARAMETERS OF SWEET CHERRY CULTIVARS UNDER NORTH – EAST ROMANIAN CONDITIONS

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Abstract
The studies were conducted at Research Station for Fruit Growing Iași in the years 2018-2020 on six cultivars of sweet cherry tree ('Regina', 'Kordia', 'Hudson', 'New Star', 'Maria' and 'Golia'). The paper presents aspect of vegetative pomological parameters under the environmental factors of Romanian Northeastern area. The average of the precipitation for the three years studied was 475 mm, with a deviation of 43.05 mm from normal with a minimum in 2020 (443.6 mm/year). The average values of the area of the trunk section (TCSA) based on the average of three years of study for the six cherry cultivars recorded values between 67.77 cm^2 ('Maria') and 121.58 cm^2 ('Regina'), with significant differences between cultivars. The crown volume had maximum values for the 'Golia' (4.56 m^3/tree) and 'Regina' (4.53 m^3/tree) cultivar and minimum values for the 'Maria' (3.78 m^3/tree) and 'Kordia' with 3.92 m^3/tree. The average of annual shoots and their average length recorded insignificant values among the cultivars studied.

Keywords: crown volume, cultivars, growth, sweet cherry, trunk section.

1. INTRODUCTION

The sweet cherry tree (*Prunus avium* L.) is one of the main fruit species, on the strenght of to the nutritional, technological and commercial characteristics of the fruit, which finds in Romania optimal conditions for manifesting its agrobiological potential, being the first link in the annual chain of fruit production (Grădinariu, 2002). Fruit yield and fruit production success are influenced by the choice of cultivars, rootstocks, production technology and the intensification of production objects achieved by increasing planting density (Grzyb et al., 1998; Mika et al., 2000). The optimal growth and development of stone species are primarily related to genetic factors but also to cultivar, rootstock and soil fertility (Stehr, 2005; Anderson et al., 1993; Hrotkó et al., 1993).

Maintaining an appropriate balance between vegetative and reproductive processes is a permanent challenge in the production of fruit trees (Sharma et al., 2009). There are many horticultural ways to maintain a permanent balance between vegetative growth and fruiting such as: choice of rootstock (which directly controls vegetative growth), type of pruning, green pruning, branch orientation and management, plant growth regulators, poor irrigation, fertilization, but so far no method has been shown to be universally successful (Pal et al., 2017). The training system and the vigour of

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rootstock must be considered and matched properly with the soil fertility and climate conditions of the orchard site (Quero-Garcia et al., 2017).
The regularity of the growth of vegetative pomological parameters, as well as the increase of the production can be related to the adaptability of the environment, in relation to the phenotypic plasticity of the genotype. Sweet cherry tree cultivars are extremely dependent on climatic conditions for regular and adequate fruiting. Only through multi-year observations or the use of multi-location tests with a marked difference in climatic conditions between sites will an accurate assessment of the adaptability of the environment be obtained (Kappel et al., 2012). During the growing season, the water consumption of fruit plants is variable. Thus, the water consumption is maximum in the periods of phenological development, it is at the growth of buds, flowering and fruit growth (Burzo et al., 1999; Ghena and Branişte, 2003).
The objective of the present study was to evaluate vegetative growth of six sweet cherry cultivars and the influence of environmental factors on it.

2. MATERIALS AND METHODS

The research took place in the period 2018-2020 at the Research Station for Fruit Growing (RSFG) Iași - Romania and targeted six cultivars of sweet cherry trees, of which two was Romanian cultivars, approved by RSFG Iași ('Maria' and 'Golia') and four was foreign cultivars ('Regina', 'Kordia', 'Hudson' and 'New Star') grafted on mahaleb (*Prunus mahaleb* L.). The experimental orchard is located in Northeastern Romania, in Iasi County and was established in the spring of 2011, with planting distances of 5 x 4 m (500 trees / ha) and the crown trees were trained as open vase with 4-5 main branches.
The average of the three years annual temperature recorded was 11.3°C and rainfall had values of 474.73 mm with a a deviation of 43.05 mm from multiannual values.
The research focused on the measurements of fruit trees and biometric determinations over the three years with the following aspects:

-Trunk cross-section area (TCSA, cm^2): each year, the diameter of the trunk was measured in two directions perpendicular to a height of 30 cm from the grafting point.

-The crown volume was determined by the formula: $V = [(D + d) / 2]^2 \times H \times 0.416$, where V - the crown volume (m^3), D- the diameter of the crown in the direction of the row, d- the diameter perpendicular to the row, H - the height of the tree, 0.416- correction coefficient.

-Crown density was calculated with the formula: TCSA (cm^2) /volume of the crown (m^3) (Parnia and Mladin, 1995).

-Total annual vegetative growth was evaluated as product of number and length of new shoots per tree.

The obtained results were processed statistically. Differences between means were evaluated by using the Duncan's multiple range test at $P \leq 0.05$.

3. RESULTS AND DISCUSSIONS

Agro-ecological conditions in the area have an essential role in the optimal growth and development of fruit trees and in profitable and competitive fruit production. In the investigation period the average yearly temperature was 10.65°C in 2018, 11.34°C in 2019 and 11.87°C in 2020, average temperature in period of vegetation (March to August) of the three years studied had values of 16.42°C, average yearly rainfalls were 529.8 mm in 2018, 450.8 mm in 2019 and 443.6 mm in 2020, average rainfalls in period of vegetation of the three years had values of 49.71 mm and

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average of total rainfalls in studied period were 474.73 mm. Consequently, it could be emphasized that the conditions for sweet cherry trees growing were not the most adequate in the investigated period, taking into consideration the climate conditions and the possibilities for irrigation, sweet cherry tree needing a rainfall requirement of 700 mm/ year (Budan, 2000).
The trunk diameter is an integral indicator of the whole vegetative potential of the trees, presented in Table 1. During the three years of study, significant differences between cultivars were recorded in 2018. Regarding the average of the three years of the TCSA, the minimum value was recorded for the cultivar 'Maria', with 67.77 cm^2 and the maximum value was for the cultivar 'Regina' with 121.58 cm^2.

Table 1. Trunk cross section area (TCSA) of sweet cherry cultivars (RSFG Iași, 2018-2020, n=3)

Cultivar	*TCSA (cm^2)*			
	2018*	**2019**	**2020**	**Average**
Regina	97.5^{a}	124.96^{a}	142.27^{a}	121.58^{a}
Kordia	57.2^{b}	79.92^{b}	130.49^{a}	89.19^{bc}
Hudson	50.9^{b}	72.60^{b}	112.07^{b}	78.38^{cd}
New Star	60.01^{b}	84.16^{b}	130.33^{a}	91.50^{b}
Maria	35.51^{c}	65.43^{b}	102.35^{b}	67.77^{d}
Golia	36.81^{c}	63.46^{b}	108.16^{b}	69.51^{d}

*Different letters correspond with the significant statistical difference for P ≤ 5%, Duncan test.

The crown parameters of the sweet cherry cultivars for three years are presented in Table 2 and recorded values with a progressive increase, so that in 2020 the cultivars had statistically insignificant values between 6.79 m^3 to 'Kordia' and 7.51 m^3 to the 'New Star' cultivar. During the three years, the cultivars reached a crown volume with values between 3.78 m^3 ('Maria') and 6.11 m^3 ('New Star'). There were significant differences between the cultivars studied at the end of the study period.

Table 2. Crown volume of sweet cherry cultivars (RSFG Iași, 2018-2020, n=3)

Cultivar	*Crown volume (m^3)/year*			
	2018*	**2019**	**2020**	**Average**
Regina	2.59^{b}	3.57^{bc}	7.43^{a}	4.53^{c}
Kordia	1.99^{bc}	3.98^{bc}	6.79^{a}	3.92^{c}
Hudson	2.17^{bc}	3.54^{bc}	7.35^{a}	4.35^{c}
New Star	3.38^{a}	7.14^{a}	7.51^{a}	6.11^{a}
Maria	1.73^{c}	2.66^{c}	6.95^{a}	3.78^{c}
Golia	2.88^{ab}	4.27^{b}	7.43^{a}	4.56^{bc}

*Different letters correspond with the significant statistical difference for P ≤ 5%, Duncan test.

The crown density is averaged over the three years and varied between 15.10 ('Golia') and 30.61 ('Regina') cm^2/m^3. From a statistical point of view, the differences of cultivars are only significant for the 'Regina' cultivar with the others (Table 3).

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The number of annual growths and their length did not register significant values between cultivars during the three years evaluated (Table 3). The number of annual shoots varied between 109.37 ('Kordia') and 169.16 pcs/ tree at 'New Star', while their average length had values of 142.64 cm. The largest increases were recorded in the 'Kordia' cultivar with 131.04 cm.
Sequential pruning as well as procedures for maintaining branching during the growing season have contributed positively to the growth of fruit tree formations and their length. The sweet cherry tree has the ability to form fruit buds on the annual growths of branch extensions (Balan and Ivanov, 2014).

Table 3. Crown density and annual shoots characteristics of sweet cherry cultivars (RSFG Iași, 2018-2020, n=3)

Cultivar	*Crown density**	*The average amount of annual shoots*	*The shoot av. length*
	(cm^2/m^3)	**(pcs./tree)**	**(cm)**
Regina	30.61^{a}	135.89^{a}	121.47^{a}
Kordia	23.79^{ab}	109.37^{b}	131.04^{a}
Hudson	19.70^{b}	139.06^{a}	122.89^{a}
New Star	15.33^{b}	169.16^{a}	100.91^{a}
Maria	19.95^{b}	140.29^{a}	69.05^{a}
Golia	15.10^{b}	162.06^{a}	67.91^{a}

*Values followed by the same letter in a column were not statistically different for $P \leq 5\%$, Duncan test.

4. CONCLUSIONS

The vegetative growth parameters of the evaluated sweet cherry cultivars are influenced by the climatic conditions.
Under the examined parameters of the vegetative growth, the 'New Star' cultivar stood out with the highest vigor, being suitable for intensive plantations, with planting distances of 5 x 4 m. Depending on the cultivar, taking into account the applied requirements for sweet cherry tree cultivars of low or moderate vigor may be of interest for high density plantations.

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