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THE INFLUENCE OF THE TYPE OF CUTTING IN THE RASPBERRY SPECIES ON THE QUALITY OF THE PRODUCTION OBTAINED

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Abstract

Even though raspberry cuts are simple, opinions differ when it comes to raspberry cuts. In general, for the exercise of a modern orchard, the varieties must be adapted to modern mechanization and soil maintenance technologies. Following the research carried out, we can specify the fact that the Cayuga variety has a high drajon capacity, and a greater shortening of the stems leads to a decrease in drajon production. In the variants where the inflorescence's were not removed, the production of raspberry stems does not decrease. The quality of the raspberry stems was influenced to a very small extent by the removal or not of the inflorescence's. The root system of the raspberry is more superficial, the vast majority of the roots, about 80% of the roots are located closer to the soil surface, respectively in the soil layer between 0-20 cm. An intense growth of raspberry stems takes place in the months of May-June and the beginning of July, but along the way the pace of growth slows down, thus at the end of August their growth stops.

Key words*: raspberry species, variety, shortening, quality.*

INTRODUCTION

In order to obtain large and quality productions, it is necessary to find methods of obtaining an increasingly better planting material, which corresponds both in terms of production quality and quantity. A major interest is to maintain the genetic material at a real biological potential and at the same time to apply specific culture technology (Butac, 2008). Many researches have been carried out in the country to improve the characteristics of the varieties of fruit trees in order to increase the production and quality of the fruits.

The characteristics of some raspberry varieties created in Romania between 1967 and 2007, namely varieties such as Citria, Ruvi, Star, Opal and Gustar, were presented respectively aspects of the fruit, of the plant, aspects of the production and use of the fruit., (Branişte et al., 2007). Within the Pitesti-Mărăcineni Research Institute, the foundations were laid for obtaining new varieties with greater adaptability to climatic conditions and greater tolerance to diseases and pests, thus in this sense new raspberry varieties were obtained such as be Star, Ruvi and Citria (Mladin, 2002). Research on raspberry culture has expanded in our country, thus establishing the most suitable varieties for the southern part of the country, especially for the psammosol area (Popescu et al., 1989). In the lowland areas, on the basis of the researches, it was reached the expansion of raspberry varieties resistant to frost and drought, such as Cayuga, Romy, (Botez et al., 1984). Also, based on the research carried out, it was found that the R 3-3-30 and R 5-3-30 FC selections have large, firm fruits and a good winter resistance (Mladin et al., 2008). Some research carried out on raspberry varieties in Estonia shows that some new raspberry varieties Aita and Alvi are promising due to their large fruits and very good resistance to anthracnose. Helkal and Tomo varieties had the highest sugar content (Arus et al., 2008). In the northern area of Montenegro, research was carried out on the propagation of raspberries, to improve the characteristics of the fruits and to increase the resistance to different biotic and abiotic factors (Galic et al., 2012). Raspberry growth can be affected by some plant materials used as mulch, thus mulching with wheat straw can affect plant growth, (Pedreros et al., 2008). The optimization of production systems can be achieved on organic matter substrates such as wood bark, bark compost, wood fibers (Carlen et al., 2020). The examination of the growth mode of seven Primocane raspberry cultivars in

order to observe whether these cultivars are suitable for the production of a summer crop, states that of the studied cultivars only Imara and Kwanza are suitable for the production of a summer crop (Palonen et al. , 2020). In Latvia, some raspberry varieties such as Gerakl, proved good adaptability to the respective region and the variety Babye Lato 2 recorded the highest productions (Laugale, 2012). The history of raspberry and blackberry cultivation in the southern USA states that 20 cultivars, including 12 cultivars with interspecific hybridization, have been created in different states of Arkansas, Florida, Virginia (Ballinghton, 2016). Fertilization with different macronutrients in raspberries with N, P, K, Ca and Mg, shows some obvious toxicity symptoms with N and K in Dormanred cultivar (Spires et al., 1999). The behavior of three raspberry cultivars under modified atmosphere conditions was studied, where Qualicum and Chilliwack cultivars showed better firmness and better keeping characteristics (Toivonen et al., 1999). The studies on the temporal evolution of some parameters in the current climate over Romania have highlighted a trend of increasing air temperature and related parameters, an aspect that can bring changes in the growth of fruit trees and shrubs (Velea et al., 2021). Worldwide, pathogens represent one of the most important biotic stress factors of fruit trees and scrubs, limiting their proper growth and affecting their genetic reproduction capacity and yielding potential, leading sometimes even to the whole tree dieback (Cotuna et al., 2020). Observations on the factors that influenced the growth and some phenological phases of several raspberry varieties in Moldova (flowering period, etc.), indicate that the Cayuga variety is one of the varieties resistant to low temperatures in winter (Sava, 2013). Norwegian raspberry cultivars tested in an infested field for root rot revealed that most cultivars were infested, except Varnes (Roslash et al., 2002). An evaluation of the vegetative growth of some raspberry and blackberry cultivars was carried out in southern Poland, where it was stated that the Willamette variety had the highest number of stems but also the highest number of leaves per stem, and the Polesie variety had obtained the largest fruits (Orzel et al., 2016).

MATERIALS AND METHODS

The biological material is represented by the Cayuga raspberry variety, the planting distance being 2.5 m between rows and 1.0 m between plants per row, respectively 4000 plants per hectare. The experience took place in 2019, the studies taking place between 2019 and 2021. The experience includes 9 variants in 4 randomized repetitions, namely: V1 - Cut to 20 cm with the removal of the inflorescence (Control); V2 - Uncut and leave the inflorescences; V3 - Uncut and inflorescences removed; V4 - Cut to 100 cm and leave the inflorescences; V5 - Cut to 100 cm and remove inflorescences; V6 - Cut to 50 cm and leave the inflorescences; V7 - Cut to 50 cm and remove inflorescences; V8 - Cut to 20 cm and leave the inflorescences; V9 - Removed the aerial part entirely. The experience was located in the town of Breasta, Dolj county, on a land sheltered from the prevailing winds with protective curtains. The objective of the work is the following:

- studying the influence of the shortening of raspberry stems on the quantity and quality of the production of planting material in order to establish the optimal shortening of the stems;
- if the removal of inflorescences influences the quantity and quality of planting material. In order to achieve the established objectives, the following observations and determinations were made: the production of suckers; the dynamics of suckers growth; quality of suckers (height and thickness); the distribution depth of the horizontal roots by the profile method; the quality of the fruits, respectively some physical and chemical properties of the fruits.

RESULTS AND DISCUSSIONS

The growth characteristics of raspberries state that raspberry suckers live independently after forming their own roots and becoming fruiting stems, (Chira, 2000). Raspberry suckers begin to appear in April and to study the dynamics of their growth the first measurement was carried out on May 13. The next three measurements were made at an interval of 14 days, after which they were made every 7 days until the cessation of suckers growth was observed. Looking at the dynamics of the increase in

length of suckers depending on the applied treatment, we find that at the time of the first measurement (May 13), the average length of suckers was close in most variants. It can be seen that this growth of suckers is very intense in the months of May - June and the beginning of July, registering large increments in the length of suckers.

For example, in the V1 variant (cut to 20 cm and removed the inflorescences), the increase in growth was 70 cm from May 13 to June 25 and 37 cm from June 25 to July 30. The lowest growth rate during this period can be observed in the V8 variant (Cut to 20 cm and leave the inflorescences) and in the V9 variant (removed the aerial part), where the growth increments were 18 cm in the V8 variant and 16 cm in the V9 variant between May 13 and July 30. Analyzing the data further, we can see a decrease in the rate of growth for all variants between June 25 and July 30, thus variant V 6 recorded an increase of 36 cm, V1 of 33 cm, V 7 of 31 cm, V 5 of 25 cm, V 2 of 23 cm, V 4 of 22 cm. Thus, the increase in length from June 25 to July 30 is between 16 cm for the V9 variant and 37 cm for the V3 variant (Figure 1).

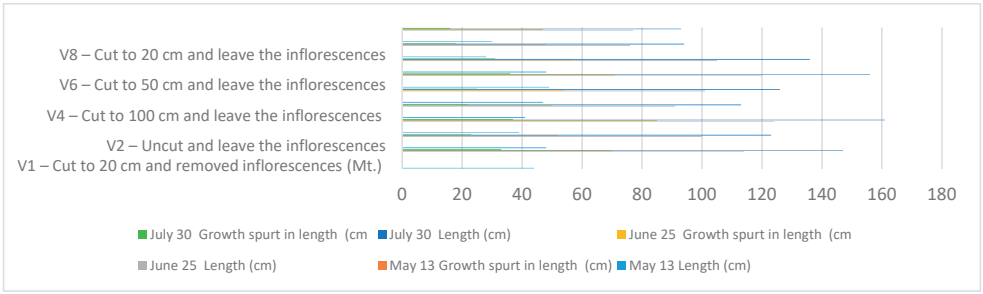

Figure 1. The dynamics of suckers growth in length depending on the applied treatment (period 14 May - 30 July)

Next, the rate of growth in the length of the suckers becomes upward until around August 20, thus the length of the stems fell within the ranges of 191 cm variant V 3 and 93.0 cm variant V 9. An upward growth in addition to the V9 variant was also recorded in the V 6 variant - 182.0 cm, the V 1 variant - 160.0 cm, the V 5 variant - 149.0 cm.

On August 20, the growth spurt was between 30 cm (variant V 3) and 6.0 cm (variant V 2). The V7, V 8 and V 9 variants no longer had an increase in length. After August 20, growth stops due to the fact that part of the nutrients are directed to the fruiting process (Figure 2).

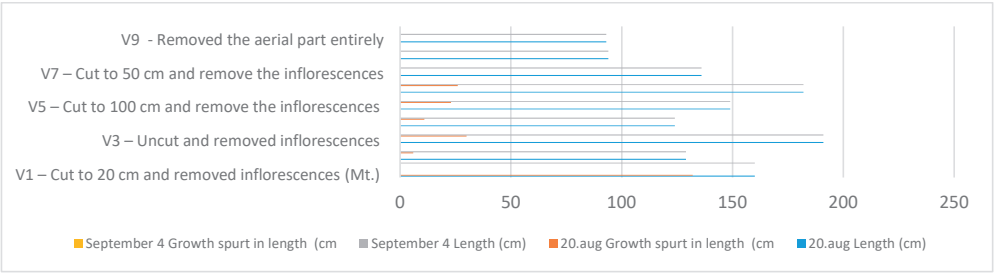

Figure 2. The dynamics of stems growth in length depending on the applied treatment (period 14 May - 04 September)

The greatest increase in length between May 13 and September 4 was recorded for the variants V3 - 152.0 cm, V 6 - 133.0 cm, V 5 – 126.0 cm and V 1 - 116.0 cm. The smallest increase in length was observed in variants V 7, V 8 and V 9 (Figure 3).

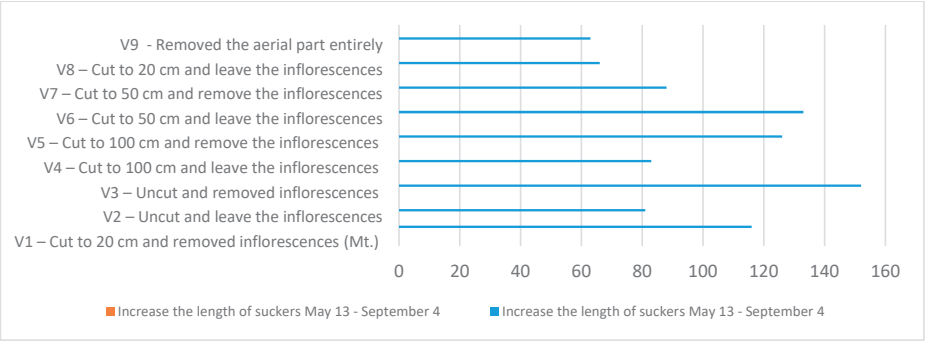

Figure 3. Increase the length of suckers (period May 13 - September 4)

Following the quality of suckers in 2020 (Figure 4), we notice that the average length of suckers falls between 103.0 cm for the V9 variant (removed the aerial part) and 137.0 cm for the V2 variant (uncut and leaving the inflorescences), the values being insignificant. Only for the V9 variant where the aerial part has been removed, the value is negative. The diameter of the suckers was influenced to a very small extent by the applied treatment, the differences being only 0.13-0.77 mm between the variants, but the values being insignificant. The average diameter of the suckers is between 6.5 mm for the V6 version and 7.93 mm for the V5 version, falling within the STAS values.

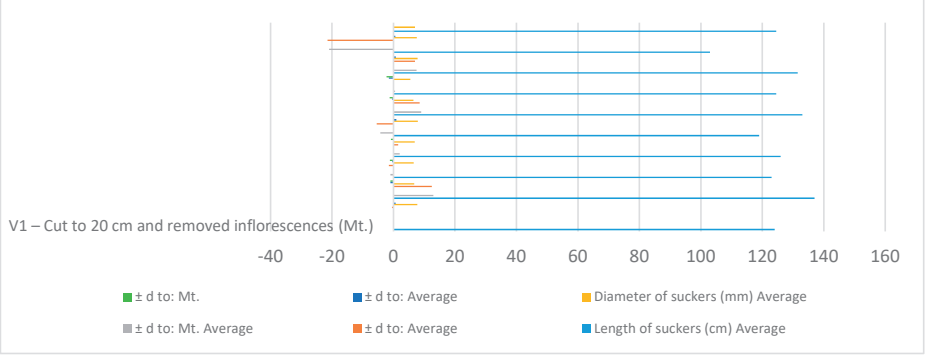

Figure 4. The influence of the degree of shortening and removal of inflorescences on the quality of raspberry suckers

Analyzing the percentage of suckers by length categories according to the degree of shortening and the removal or not of the inflorescences (Figure 5), we notice that the percentage of suckers with a length of less than 50 cm is between 1.9 % for variant 3 and 6.3% for variant 1. The percentage of suckers with lengths of 50-80 cm is between 1.8% for variant 8 and 17.9% for variant 2.

In the 81-110 cm category, the percentage of suckers is 16.7% in variant 1 and 58.0% in variant 9. In the 111-140 cm length category, the percentage of suckers is 28.0% in variants 9 and 2, and 62.3% for option 8. In the category between 141 and 170 cm, the lowest percentage is recorded in variant 9 of 7.1%, and the highest of 30.2% in variant 4. In the category between 171 and 200 cm, the lowest percentage of suckers is 1.8% in option 7, and the highest percentage was recorded in option 3 of 13.0%. In the over 200 cm category, the lowest percentage was recorded for version 2 of 3.0% and the highest for version 3 of 7.0%. From the analysis of suckers by length categories expressed in percentages, we found that most suckers fall between 81 and 160 cm long.

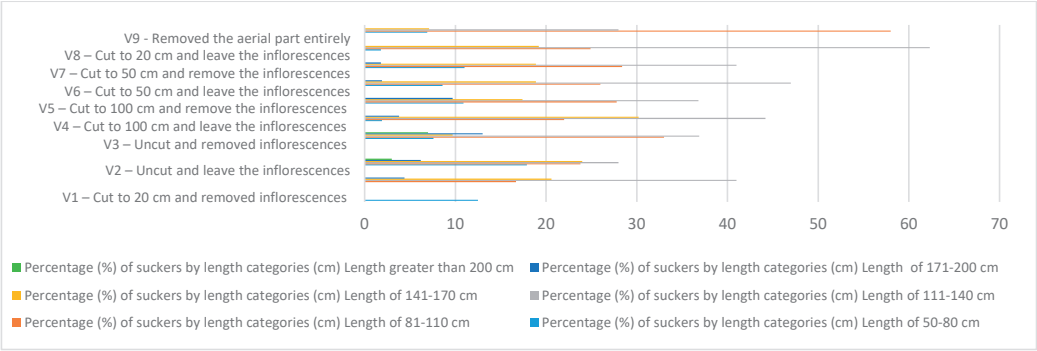

Figure 5. The percentage of suckers by length categories according to the degree of stems shortening and the removal or not of inflorescences

Studying the distribution of horizontal roots by the profile method, depending on the degree of shortening of the suckers and the removal or not of the inflorescences, we noticed that most of the horizontal roots are found in the soil layer from 0-10 cm and 11- 20 cm (Figure 6). Some of the roots reach deeper, but not in too great a number (Table 1 and Table 2).

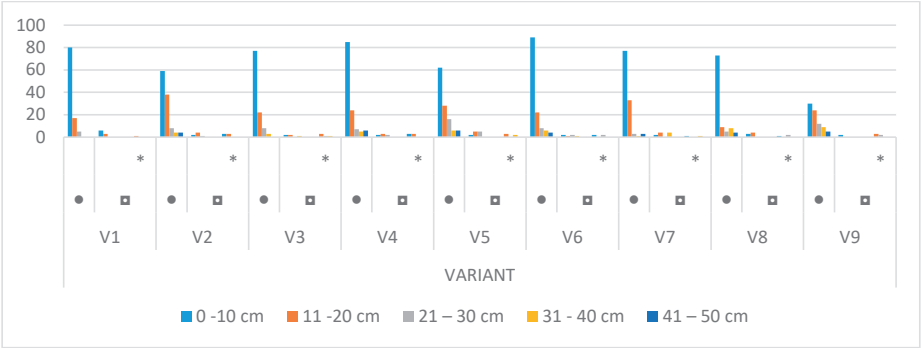

Figure 6. Distribution depth of raspberry roots according to the degree of stem shortening and the removal of inflorescences

Table 1 - Distribution depth of raspberry roots according to the degree of stem shortening and the removal of inflorescences

The distribution depth of the roots	VARIANT														
	V1			V2			V3			V4			V5		
	●	◘	*	●	◘	*	●	◘	*	●	◘	*	●	◘	*
0-10 cm	80	6	-	59	2	3	77	2	-	85	2	3	62	2	-
11-20 cm	17	3	1	38	4	3	22	2	3	24	3	3	28	5	3
21-30 cm	5	-	-	8	1	-	8	-	1	7	2	-	16	5	-
31-40 cm	-	-	-	4	-	-	3	1	1	5	-	-	6	-	2
41-50 cm	-	-	-	4	-	-	-	-	-	6	-	-	6	-	-
Total roots by category	102	9	1	113	7	6	110	5	5	127	7	6	118	12	5
TOTAL ROOTS	112			126			120			140			135		

Table 2 - Distribution depth of raspberry roots according to the degree of stem shortening and the removal of inflorescences

The distribution depth of the roots	V6			V7			V8			V9		
	●	◘	*	●	◘	*	●	◘	*	●	◘	*
0-10 cm	89	2	2	77	2	1	73	3	1	30	2	-
11-20 cm	22	1	-	33	4	-	9	4	-	24	-	3
21-30 cm	8	2	2	3	-	-	5	-	2	12	-	2
31-40 cm	6	1	-	1	4	1	8	-	-	9	-	-
4150 cm	4	-	-	3	-	-	4	-	-	5	-	-
Total roots by category	129	6	4	117	10	2	99	7	3	80	2	5
TOTAL ROOTS	139			129			109			87		

Legend: ● - roots less than 1 mm in diameter; ◘ - roots with a diameter between 1 –2 mm; * - roots over 2 mm in diameter

An essential condition of the functionality of the root system is the exploitation by the root system of a volume of soil as well as the horizontal and deep extension of the roots (Voiculescu et al., 2001). The roots are generally superficial in raspberries and have the particularity of forming buds from which root shoots appear, (Militiu et al., 1962). The roots have the role of ensuring an absorption of nutrients from the soil, which will help an optimal differentiation of the fruit buds (Cichi et al., 2019).

Analyzing the percentage of roots at the depth of 0-50 cm for each variant, the situation is as follows:

Variant 1 (Cut to 20 cm and removed the inflorescences) at the depth of 0-10 cm 76.7% of the total roots were found, at the depth of 11-20 cm 18.7 % were found and only 4.4% up to 30 cm deep (Figure 7).

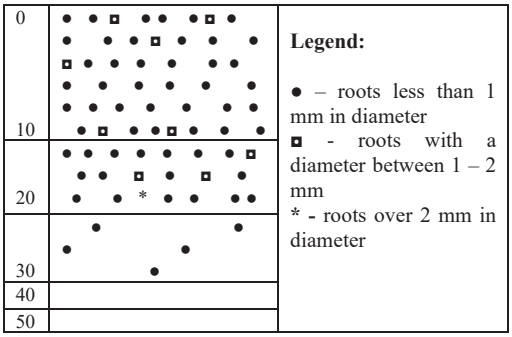

Figure 7. The distribution depth of the roots at V1

In variant 2 (Uncut and leave the inflorescences) in the first layer at the depth of 0-10 cm 50.7% were found, in the second layer of 11-20 cm the percentage was 35.7 %, 21-30 cm 7.1 % were found at 41-50 cm, 3.1% were found at 31-40 cm and 41-50 cm (Figure 8).

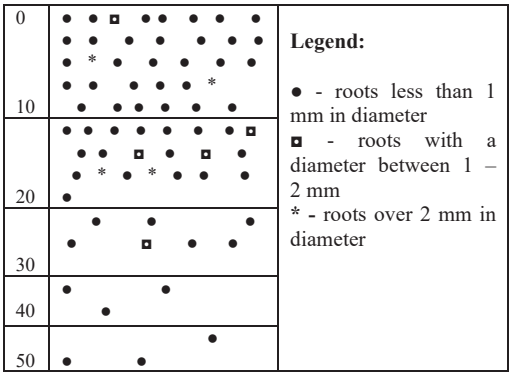

Figure 8. The distribution depth of the roots at V2

In variant 3 (Uncut and inflorescences removed) at the depth of 0-10 cm, 65.8% of the total roots were found, at the depth of 11-20 cm, 22.5% and 7.5 % up to 21-30 cm deep, and in the layer from 31 - 40 cm only 4.1 %, (Figure 9). In variant 4 (Cut at 100 cm and leave the inflorescences) in the first layer of 0-10 cm 64.2 % were found, in the second layer 21.4 %, from 21-30 cm 6.4 %, at 31-40 cm were recorded 3.5% and at 41-50 cm 4.2% were found (Figure 9). In variant 5 (Cut at 100 cm and removed the inflorescences) in the first layer of 0-10 cm 47.4% were found, in the second layer 26.6%, from 21-30 cm 15.5%, at 31-40 cm were recorded 5.9% and at 41-50 cm 4.4% were found (Figure 9).

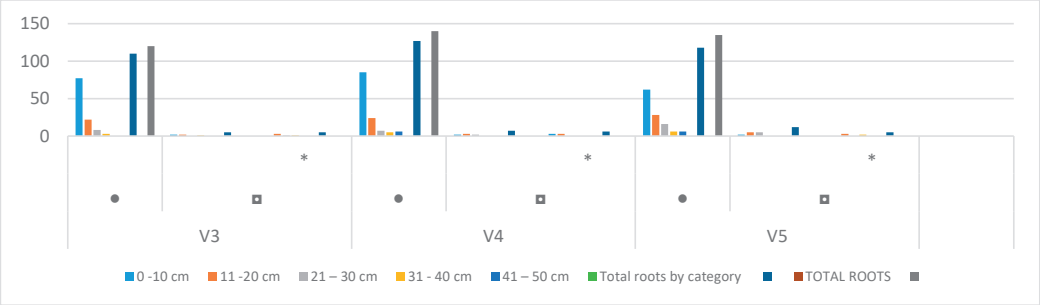

Figure 9. Distribution depth of raspberry roots according
to the degree of stem shortening and the removal of inflorescences

In variant 6 (Cut to 50 cm and leave the inflorescences) in the first layer of 0-10 cm 66.9% were found, in the second layer 16.5%, from 21-30 cm 8.6%, at 31-40 cm were recorded 5.0% and at 41-50 cm 2.8% were found (Figure 10). Next, in variants 7, 8 and 9, the highest percentage of roots is also found in the 0-10 cm layer, respectively V 7 - 62.0%, V 8 - 70.6% and V 9 - 36.7%. At the depth of 11-20 cm the percentage of roots was 28.6% - V 7, 11.9% at V 8, and 31.0% at V 9. Only a percentage of 2.3% - 3.6% - 5.7% is in the layer between 41-50 cm in variants 7, 8 and 9, (Figure 10).

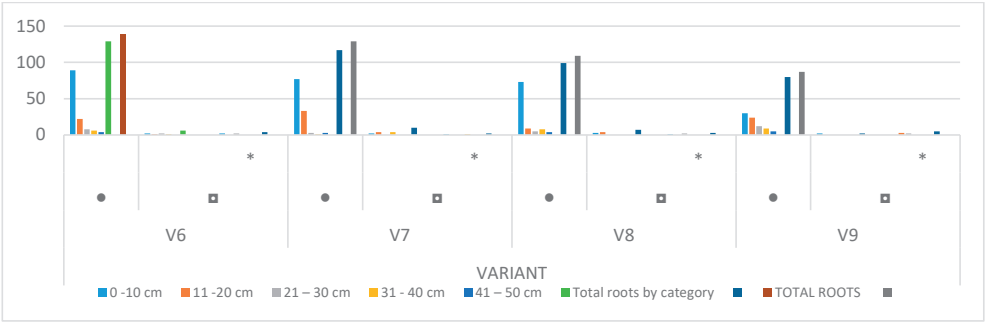

Figure 10. Distribution depth of raspberry roots according
to the degree of stem shortening and the removal of inflorescences

The root is formed by the rhizome (underground stem) from which the vast majority of roots start at a depth of 10-50 cm and very few reach deeper, (Popescu et al., 1992). Knowing the distribution of horizontal roots in the soil helps to distribute fertilizers in the place explored by the largest mass of roots, (Cichi et al., 2008). Due to the fact that raspberry roots develop more on the surface of the soil, it should be pointed out that the soil work should be carried out at a depth of 0-10 cm per row and 5-10 cm between rows. Root system growth occurs throughout the growing season, but the intensity of growth varies. The most intense growth is observed during the flowering period and after harvest. Soil work

must be carried out during the period of minimum root growth, that is, before the buds open and in September. The fruits obtained are large, with an average weight of 2.5-2.8 g reaching up to 3.0 g. Regarding the chemical composition, they contain 4.0-4.10 g of sugar per 100 g of fresh pulp, 1.60 g per 100 g fresh pulp acidity expressed in malic acid and 26.10 mg per 100 g fresh pulp ascorbic acid. The Cayuga variety has a soluble dry matter content of 11.2%.

Along with the physical and chemical properties of the fruits, the very pleasant aroma and the possibility of obtaining numerous industrialized products, we appreciate the southern part of the country as a favorable area for this culture. The evaluation of the characteristics of an individual from a certain region has an important role in identifying the agrobiological performances of that individual (Cichi et al., 2022).

CONCLUSIONS

The rooting capacity of the Cayuga variety is generally medium to high. The severe shortening of the stems and the total removal of the aerial part leads to a decrease in the production of suckers. The moderate shortening to about 100 cm with the preservation of the inflorescences on the stems of two years, allow obtaining productions of 100 thousand pieces of suckers/ha and at the same time obtaining very good fruit productions. In the variants where the inflorescences were not removed, the production of suckers does not decrease, on the contrary, the production increases. Raspberry suckers have an intense growth in the months of May-June and early July, then the rate of growth decreases so that at the end of August the growth of suckers stops. The quality of the suckers was influenced to a very small extent by the treatment applied and by the removal or not of the inflorescences, the results obtained were not significant. Most of the suckers obtained have a length between 85-180 cm, respectively in a percentage of 75- 80.0%. The root system of the raspberry is quite superficial, about 60-77.0% of the roots are located in the soil layer between 0-10 cm, in the soil layer between 11-20 cm there is a percentage of 11.0-35.0% roots and only a percentage of 2.3-5.7% reach up to 41-50 cm depth. It is necessary to research different varieties in different areas in the context of climate change.

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