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PRELIMINARY RESULTS REGARDING THE BEHAVIOR OF SOME CHOKEBERRY CULTIVARS (*ARONIA MELANOCARPA*) IN ORGANIC SYSTEM

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Abstract

The paper presents partial data related to the evolution of three chokeberry Aronia varieties, grown organically. Aronia melanocarpa, is a crop that is very suitable for organic system, and its fruits have special nutraceutical qualities, containing very high levels of anthocyanins and flavonoids, as well other important substances that can reduce the risk of serious illness. The experiment was performed on plantation established in 2020 in a farm belonging to Fruit Research Station in Ilfov County. The chokeberry cultivars observed were: 'Melrom', 'Nero' and 'Galicjanka'. Planting distances 1.5 m/3 m, in 2 variants, plants canopy conducted as bush. In 2021, number of shoots and inflorescences per plant, shoots length and the number of fruits per inflorescence were done. Also, fruit weight, size, sugar content, and pH for each cultivar were determined. The observations showed for shoots growth values between 70-117 cm with and average number of fruits per inflorescence between 15-22. Regarding fruit weight varied between 0.54 and 1.63 grams. The study will continue in order to gather more data for the organic cropping system of Aronia

Key words*: aronia, organic technology, cultivars, canopy, growth dynamic.*

INTRODUCTION

Black chokeberry (*Aronia melanocarpa* (Michx.) Elliott) is a deciduous shrub native to North America, botanically classified as belonging to the family *Rosaceae*. Shrub of chokeberry grows 1.2 to 2.4 m producing beautiful white flowers and navy-blue berries of tart-sweet taste and aromatic flavour (Jeppsson, 2000; Brand, 2010). Chokeberry plantation can be established in any climate condition. It is a cold-hardy plant tolerant of very low temperatures even below –35°C and it is not sensitive to the spring frosts (Bussières et al., 2008). Chokeberries are noted for their modest requirements and adaptability to different soil types (sandy, acid and humid soils) and soil management systems.

According Ioan Viorel Raţi (2016), increased population demands for healthy food has led to the expansion of shrubs cultures by: the emergence of new growing areas; new systems of cultivation (crop protected in tunnels, greenhouses, growing without soil, organic production). A major issue related to shrub cultivation is given by the fact that the ripening season is overlapping with the harvesting time of the spontaneous flora. Also, few varieties of the global selection suit the pedoclimatic conditions in Romania (Ligia Ion, 2007, the National Program for Rural Development 2014-2020).

Romanian traditional agriculture relies on the use of clean technologies; it is possible to delineate green, non-polluting perimeters for the application of environmentally friendly farming practices; the demand for organic products is growing; organic farming has become a source of income for the rural population (Sumedrea D. et al., 2014; Tănăsescu N., 2005; Rati I. V, 2008).

This paper presents preliminary results of the study conducted on 3 *Aronia melanocarpa* cultivars (Melrom, Nero and Galicjanka) variety) plants of the future with high tolerance to environmental biotic and abiotic factors. The aronia berries are rich in nutrients, polyphenols and anthocyanins, with numerous beneficial effects on the health of the human body, being sought both on the domestic and international

market. Due to these characteristics, aronia has become much demanded specie for cropping in organic system.

MATERIALS AND METHODS

The research was conducted in 2021 at the Fruit Research and Development Station Băneasa, Farm Moara Domnească, county Ilfov, Romania. The farm is located N-E of Bucharest in Afumați, Ilfov County, in the Vlasiei Plain, a subunit of the Roman Plain. The site is located at 44°50' Northern latitude and 26°24' Eastern longitude and 70 m above the sea level.

Continental temperate climate regime is specific for the area, with hot summers, frequent droughts and cold winters. The annual mean temperature is 12°C and the total annual amount of precipitation is ranging between 550 and 600 mm, the maximum occurring between May and July, torrential rains being common. The dominant air circulation is from the East and North-East in winter and from the West in the rest of the year, with a maximum wind speed of 12.6-14.4 km/h. The zonal soil type is reddish luvisol. In the depressed areas and in the crevices there are reddish luvisols and stagnosols

The organic aronia plantation was established on spring of 2020 and the experiment was designed with 2 experimental factors: Factor A - cultivars: a1 Melrom, a2 Nero, a3 Galicjanka, Factor B - mulching of plant rows with 2 graduations: b1 - bear soil, b2 - mulched with wooden chips in a layer of 15 cm (material resulted from the previous fruit tree plantation) (Figure 1).

Figure 1. Aronia plants mulched with wooden chips

The plantation scheme consists in spacing of 3 m between rows and 1.5 m in the row. Between the rows, the soil was kept tilled and without grass. The experiment was set up as a randomized block design with three replications, giving a total of 60 black chokeberry bushes (Figure 2). During the trial, standard cultural, training and pruning practices were used, including drip irrigation.

Figure 2. Aronia plants in organic experimental field

Generative potential parameters (number of shots and inflorescences per plant, number of berries per cluster) were observed by counting.

The measurements of shoot length were made in 2021, at the end of the growth cycle, with roulette.

For the biometric measurements of fruits 60 fruits for each cultivar and variant were used.

Fruit height and diameter were measured with electronic caliper, and the fruit weight was determined using the electronic balance with an accuracy of 0.01 g

Sugar content expressed as % Brix, was determined by the electronic refractometer (Hanna instruments HI 96800) and the pH value was measured by pH Meter Hanna HI 700630.

The collection of information resulted in a series of variations were statistically analyzed using the MS Excel program "Data analysis" addon. Given the fact that in the study there were 2 variants and data was collected in 2021 for each cultivar, the samples were tested for the statistical hypothesis on differences between variants, using the Duncan – T - Student concordance test (t) with a probability 0.05.

RESULTS AND DISCUSSIONS

Regarding generative potential the analysis of the data showed differences among treatments. Mulching with wood chips affected the average number of shoots per plant so the mulched variant has showed a smaller average number of shoots per plant (13.56) compared with the

variant with bare soil (18.00). On the other hand, the average shoot length has not been highly influenced by the treatment (93.26 cm in V1 and 93.56 cm in V2). The same applies also for the average number of inflorescences per plant: 15.67 in V1 and 15.89 in V2.
Regarding number of berries per cluster the mulched variant had better results (19.15 berries) compared with the bare soil variant where the average number of berries per cluster were smaller, respectively 17.48 berries. Figures are presented in Table 1.

Table 1. Generative potential of aronia plants in 2021

Treatment	Cultivar	Average no. shoots/ plant	Average shoot length (cm)	Inflorescences no./ plant (pieces)	Number of berries/cluster
V1 - mulched	GALICJANKA	11.00	91.11	17.33	18.56
	MELROM	14.33	102.00	10.33	17.44
	NERO	15.33	86.67	19.33	21.44
	AVG	***13.56***	**93.26**	**15.67**	**19.15**
	STDEV	*2.27*	*7.89*	*4.73*	*2.06*
	VAR	*16.74*	*8.46*	*30.16*	*10.78*
V2 - bare soil	GALICJANKA	18.00	92.67	16.33	25.11
	MELROM	19.33	91.33	8.67	13.22
	NERO	16.67	96.67	22.67	14.11
	AVG	***18.00***	**93.56**	**15.89**	**17.48**
	STDEV	*1.33*	*2.78*	*7.01*	*6.62*
	VAR	*7.41*	*2.97*	*44.12*	*37.88*

Comparing the variances of average number of shoots per plant in both variants the highest value was observed in mulched variant with 16.74 % compared with the bare soil variant were the variance has reached the value of 7.41%.
In the Figure 3, can be observed that during the year of 2021 the highest average number of shoots per plant was obtained by cultivar 'Melrom' in V2 (19.00 shoots/plant) and the smallest by 'Galicjanka'in V1 with 11 shoots per plant.

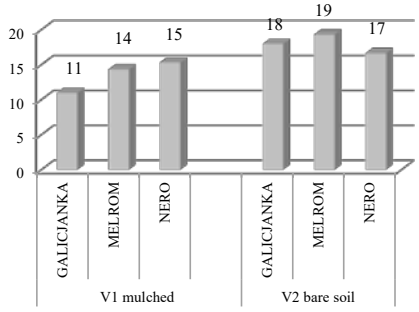

Figure 3. Average number of shoots per cultivar and per variant

Number of fruits/cluster
Statistical analysis of data on the number of berries per cluster, using Duncan's multiple range test ($P \leq 0.05$) shows that between cultivars were no significant difference.
The highest average number of fruits per cluster, was recorded by 'Galicjanka' cultivar in V2 (25.00 fruits/cluster), and the lowest average number of fruits was recorded by 'Melrom' also in V2 (13.00 fruits/cluster). Besides the cultivar 'Galicjanka', a large number of fruit per cluster was recorded by Nero in V1 with 21 berries/cluster - Figure 4. On average, in the two treatments, the best results were obtained by V1 mulched variant (19.15 berries/cluster) and the lowest bare soil V2 - 17.48 berries/cluster. (fruits/plant).

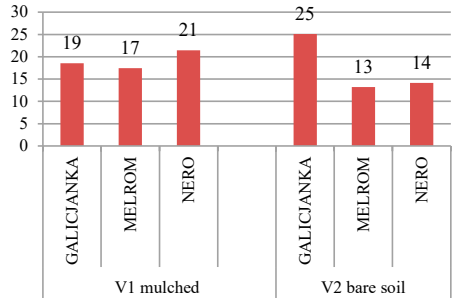

Figure 4. Average number of fruits per cluster

Fruit analysis
On the basis of the results obtained, different sizes of chokeberry fruit cultivars were observed (Table 2). Fruits of 'Galicjanka' variety had the highest weight of fruits, followed by fruits picked up from 'Nero' and 'Melrom'. The average weight of 'Galicjanka' fruit amounted to 1.09 g, 'Nero' 1.08 g and 'Melrom' with 1.03 g. If we extrapolate the weight of 'Galicjanka' fruit to 100 fruits, the weight will be 109 g, value is higher than the one considered by Jeppsson (2000 b and a) as large fruits. Also, Jeppsson (2000 b and a) stated that the fruits of 'Nero' cultivar is to be considered large fruits. These cultivars weighed from 65 to almost 95 g, so the average fruit weight obtained during our experiment is confirming from the first year of crop, the conclusion of Jeppsson.
Sugar content along with other fruit characteristics determines the fruit quality. Regarding the taste of aronia fruit, it is well

known that it can be described as a complex flavor incorporating components of dryness, tartness, earthy undertones, and astringency (from the high tannin content, like a dry red wine). In order to be edible, the aronia fruit has to have high sugar content.

From the Figure 5, it can be observed that maximum average value of brix % in V1 has been reached by 'Galicjanka' cultivar (23.00) followed by 'Melrom' and 'Nero' with the same value (21.4) Brix units.

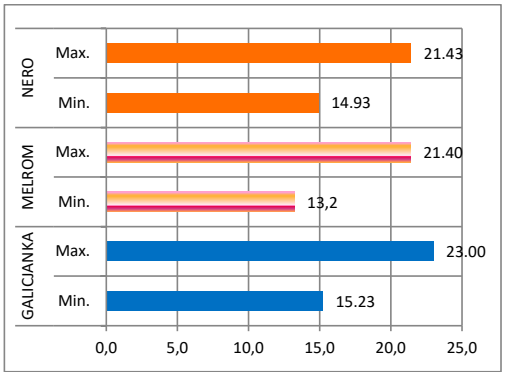

Figure 5. Maximum and minimum Brix % value in aronia fruits in V1

Regarding maximum brix value in V2, the highest brix has been reached by 'Nero' cultivar with a value of 21.43 (Figure 6).

The maximum determined values are quite similar for both treatments and for all cultivars, showing that the treatments have had no significant effect on the fruit characteristics but it has to be taken in to account that the observations were made just in the year 2021, second year after plantation was established.

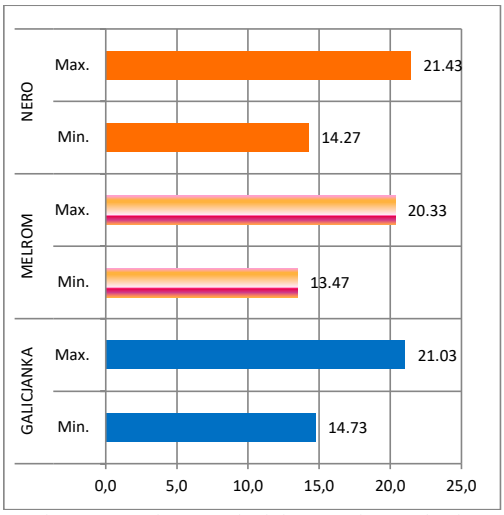

Figure 6. Maximum and minimum Brix % value in aronia fruits in V2

In the Table 2. values determined for each harvest are listed. Also, mean, standard deviation, coefficient of variation and variance for brix value are calculated.

Table 3 including all relevant data regarding fruit quality, regarding average fruit weight, the minimum and maximum fruit size.

The fruit pH is considered on normal values with the highest value determined for 'Nero' fruits (4.03), followed closely by 'Galicjanka' (4.01) and 'Melrom' with 3.98. there is no significant statistical difference between the pH cultivars values. A Duncan-T-Student concordance test (t) with a probability 0.05 has been performed and the P(T<=t) two-tail value was 1,23259E-06. between the two sets of data (pH for V1 fruits and V2).

Table 2. Brix values calculation by harvest - aronia fruits

Treatments	Cultivar	Values for min./max.	Harvest 1 13 Aug 2021	Harvest 2 18 Aug 2021	Harvest 3 24 Aug 2021	Mean	St. dv. σ	CV%	Var
V1 - mulched	GALICJANKA	Minim	14.20	16.20	15.30	15.23	1.00	15.21	1.00
		Maxim	22.80	25.10	21.10	**23.00**	2.01	11.46	4.03
	MELROM	Minim	11.20	16.40	12.10	13.23	2.78	4.76	7.72
		Maxim	21.20	22.60	20.40	21.40	1.11	19.22	1.24
	NERO	Minim	13.30	15.50	16.00	14.93	1.44	10.40	2.06
		Maxim	18.60	22.40	23.30	**21.43**	2.49	8.59	6.22
V2 - Bare soil	GALICJANKA	Minim	12.30	16.80	15.10	14.73	2.27	6.48	5.16
		Maxim	20.30	22.40	20.40	21.03	1.18	17.76	1.40
	MELROM	Minim	11.60	14.10	14.70	13.47	1.64	8.19	2.70
		Maxim	19.50	19.80	21.70	20.33	1.19	17.04	1.42
	NERO	Minim	13.20	16.10	13.50	14.27	1.59	8.95	2.54
		Maxim	20.20	23.50	20.60	21.43	1.80	11.90	3.24

Table 3. Overall aronia fruit characteristic for 2021

Fruit characteristics	Cultivars		
	'Galicjanka'	'Melrom'	'Nero'
Average weight of fruit (g)	1.09a	1.03a	1.08a
Fruit size (mm) (min-max)	9.55-14.40	9.45-14.61	9.66-14.35
Mean	11.98a	12.03a	12.01a
Sugar content (% Brix) (min-max)	12.30-25.10	11.20-22.60	13.20-23.30
Mean (% Brix)	18.70a	16.90a	18.35a
pH mean	4.01a	3.98a	4.03a

Having in mind that the study was done just for the year 2021 and the aronia plantation has been planted in 2020, it should be considered that in this paper, the results are preliminary results.

CONCLUSIONS

The study was aiming to state the actual status of the aronia plantation and its characteristic for cultivars grown.

In order to define better the results and to be able to form a statistically based conclusion the research will continue.

From the partial results of 2021, we can conclude that *Aronia melanocarpa* is a very vigorous specie that can adapt to the climatic and pedologic conditions of south-east Romania area.

The best results has been shoed by the cultivar 'Galicjanka' followed by 'Melrom' and 'Nero'.

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