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STUDY REGARDING THE BEHAVIOR OF THREE CHOKEBERRY CULTIVARS (*ARONIA MELANOCARPA*) CULTIVATED IN ORGANIC SYSTEM

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Abstract

The paper presents data related to the evolution during 2021-2022, of three chokeberry Aronia varieties, grown organically in the farm belonging to FRDS Băneasa, located in N-E of Bucharest in Afumați, Ilfov County, in the Vlasiei Plain, a subunit of the Roman Plain. Aronia melanocarpa, is a crop that issuitable for organic system, and the importance of fruits is given by the fact that it has special nutraceutical qualities, mainly due to the high contain of anthocyanins and flavonoids among other important substances that can reduce the risk of serious illness. The study was continued on a plantation established in 2020. The chokeberry varieties under observations were: 'Melrom', 'Nero' and 'Galicjanka'. Planting distances 1.5 m/3 m, in 2 variants, plants canopy conducted as bush. In 2022, number of shoots and inflorescences per plant, shoots length and the number of fruits per inflorescence were counted. Also, fruit weight, size, sugar content, pH and citric acid for each variety was determined and compared to the 2021 results. The study will continue in order to gather more data for the organic cropping system of Aronia.

Key words*: chokeberry, 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). It is possible to establish a chokeberry plantation in any climate. Because 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).

Moreover, only a limited number of global cultivars are well-suited to the specific pedoclimatic conditions present in Romania, as indicated by Ligia Ion (2007, the National Program for Rural Development 2014-2020). The traditional agricultural practices in Romania emphasize the use of clean technologies, allowing for the establishment of environmentally friendly farming zones. This commitment to eco-friendly approaches is reinforced by the increasing demand for organic products, transforming organic farming into a viable source of income for the rural population, as highlighted by many authors Sumedrea D. et al. (2014) and Rati I. V. (2008).

The paper reports on the research done in an organic system between 2021 and 2022 on three cultivars of *Aronia melanocarpa*: 'Galicjanka', 'Melrom', and 'Nero'. The chokeberry and leaves of *Aronia melanocarpa* provide a multitude of health benefits because of the presence and high concentration of different bioactive components, including vitamins, minerals, and polyphenolic compounds (Szopa et al., 2017). Organic farming systems have

become increasingly interested in cultivating aronia because of its high demand for cultivation due to its nutritional value and resistance to both biotic and abiotic factors.

MATERIALS AND METHODS

The study took place over a span of two years, from 2021 to 2022, at the Fruit Research and Development Station Băneasa, Moara Domnească Farm, situated in Ilfov County, Romania. The site is positioned approximately 25 kilometers northeast of Bucharest in Ilfov County. The locale features a continental temperate climate with clearly delineated seasons. Elevated temperatures define summers, while winters experience cold conditions, often accompanied by recurring droughts. The average yearly temperature is 14°C, and the annual precipitation falls within the range of 500 to 650 mm. The zenith of precipitation, frequently characterized by intensity, occurs between May and July. During winter, prevailing air circulation follows patterns from the East and North-East, transitioning to the West in the other months.

Maximum wind speeds vary between 11.5 and 20.5 km/h. The soil type is reddish luvisol. In the depressed areas and in the crevices there are reddish luvisols and stagnosols (Dragomir et al., 2002).

The organic Aronia plantation was established in the spring of 2020 (Figure 1.), and the experiment was designed with two experimental factors: cultivars: 'Melrom', 'Nero', 'Galicjanka', mulching of plant rows with two systems: 1. bare soil, 2. mulched with rests from wood. The mulch was of approx 20 cm thick.

Figure 1. Aronia plants newly planted in 2020 mulched

In 2020, the soil between the rows was regularly tilled and lacked grass. In contrast, by 2022, a consistent grass cover was present, as shown in Figure 2. The experimental design employed a randomized block design, with three replications and a total of sixty black chokeberry plants. During the trial, standard cultural, training, and pruning practices were used, including drip irrigation.

Figure 2. Aronia plants in organic experimental field mulched (2022 Farm Moara Domnească)

Variables linked to generative potential, such as the count of shoots and inflorescences per plant, along with the number of berries per cluster, were assessed through counting. Biometric measurements of the fruits were conducted using 60 specimens for each cultivar and variant. The height and diameter of the fruit were measured using an electronic caliper, while the weight of the fruit was determined using an electronic balance with precision up to 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 data gathering process produced a number of variants, and the MS Excel "Data analysis" addon was used to statistically evaluate. The Duncan-T-Student concordance test (t) with a probability of 0.05 was used to assess the samples for the statistical hypothesis on differences between variants since there were two variations in the study and data were gathered for each cultivar in 2021 and 2022. (Dragomir et al., 2002).

RESULTS AND DISCUSSIONS

There were no significant differences found between treatments or years in terms of generative potential, more especially in relation to the number of shoots per plant. In the year 2021, the cultivar 'Melrom' in V2 showed the most shoots per plant.

The application of wood chip mulch in both years has affected the average number of shoots per plant for all cultivars. More specifically, on V1, the mulched variant showed 14-13 shoots per plant in 2021, but on bare soil (V2) in 2022, there were 18-15 shoots per plant (Table 1)

Table 1. Comparison of the generative potential of aronia in 2021 versus 2022 regarding the number of shoots per plant

Treatment	Cultivar	Average no. shoots/plant 2021	Average no. shoots/plant 2022
V1 - mulched	GALICJANKA	11	12
	MELROM	14	14
	NERO	15	13
V2 - bare soil	GALICJANKA	18	14
	MELROM	19	15
	NERO	17	15

As far as the average number of flower clusters per plant is concerned, V2 had the highest count in 2021 - an average of 17.33 flowers. By contrast, V1 recorded 15.67 inflorescences on average per plant in the same time frame.
The variation on the average number of inflorescences per plant between the years 2021 and 2022 is notable. The mean number of inflorescences per plant in V1 and V2 in 2022 was 156 (min. 153 and max. 197 clusters/plant), as compared to 15.66, with a minimum of 10.33 and a maximum of 19.33 in 2021 (Figure 3).

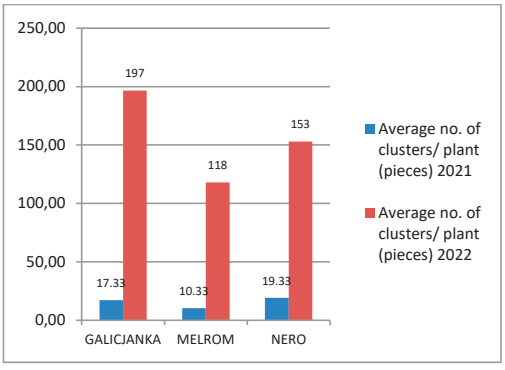

Figure 3. Average number inflorescences per plant 2021 compared with 2022

Number of fruits/cluster

Regarding the data on the number of berries per cluster, it here was little difference between the cultivars in the two years.
When comparing 2021 and 2022 with respect to the average number of fruits/cluster, the 'Galicjanka' cultivar in V2 had the highest average number of fruits per cluster (25.11 fruits/cluster in 2021) (Figure 4). The lowest average number of fruits/cluster has been observed by 'Nero' in V2 in 2021. If we compare the cultivars production of fruits/ cluster in 2022 the highest number is observed also at the cultivar 'Galicjanka' in V2 (23.00 fruits) and the smallest number of fruits per cluster by 'Galicjanka' in V1 (16.00 fruits).

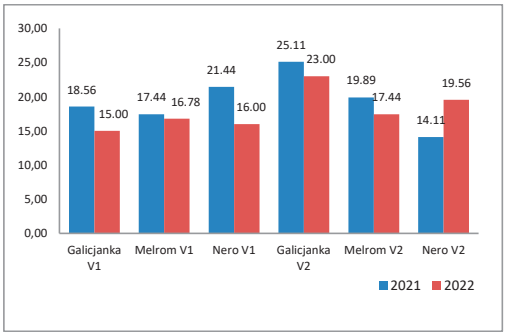

Figure 4. Average number of fruits/cluster 2021 compared with 2022

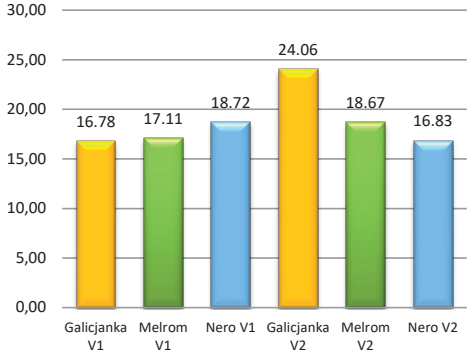

Figure 5. Number of fruits/cluster average for 2021 and 2022

In the Figure 5, it is shown the overall production of fruits per cluster expressed as an average number for each cultivar observed in 2021 and 2022. 'Nero' in V2 showed an exceptionally high average number of fruits per cluster - 16.83 berries per cluster - apart from the 'Galicjanka' cultivar with the highest average fruits/cluster of 24.06.

Fruit analysis

Different sizes of chokeberry fruit cultivars were noted based on the results (Table 2).

The ‘Galicjanka’ cultivar had the largest fruit weight in 2021, followed by fruits from the ‘Nero’ and ‘Melrom’ cultivars. The average weight of ‘Galicjanka’ fruit in 2021 was 1.09 g, whereas in 2022 it was 0.71 g in V1 and 0.52 g in V2. The average weight of the other two cultivars, Melrom and Nero, is comparatively lower at 0.55 g.

Jeppsson (2000b; 2000a) classified large fruits as weighing 71 g for 100 berries; this value is lower than the weight of 109 g resulting from extrapolation of the weight of the ‘Galcjanka’ fruit to 100 fruits. Since the average fruit weight recorded during our experiment corresponds with the first crop year, the conclusion of (Jeppsson, 2000), these cultivars ranged in weight from 65 to nearly 95 g. Every relevant detail about the minimum and maximum fruit sizes for the years 2021 and 2022, as well as the average fruit weight, is included in Table 2.

Fruit pH in 2022 was determined to be at normal levels; the highest value was found for ‘Nero’ fruits in V1 (3.46), closely followed by ‘Melrom’ (4.45) and ‘Galcjanka’ (3.40) in V1. Based on a probability test with a 0.05 P (T<=t) probability, there is no statistically significant difference between the pH cultivar values. Many fruit characteristics as well as the amount of sugar in the Aronia fruit all influence its quality. The flavor profile of aronia fruit is often described as having a complex combination of dryness, tartness, earthy undertones, and astringency. The elevated tannin content of the fruit generates a profile reminiscent of characteristics found in dry red wine. Aronia fruit typically needs a significant sugar content in order to be considered edible.

From the Figure 6, it can be observed that maximum average value of Brix % in 2022 has been reached by 'Melrom' V2 (19.10) followed by 'Galicjanka' V1 with (18.80) Brix units.

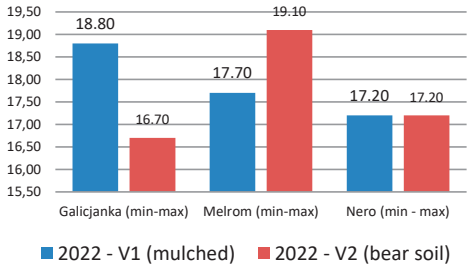

Figure 6. Minimum and maximum, sugar content of aronia fruits (harvest 2022)

In addition to the fruit's sugar content, the citric acid content was measured in 2021 and 2022. This particular compound is particularly significant because it is essential to the fruit's overall composition and influences both its flavour and possible health benefits. It has been noted from the laboratory results that in 2022.

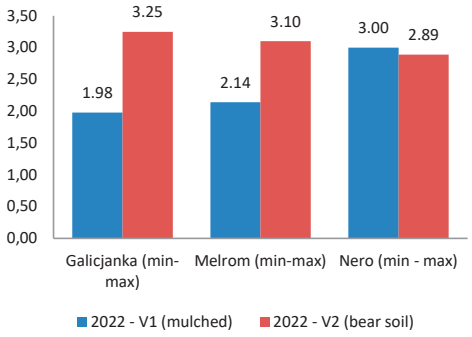

Figure 7. Minimum and maximum citric acid content of aronia fruits (harvest 2022)

The highest acidity value was found in 'Galicjanka' V2 (3.25), and simultaneously in V1 (1.98) had the lowest level (Figure 7.).

As can be seen from Table 2 values were calculated for each year, and all three cultivars were exhibiting comparable results.

Table 2. General characteristics of aronia fruit in 2021 and 2022

Fruit characteristics	Cultivars		
	‘Galicjanka’	‘Galicjanka’	‘Nero’
Average weight of fruit (g) V1 best results			
2021	1.09a	1.03a	1.08a
2022	0,71a	0.55a	0.51a
Fruit size diameter (mm) min.-max.			
2021	9.55-14.40	9.45-14.61	9.66-14.35
2022	10.40-13.09	10.81-13.45	10.00-13.22
Mean fruit size			
2021	11.98a	12.03a	12.01a

2022	11.81a	11,83a	11.38a
Sugar content (% Brix) Mean (% Brix)			
2021	18.70a	16.90a	18.35a
2022	18.80a	17.70a	17.20a
pH mean			
2021 (august harvest)	4.01a	3.98a	4.03a
2022 (july harvest)	2.62a	2.62a	2.95a

Considering that the study was conducted over two years after the plantation was started in 2020 and that there were notable changes in the weather (particularly with regard to rainfall and solar insolation) during this period, the results showed that, on average, the year 2021 produced better fruit than the year 2022 in all categories related to its quality and physical attributes.

CONCLUSIONS

The objective of the study was to investigate changes from 2021 to 2022 in the organic aronia plantation and the characteristics of its cultivars. But drawing firm conclusions is difficult because of the significant variations in the weather throughout these two years. Early findings from 2021 and 2022 suggest that *Aronia melanocarpa* is a very adaptable plant, demonstrating the ability to adapt to the soil and climate in Romania's southeast.

The cultivar 'Galicjanka' had the greatest results in both research years, followed by 'Melrom' and 'Nero'.

It is evident that the V1 mulched form has yielded superior outcomes when comparing the two varieties, V1 with mulch and V2 with bare soil. This can be attributed to its capacity to hold onto water, guaranteeing the plants a consistent supply of moisture when needed.

To collect further data from years with similar climatic circumstances, variables influencing plant growth and development, and the expression of distinctive features in aronia cultivars, more study is required.

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REFERENCES

Brand, Mark (2010). Aronia: Native Shrubs With Untapped Potential. *Arnoldia*, 67(3), 14–25.

Bussieres, Julie, et al. (2008): Growing black chokeberry (*Aronia melanocarpa*) in cut-over peatlands. *Hort Science*, 43.2 494-499.

Dragomir D, Dogaru M, Căliniță C, Hoza D (2022). Preliminary results regarding the behavior of some chokeberry cultivars (*Aronia melanocarpa*) in organic system. *Scientific Papers. Series B. Horticulture*, LXVI: 80-84.

Eggert P. (2008). *Aronia Chokeberry from Planting to Harvest*, Ed. Wektor, Poland, ISBN 978-83-922198-8-0.

Hardin JW. (1973). The enigmatic chokeberries (Aronia, Rosaceae). Bull Torrey, Bot Club; 100: 178.

IoanViorel Rați, Dumitra Răducanu, Nicoleta Bădăluță (2016). Research on the introduction of the species *Aronia melanocarpa*, with a high natural value, from the spontaneous flora into organic farms, *Studii şi Cercetări, Biologie*. Universitatea „VasileAlecsandri" din Bacău.

Ion Ligia (2007). *Pomicultura*, Ed Ceres, Bucuresti.

Jeppsson, Niklas (2000). The effects of fertilizer rate on vegetative growth, yield and fruit quality, with special respect to pigments, in black chokeberry (*Aronia melanocarpa*) cv. `Viking'. *Scientia Horticulturae*, 83, 127-137. 10.1016/S0304-4238(99)00070-9.

Ochmian, Ireneusz & Grajkowski, Józef & Smolik, Miłosz (2012). Comparison of Some Morphological Features, Quality and Chemical Content of Four Cultivars of Chokeberry Fruits (*Aronia melanocarpa*). *Notulae Botanicae Horti Agrobotanici* Cluj-Napoca. 40. 253-260. 10.15835/nbha4017181.

Skender, Azra & Ajdinović, Tea & Becirspahic, Dinko & Kurtović, Mirsad & Hadziabulic, Semina & Aliman, Jasmina (2014). The Comparison of Phenotypic Characteristics of Improved and Wild Blackberry Genotypes.

Scott R.W., Skirvin R.M.(2007). Black Chokeberry (*Aronia melanocarpa* Michx.): A Semi-Edible Fruit with No Pest, *Journal of the American Pomological Society*, 61(3)S 135-137 253-260. https://doi.org/10.15835/nbha4017181.

Sumedrea D. et al. (2014). *Pomi, arbuşti fructiferi, căpşun – ghid tehnic şi economic*. Piteşti Invel Multimedia, pag. 17-25; 261-274.

Szopa, A., Kokotkiewicz, A., Kubica, P. et al. (2017) Comparative analysis of different groups of phenolic compounds in fruit and leaf extracts of *Aronia* sp.: *A. melanocarpa*, *A. arbutifolia*, and *A. × prunifolia* and their antioxidant activities. *Eur Food Res Technol,* 243, 1645–1657. https://doi.org/10.1007/s00217-017-2872-8