

## RESEARCH ON THE DEVELOPMENT OF RASPBERRY CULTIVATION IN CONDITIONS OF ORGANIC AGRICULTURE

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### Abstract

*This paper highlights the evolution of raspberry culture between March and November 2023 on a 1000 m certified organic field in the Bucharest Region. It is based on data obtained during the specified period, monitoring soil parameters at the beginning of the establishment of the crop of two species of raspberries, namely: Opal variety and Delniwa variety. The two varieties were divided into two rows, each occupying half of the total area. The results obtained were evaluated both per variety and per row. There were observed differences between varieties but also between rows in terms of the amount of fruit obtained, in each month of the harvest period. These results support farmers, highlighting varieties suitable for organic crops in the monitored area.*

**Key words:** raspberries, culture, ecological, development, yield.

### INTRODUCTION

The raspberry (*Rubus idaeus* L.), is a fruit-bearing shrub belonging to the Rosaceae family of the genus *Rubus*. This family includes fruit trees such as apple, pear, plum, cherry; fruit bushes: raspberry, mulberry but also ornamental shrubs such as rose or other perennial species: *Fragaria* (strawberry) (Titirică et al., 2023; Veljković et al., 2019; Krauze-Baranowska et al., 2014).

It has been cultivated since ancient times in areas such as Europe, North Asia and North America. In Europe the main raspberry producing countries are Russia, Serbia, Poland, Spain, Ukraine, England (Wróblewska et al., 2020). In Romania most of the raspberry fruits generally come from wild flora, but this is not enough to satisfy the need for domestic consumption and export. This can only be achieved by growing on larger areas of land (Dulf et al., 2012).

According to the FAO in 2022, the main producers of raspberries in the world were Russia, Mexico and Serbia (Figure 1). Romania

had an area of 90 hectares cultivated with raspberries and a production of about 170 tons.

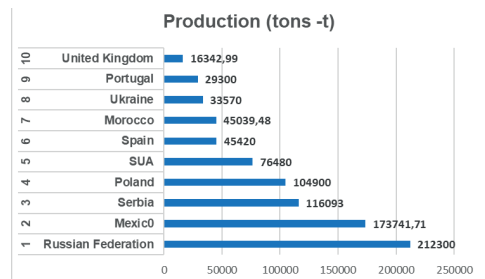


Figure 1. Main producers of raspberries worldwide (<https://www.fao.org/faostat/en/#data/QCL/visualize>)

In recent years, consumers have started to turn their attention more towards healthy, organic foods that have multiple health benefits. Raspberries can be considered such a food because they are a pleasant-tasting, sweet-sour, aromatic fruit, rich in vitamins, minerals, antioxidants and fibre. It has a low caloric content being an ideal food in diets, whether consumed in its natural state or in various processed products (Bobinaitė et al., 2020;

Jakobek et al., 2007; Koraqi et al., 2019; Ponder et al., 2020; Lopez-Corona et al., 2022). Although organically produced food does not always look pristine or commercial, it costs more, but it is healthier, and this makes consumers increasingly prefer it (Ardelean, 2023). Productivity and quality of raspberry fruit depends primarily on the variety, but also on various factors such as: applied agricultural techniques, environmental conditions, soil, climate, proper crop management including fertilization (Anttonen & Karjalainen, 2005; Milivojevic et al., 2011; Palonen et al., 2017; Valentinuzzi et al., 2018).

Given the fact that raspberries are a very popular functional food and the increasing need to grow raspberries in Romania to meet the growing needs of consumers, this paper aims to analyse raspberry production for the two varieties studied.

## MATERIALS AND METHODS

The raspberry crop was set up on a 1000 m<sup>2</sup> plot of land certified ecologically, within INMA Bucharest.

For the planting of the two varieties of cuttings, the land was first prepared with a scarifier at a depth of 60 cm in order to decompress the deep layers of soil, then shredded and levelled first with a disc harrow and then with a rotary tine harrow.

After soil preparation, 6 soil samples were collected, one from the corners and two from the middle of the field for two depths (0-20 cm and 20-40 cm). Samples were homogenized and analyzed to determine both pH and organic and inorganic soil compounds.

Two raspberry varieties were chosen for this study, namely Opal cuttings and Delniwa cuttings. The planting material was certified (disease free) nursery grown (cuttings, root cuttings) without soil on the roots (bare roots). The Opal variety (Figure 2 a) was purchased from the Institute for Research and Development in Pomiculture (ICDP) Pitești-Mărăcineni. The Delniwa variety (Figure 2 b) was purchased from Nurseries Fundulea and was accompanied by phytosanitary passports and quality documents.

The raspberry cuttings were planted in mid-March 2023. The plot was divided into four

rows, the first two rows were planted with Opal and the other two with Delniwa, each row having three 26 m zones delimited by a 4 m crossing zone. The row spacing was 3.3 m and the plant spacing was 0.5 m (Opal) and 0.75 m (Delniwa), according to the staking scheme shown in Figure 3.



Figure 2 a. The Opal variety



Figure 2 b. The Delniwa variety

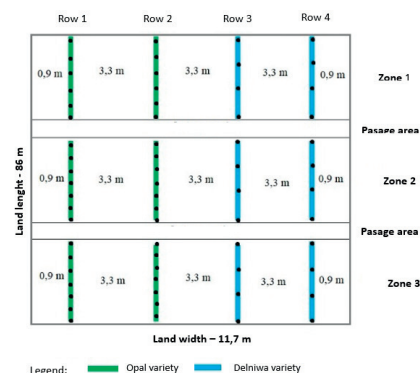


Figure 3. The scheme of picketing the land

Before planting, the planting material was moistened for 2 hours and then introduced into the soil at a depth of 20-25cm using a hand planter (Figure 4), then the hole was covered with loose soil.



Figure 4. Planting raspberry cuttings

Finally, a drip irrigation system was installed and biodegradable mulching film was applied

to the cuttings to increase yield and maintain soil moisture (Figure 5).



Figure 5. Laying irrigation system and mulching film

For optimal maintenance of the crop and to ensure the verticality of the raspberry stems in July 2023, a support system (trellising) was installed on the trellises (Figure 6).



Figure 6. Trellis support system

The system is composed of 1.7 m high support poles to which three rows of wires of varying widths are attached, the first wire is 60 cm above the ground and the other two are approximately 30 cm apart (Figure 7).



Figure 7. Placement of the support system on the trellises

The raspberry crop establishment technology is shown schematically in figure 8.

Throughout the vegetation period from planting (mid-March) to dormancy (end of November), the raspberry crop was monitored and maintenance work was carried out. The evolution of the crop in the first year after establishment can be seen in Figure 9.

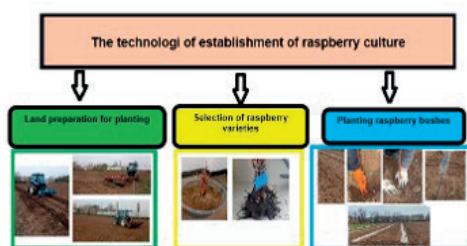


Figure 8. Technology of establishing raspberry culture



Figure 9. The evolution of raspberry culture in the first year after establishment

## RESULTS AND DISCUSSIONS

Results from soil samples taken before crop establishment showed that the soil had a pH of 6.54 at 0-20 cm depth, and a pH of 6.63 at 20-40 cm depth. The values of organic and inorganic compounds analysed are highlighted in Table 1.

Table 1. Organic and inorganic compounds analysed

	Organic and inorganic compounds analysed	Content to a depth of 20 cm (mg/kg)	Content to a depth of 20-40 cm (mg/kg)
1	Lead	17.0	17.0
2	Nickel	18.9	18.2
3	Copper	19.6	18.6
4	Cadmium	0.35	0.33
5	Manganese	509.1	493.3
6	Zinc	78.9	79.8
7	Aqueous extract chlorides (1:5)	106.4	88.6
8	Sulphates (S-SO <sub>4</sub> <sup>2-</sup> ) aqueous extract (1:5)	96.0	72.0
9	Soluble calcium aqueous extract (1:5)	319.7	269.0
10	Soluble magnesium aqueous extract (1:5)	42.0	31.0
11	Soluble sodium aqueous extract (1:5)	11.0	11.3
12	Exchangeable calcium	5474.0	4310.0
13	Exchangeable magnesium	389.5	400.6
14	Exchangeable sodium	267.9	161.7
15	Exchangeable potassium	335.7	331.6
16	Ammonium (N-NH <sub>4</sub> <sup>+</sup> ) extractable	7.255	5.772
17	Nitrit (N-NO <sub>2</sub> <sup>-</sup> ) extractibil	0.903	0.729
18	Extractable nitrate (N-NO <sub>3</sub> <sup>-</sup> )	6.497	3.424

Although samples were taken from two different depths, the compound values did not differ significantly.

The obtained values of the analysed compounds are within the parameters for organic crop development.

The first raspberry harvest was on 16 June and the last on 28 November. During this period, depending on the flow of ripe fruit, harvests were made once or twice a week.

The Opal variety started fruiting earlier. The first harvest was directly from the planted cuttings (Figure 10 a) and in September the new shoots started to bud (Figure 10 b). As can be seen the fruits are of medium size but the yield per plant is very high.



Figure 10 a -Harvest from planted cuttings Opal variety



Figure 10 b Harvest from new sprout Opal variety

The Delniwa variety started fruiting later because the planted cuttings did not fruit, but new shoots sprouted from the same root (Figure 11) and fruited in the first year. The fruits of this variety are larger than those of Opal.

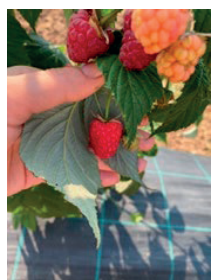


Figure 11. Harvest from the Delniwa variety

### Fruit yield

As regards raspberry fruit yield in each month of the harvest period, differences were observed between varieties but also between rows (Figure 12).

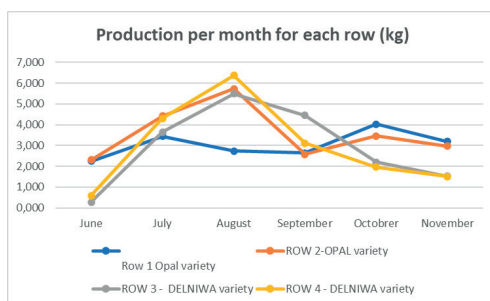


Figure 12. Production per month for each row in kg

At the beginning of the harvest period, the yield was higher in the Opal variety, without too great a difference between rows. In the middle of the harvest period, the yield was higher in Delniwa but also in the second row of Opal, and at the end of the harvest period the yield was again higher in Opal.

Figure 13 shows the total yield per row. The highest yield per row was recorded in Opal with major differences between rows 1 and 2. The Delniwa variety although had a lower yield, the differences between rows were not considerable.

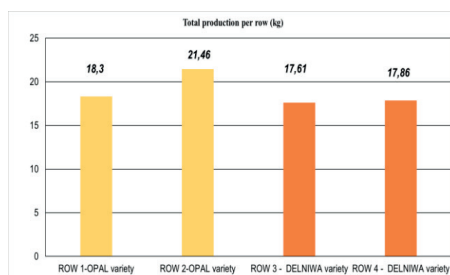


Figure 13. The amount of harvested raspberries in kg

Although the Opal variety recorded higher yields at the beginning and end of the harvest period, it also had the highest yield in row production, in the end the total yield was higher for Delniwa.

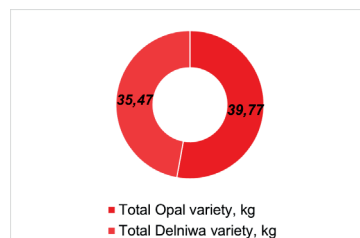


Figure 14. Total production by varieties



## CONCLUSIONS

Following the research carried out in the first year since the establishment of the crop we can draw the following conclusions:

The Opal raspberry variety is a variety with bushes with erect stems that fructify in the year of formation. The harvest period is from mid-June to late autumn.

The Delniwa raspberry variety bears fruit later, the first fruits appear on the newly formed shoots. The optimal harvest period is from mid-July to late autumn.

Although there were differences in yield both between varieties and between rows of the same variety, the total yield by variety did not register minor differences (about 4 kg).

Finally, we can say that both varieties are suitable to be grown organically in the monitored area.

## ACKNOWLEDGEMENTS

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