

## SOME RESULTS ON NUTRITIONAL PROPERTIES OF ORGANIC ROSE PETALS AND RELATED PROCESSED PRODUCTS

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### Abstract

The actual paper presents the first results on the nutraceutical substances found in the rose petals of different varieties, grown organically in different experimental variants. The petals were collected from each variant and analysed in fresh and dehydrated status. Rose petal jams produced with different ingredients (ginger, lemon, seabuckthorn) were also analysed. Total carotenoids content in fresh petals for all 'Crown Princess Margareta' variants was influenced by the mulch and ameliorative variants. Dried petals preserved the carotenoids content while in the rose petal jam was very low. Total anthocyanin content in fresh petals of 'Falstaff' variants were in average at 33.06 mg/100 g. Wool was beneficial, the maximum values on anthocyanin being registered in these variants. Water content was similar in all variants with an average of 84.14%. Total soluble solid (TSS) content varied with the mulch variants (wood chips and wool) and also with the plant ameliorative species. The maximum value obtained was 11.10%. Both rose varieties analyzed have close TSS values.

**Key words:** organic horticulture, carotenoids, anthocyanins, rose petal jam

### INTRODUCTION

From ancient times, roses have been used in medical treatments and as food ingredients. Still now, rose petals and fruits are used in different combinations in pharmaceutical and food products, being highly appreciated for their bioactive substances: etheric oils, tannins, carotenoids, anthocyanin, organic acids, vitamins, minerals etc. (Vasilca Mozăceni, 2002; Milică et al., 2010; Lambraki, 2001.)

Rose petals, like the rose fruits, are an import source of antioxidants (Barros et al., 2011).

The actual paper presents the first results on the nutraceutical substances found in the rose petals of different varieties, grown organically in different experimental variants.

### MATERIALS AND METHODS

The organic culture was established in 2015 at the Didactic Experimental Field of the University of Agronomic Sciences and Veterinary Medicine of Bucharest, using three climbing David Austin rose varieties: 'Falstaff', 'Brother Cadfael' and 'Crown Princess Margareta'.

'Falstaff', created in 1999, is a large and full petalled flowers with a dark crimson colouring. The growth is strong and can reach 2.0 - 2.5 m high as a climber.

'Brother Cadfael', created in 1986, has a large, globular with a clear pink flowers. It has a particularly strong and rich old rose fragrance and can reach 2.5 - 3.0 m high.

'Crown Princess Margareta', created in 1999, has a strong and fruity fragrance like a Tea Rose type. It grows to 2.5 - 3.0 m high, usually bearing clusters of large apricot colour flowers. (Austin, 2012; Wagner, 2010).

Before and after establishing the organic rose culture, three ameliorative species: *Sinapis alba* L., *Phacelia tanacetifolia* L. and *Tagetes patula* L. were use to increase the soil biologic activity and for soil disinfection and disinsection.

All the three ameliorative species were sown in the spring, by combining the three species in 7 variants: V1 *Sinapis*, V2 *Sinapis* + *Phacelia*, V3 *Phacelia*, V4 *Sinapis* + *Tagetes*, V5 *Sinapis* + *Tagetes* + *Phacelia*, V6 *Tagetes* + *Phacelia*, V7 *Tagetes* and a control parcel V8, was kept as black field, without sowing.

They were trimmed and incorporated into the soil after the flowering period.

Starting with 2016, on the rose rows, the soil was mulched with saw dust and wool for each initial variant (Vn): Vn.1. wood chips and Vn.2. wool, while the control Vn.3., was represented by unmulched soil. Both mulched rows had the same 1 m width with the specific material.

For each experimental variant, the same technology was applied using manure fertilizing at planting and other organic products in the following years. Plant protection was ensured with copper, sodium bicarbonate, sulfur, pepper, garlic and propolis tincture. Different biostimulators and cow milk were used to increase the plant immunity system.

The petals were collected from each variant beginning with May, in the morning (08.00 - 10.00), being collected initially in plastic bags and transported in cold rooms.

A part of the rose petals were dehydrated with an Escalibur dehydrator, 3 hours at 40°C. The dehydrated petals were kept in paper bags at room temperature.

From fresh petals were produced more variants of rose petal jam (D1 - 'Crown Princess Margareta', D2 - 'Falstaff', D3 - 'Brother Cadfaell') with different ingredients: lemon (Dn.1), ginger (Dn.2), seabuckthorn (Dn.3).

The recipe for every variant consisted in a base formula (sugar sirup: 1.5 kg sugar at 1.0 l water with 0,5 kg fresh rose petals) with ingredients added in the final stage ( 0.3 ml lemon juice, 1.2 ml seabuckturn or 50 g. ginger)

This study presents the first results on some nutraceutical substances found in rose petals and rose jams, as total carotenoids and total anthocyanins, influenced by the three varieties and the applied organic growing technologies. The content in total soluble solids and dry matter is also reported.

**Total soluble solids** were determined from rose petal juice (Yoon, 2005; Saei, 2011; Mureşan, 2014; Oltenacu, 2015; Bezdadea Cătuneanu et al., 2017), with refractive device Kruss DR301-95 (% Brix).

**Dry matter and water content** of the samples were determined by oven drying for 24 hours at 105°C using a UN110 Memmert oven, method used also by Moura (2005), Skupień (2006), Delian (2011), Corollaro (2014), Mureşan

(2014), Ticha (2015), Bezdadea Cătuneanu et al. (2017).

**Total anthocyanins content** was studied to 'Falstaff' variety and was measured with Specord 210 Plus spectrophotometer at  $\lambda = 540$  nm (Bărăscu et al., 2016; Bezdadea Cătuneanu et al., 2017), after an adapted method. The extracts were filtered under vacuum and completed up to 50 ml volume. The results were calculated using the formula: Total anthocyanins =  $DO_{540} \times F$ , where  $DO_{540}$  is absorbance at wavelength  $\lambda = 540$  nm and factor  $F = 11.16$ . The total anthocyanins content was expressed in mg/100 g in fresh weight.

**Total carotenoids** were studied to 'Crown Princess Margareta' variety. The identification and quantification of total carotenoids content was made after an adapted method after Lichtenthaler and Wellburn (1983) and Arnon (1949).

The analyses were conducted in the Research Center for Studies of Food and Agricultural Products Quality, University of Agronomic Studies and Veterinary Medicine of Bucharest.

## RESULTS AND DISCUSSIONS

For the '*Crown Princess Margareta*' variety were analysed total soluble solids, dry matter and total carotenoids content in fresh petals, dry petals and jam comparing the variants of ameliorative species and mulch used (Table 1).

Table 1. Influence of variants on evolution of total soluble solids and dry matter on fresh petals of 'Crown Princess Margareta' variety

Variant	Dry matter content (D.M. %)	Water content (U) (%)	Total Soluble Solids (TSS) (% Brix)
V1.1	19.33	80.67	8.90
V2.1	16.38	83.62	8.50
V3.1	15.06	84.94	9.80
V4.1	14.97	85.04	7.80
V5.1	15.60	84.40	7.60
V6.1	17.02	82.98	9.70
V7.1	14.66	85.34	8.10
V8.1	15.09	84.91	7.90
<i>Average Vn.1</i>	<i>16.01</i>	<i>83.99</i>	<i>8.54</i>
V1.2	15.51	84.49	8.00

Variant	Dry matter content (D.M. %)	Water content (U) (%)	Total Soluble Solids (TSS) (% Brix)
V2.2	17.16	82.84	10.30
V3.2	15.16	84.84	8.20
V4.2	17.43	82.57	8.50
V5.2	16.47	83.53	7.80
V6.2	17.50	82.50	8.70
V7.2	15.83	84.17	8.10
V8.2	17.98	82.03	9.80
<b>Average Vn.2</b>	<b>16.63</b>	<b>83.37</b>	<b>8.68</b>
V1.3	15.75	84.25	8.00
V2.3	15.24	84.76	7.80
V3.3	16.70	83.30	9.60
V4.3	13.47	86.54	10.20
V5.3	15.98	84.02	9.70
V6.3	17.82	82.18	7.80
V7.3	18.63	81.37	7.60
V8.3	14.88	85.12	9.00
<b>Average Vn.3</b>	<b>16.06</b>	<b>83.94</b>	<b>8.71</b>
<b>Average Vn.n.</b>	<b>16.23</b>	<b>83.77</b>	<b>8.64</b>

Water content was similar in all variants, with an average of 83.77%. In the wood chip mulch variants the minimum was in V1.1 (80.67%) and the maximum in V6.1 (85.34%) and V4.1

(85.04%). In the wool mulch variants the minimum was in V8.2 (82.03%) and the maximum in V3.2 (84.84%). In the control mulch variants the minimum was in V7.3 (81.37%) and the maximum in V4.3 variant (86.54%).

V6 variant registered the lowest value of water content in average (82.56%) and V4 variant the maximum value (84.71%).

Total soluble solids for all the ‘Crown Princess Margareta’ variants were in average at 8.64 (% Brix).

In the wood chips mulch variants the minimum were in V5.1 (7.60%), V4.1 (7.80%) and V8.1 (7.90%); the maximum values were in V3.1 (9.80%) and V6.1 (9.70%).

In the wool mulch variants the minimum were in V5.2 variant (7.80%) and the maximum in V2.2 (10.30%) and V8.2 (9.80%).

In the control mulch variants the minimum were in V7.3 (7.60%), V2.3 (7.80%) and V6.3 (7.80%); maximum were in V4.3 (10.20%), V5.3 (9.70%) and V3.3 (9.60%).

V7 variant registered the lowest value of total soluble solids in average (7.93%) and V3 variant the maximum values of TSS (9.20%).

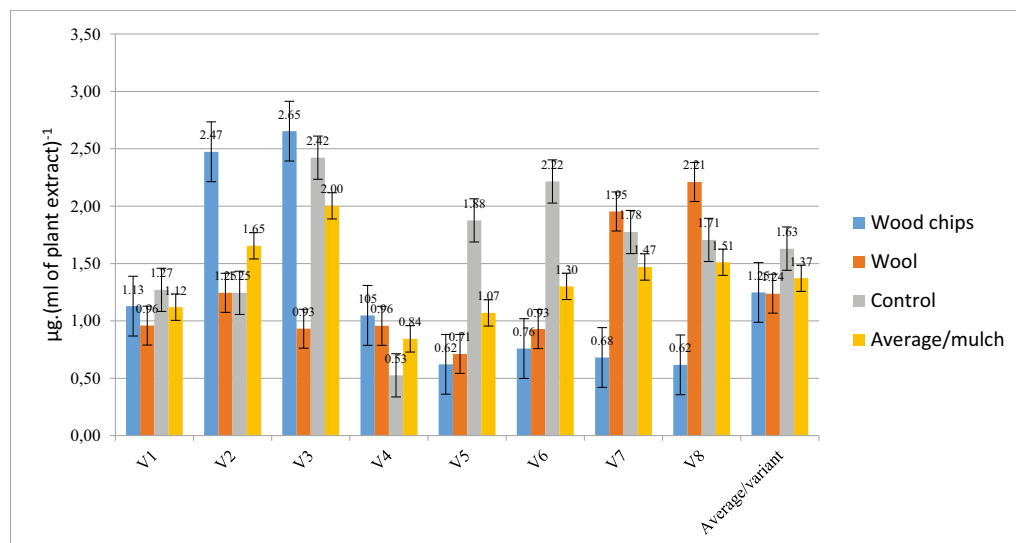


Figure 1. Variation of total carotenoids content ( $\mu\text{g}(\text{ml of plant extract})^{-1}$ ) in fresh petals of ‘Crown Princess Margareta’ variety, according to mulch and ameliorative species variants

Total carotenoids content in fresh petals for all ‘Crown Princess Margareta’ variants were in average at 1.37 ( $\mu\text{g.}(\text{ml of plant extract})^{-1}$ ).

In the wood chips mulch variants the minimum were in V5.1 (0.62), V7.1 (0.68), V8.1 (0.62); the maximum values were in V3.1 (2.65) and V2.1 (2.47).

In the wool mulch variants the minimum were in V5.2 variant (0.71%) and the maximum in V8.2 (2.21%).

In the control mulch variants the minimum were in V4.3 (0.53) and the maximum were in V3.3 (2.42%).

V4 variant registered the lowest value of total carotenoids content in average (0.84) and V3 variant the maximum values (2.00) (Figure 1).

Table 2. Total soluble solids content, dry matter and total carotenoids content on dehydrated rose petals and rose petal jam from ‘Crown Princess Margareta’ variety

Variant	Dry matter content (D.M. %)	Water content (U) (%)	Total Soluble Solids (TSS) (% Brix)	Total carotenoids ( $\mu\text{g.}(\text{ml of plant extract})^{-1}$ )
U	91.90	8.10		2.07 $\pm$ 0.170
D1	20.00	80.00	68.50	0.13 $\pm$ 0.082
D4	26.00	74.00	61.30	0.05 $\pm$ 0.055
D7	20.00	80.00	68.10	0.09 $\pm$ 0.008
<i>Average D.n</i>	<b>22.00</b>	<b>78.00</b>	<b>65.97</b>	<b>0.09<math>\pm</math>0.063</b>

In the dry petals of ‘Crown Princess Margareta’ variety, total carotenoids were similar to the average of fresh petals (2.07 $\pm$ 0.170) (Table 2).

In all rose petal jams from this rose variety, total carotenoids were significant lower than in fresh or dry petals.

For the ‘Falstaff’ variety total soluble solids, dry matter and total anthocyanin content in fresh petals, dry petals and jam were analysed comparing the variants of ameliorative species and mulch used (Tables 3, 4).

Water content was similar in all variants, with an average of 84.51%. In the wood chip mulch variants the minimum was in V7.1 (76.85%) and the maximum in V8.1 (86.69%). In the wool mulch variants the minimum was in V4.2 (83.30%) and the maximum in V7.2 (86.60%). In the control mulch variants the minimum was in V5.3 (84.22%) and the maximum in V2.3 (86.81%).

Table 3. Influence of variants on evolution of total soluble solids and dry matter on fresh petals of ‘Falstaff’ variety

Variant	Dry matter content (D.M. %)	Water content (U) (%)	Total Soluble Solids (TSS) (% Brix)
V1.1	16.06	83.94	7.20
V2.1	13.68	86.32	8.00
V3.1	14.63	85.37	8.30
V4.1	19.87	80.13	8.30
V5.1	15.20	84.80	10.30
V6.1	18.59	81.41	9.90
V7.1	23.15	76.85	10.00
V8.1	13.31	86.69	8.70
<i>Average Vn.1</i>	<b>16.81</b>	<b>83.19</b>	<b>8.84</b>
V1.2	15.09	84.91	8.40
V2.2	16.35	83.65	8.00
V3.2	15.91	84.09	10.10
V4.2	16.70	83.30	7.40
V5.2	15.25	84.75	8.80
V6.2	14.88	85.12	11.10
V7.2	13.40	86.60	8.50
V8.2	14.33	85.67	7.10
<i>Average Vn.2</i>	<b>15.24</b>	<b>84.76</b>	<b>8.68</b>
V1.3	14.70	85.31	7.30
V2.3	13.19	86.81	6.70
V3.3	14.34	85.66	7.90
V4.3	14.38	85.62	8.50
V5.3	15.78	84.22	7.70
V6.3	13.96	86.04	7.80
V7.3	13.86	86.14	6.90
V8.3	15.09	84.91	7.80
<i>Average Vn.3</i>	<b>14.41</b>	<b>85.59</b>	<b>7.58</b>
<i>Average Vn</i>	<b>15.49</b>	<b>84.51</b>	<b>8.36</b>

V4 variant registered the lowest value of water content in average (83.02%) and V8 variant the maximum value (85.76%).

Total soluble solids for all the ‘Falstaff’ variants were in average at 8.36 (% Brix). In the wood chips mulch variants the minimum was in V1.1 (7.20%) and the maximum was in V5.1 (10.30%) and V7.1 (10.00%). In the wool mulch variants the minimum was in V8.2 variant (7.10%) and the maximum in V6.2 (11.10%).

In the control mulch variants the minimum were in V2.3 (6.70%), V7.3 (6.90%) and maximum was in V4.3 (8.50%).

V2 variant registered the lowest value of total soluble solids in average (7.57%) and V6 variant the maximum values of TSS (9.60%).

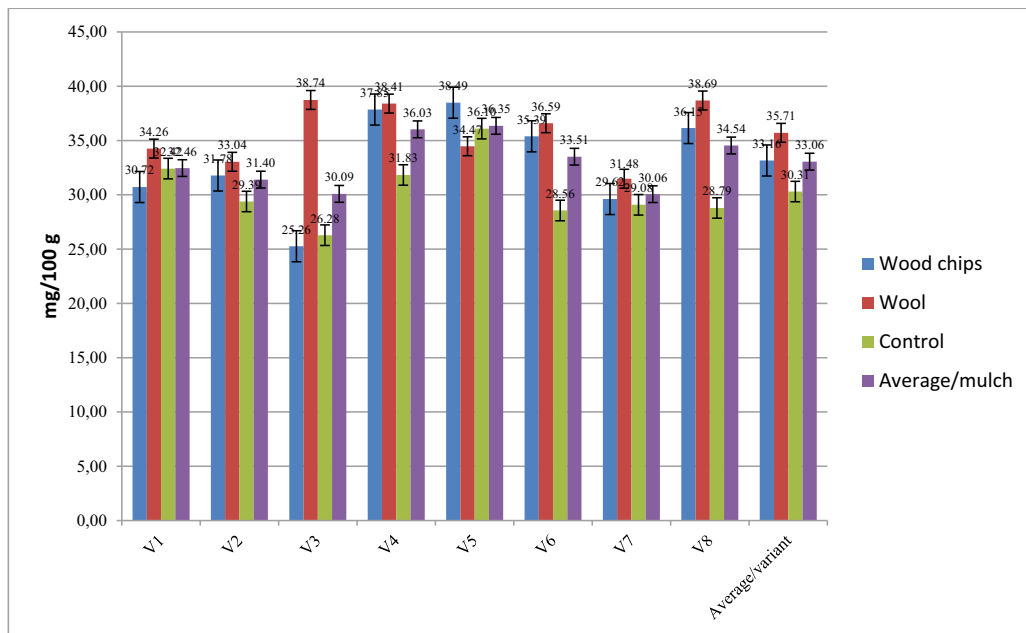


Figure 3. Variation of total anthocyanin content (mg/100 g) of 'Falstaff' variety, according to mulch and ameliorative species variants

Total anthocyanin for all the 'Falstaff' variants were in average at 33.06 mg/100 g.

In the wood chips mulch variants the minimum was in V3.1 (15.26) and maximum was in V5.1 (38.49).

In the wool mulch variants the minimum was in V7.2 variant (31.48%) and the maximum in V3.2 (38.74), V8.2 (38.69) and V4.2 (38.41).

In the control mulch variants the minimum was in V3.3 (26.28) and maximum was in V5.3 (36.10).

V7 and V3 variants registered the lowest values of total anthocyanin in average (30.06 respectively 30.09); V5 and V4 variants registered the maximum values of total anthocyanin in average (36.35 respectively 36.03). In the dry petals of Falstaff variety, total anthocyanin content was bigger than the average of fresh petals (33.06±0.626).

In all rose petal jams from this rose variety, total anthocyanin content was significant lower than in fresh or dry petals.

Table 4. Total soluble solids, dry matter and total anthocyanin on dehydrated rose petals and rose petal jam of 'Falstaff' variety

Variant	Dry matter content (D.M.) (%)	Water content (U) (%)	Total soluble solids (TSS) (% Brix)	Total anthocyanin content (mg/100 g)
Fd	92.40	7.60	-	39.76±0.272
D2	21.00	79.00	68.70	6.67±0.009
D5	29.00	71.00	58.60	7.20±0.329
D8	27.00	73.00	61.80	5.96±0.399
<i>Average D.n</i>	<i>25.67</i>	<i>74.33</i>	<i>63.03</i>	<i>6.61±0.599</i>

## CONCLUSIONS

This study aimed to determine and compare different parameters analyzed in rose petals and rose jams, as total carotenoids, total anthocyanins, total soluble solids and dry matter influenced by the three varieties of roses and the applied organic growing technologies.

Water content was similar in all variants both for the two rose variety ‘Crown Princess Margareta’ and ‘Falstaff’, with an average of 84.14%. Total soluble solid content varied with the mulch variants (wood chips and wool) and also with the plant ameliorative species. The lower values was in V7 (7.93%) variant and the biggest in V3 for ‘Crown Princess Margareta’ (9.20%). The maximum value was obtain in V4.3 with 10.20%. For the ‘Falstaff’ the lower value was in V2 variant (7.57%) and the biggest in V6 (9.60%). The maximum value was obtain in V6.2 with 11.10%. Both rose varieties have close TSS values on average.

Total carotenoids content in fresh petals for all ‘Crown Princess Margareta’ variants was influenced by the mulch and ameliorative variants. V4 variant, *Sinapis* + *Tagetes* registered the lowest value of total carotenoids content in average (0.84) and V3, *Phacelia*, variant the maximum values (2.00). Wood chip mulch variants had a positive influence, total carotenoids content was higher in these variants. Dried petals preserved the carotenoids contents while in the rose petal jam was very low. Total anthocyanin content in fresh petals of ‘Falstaff’ variants were in average at 33.06 mg/100 g, more than in many fruits as blueberry, apple (Bezdadea Cătuneanu et al., 2017). V7, *Tagetes*, and V3, *Phacelia*, variants registered the lowest values of total anthocyanin in average (30.06, respectively 30.09) while the mixed species variants V5 and V4 registered the maximum values of total anthocyanin in average (36.35, respectively 36.03). Wool was beneficial, the maximum values on anthocyanin being registered in these variants. Dried petals preserved the anthocyanins while in the rose petal jam they are very low.

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