Production and quality potential of different black and red currant cultivars in Baneasa Research Station condition

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Abstract Berry fruit play a significant role in human nutrition, especially as sources of vitamins, minerals, antioxidants and dietary fiber. The purpose of this study was investigation of yield, quality characteristics of some black and red currant cultivars grown in Romania. Physical parameters (weight, dry matter) and chemical parameters (soluble solids contents, titratable acidity, ascorbic acid, anthocyanins) were evaluated. The results showed that the tested genotypes different in evaluated traits The Bogatyr and Slitza cultivars are characterized by dark coloured fruit and a high anthocyanins and C vitamins content. Red Lake and Stanza red currant cultivars have a high content of dry matter, ascorbic acid but only Red Lake cultivar have a high anthocyanins content.

Key words anthocyanins, vitamin C, quality fruit, yield

A considerable interest has been developed over the years in red and black currant due to their potential biologic and health promoting effect (1;8;12).

Over the last years numerous publications have demonstrated high content of bioactive compounds like ascorbic acid, polyphenols, anthocyanins, which are responsible for their antioxidant capacity (2; 6; 9;10;13). Also, some authors reported high amounts of mineral elements for red and black currants, which are essential for human health (11). In black and red currant breeding attention is paid for both the potential in fresh market as well as for good taste, aroma and large size. Also, particular attention is paid to the improvement of the quality of processed berries, especially juice color, ascorbic acid content, soluble solids.

Therefore is important to evaluate foreign and local cultivars from collection and comparisons of these studies for development new cultivars with good quality, yield and economic values.

The purpose of our study are evaluation of some black currant and red currant cultivars under south-east condition of Research Station Baneasa (our region) to assess their breeding value. Results obtained in this study will help breeders to use the best variety as genitor.

Material and Methods

In this study were evaluated 3 black currant and 3 red currant cultivars of different geographic proveniences, cultivated in experimental field of Research Station Baneasa. The fruits of berries were harvested at the optimum ripe stage and analysed during two seasons.

Representative samples were taken to evaluate physico-chemical composition such as, weight, dry matter, soluble solids, titratable acidity, total anthocyanins and total polyphenols of berries.

Was determined yield of fruit, in Kg/plot or Kg/bush and the size of fruit defined as weight of 100 berries randomly chosen from every plot expressed in grams.

The percent of dry matter was determined by drying the slices of fruit to a constant weight in an oven at 105°C. The results was presented in percentage.

The titratable acidity was determined by titration of a known amount of juice of fruits with 0.1N NaOH using phenolphthalein as an indicator. It was expressed as g citric acid / 100 g fresh weight.

Content of soluble solids was determined by means Abbe refractometer with temperature correction. The results were expressed in °Brix.

The total anthocyanins content of the berries extract was determined using a pH differential method previously described by (4). Results were expressed as mg cyanidin-3 glucoside equivalents/100g fresh weight.

Total phenolics content of berries ethanolic extracts was assessed by using the Folin-Ciocalteu phenol reagent method (14) the total phenolics
content was expressed as mg gallic acid equivalents/mg fresh weight.

Assessment of ascorbic acid content was achieved by quantitative reduction of 2,6-dichlorophenolindophenol and the excess of dye is spectrophotometrical determination at 500 nm. The results were expressed as mg/100g fresh weight.

Results and Discussions

Significant differences in the physico-chemical content were detected amount cultivars and species

The results relating to yield value, fruit ripening time, fruit weight of the berries studied in the experiment are presented in Table 1. Under conditions of Baneasa Research Station the harvest fruits started usually at the beginning of June and finished after 10 June for red currant and for black currant bigning of 08 June and finished approximate in 11 July.

<table>
<thead>
<tr>
<th>Cultivars</th>
<th>Fruit ripening time</th>
<th>Fruit yield kg/bush</th>
<th>Fruit yield kg/plot</th>
<th>Fruit weight g/100berries</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Black currant</strong></td>
<td></td>
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<tr>
<td>Negre mari</td>
<td>3.07-11.07</td>
<td>2.59 ±0.36</td>
<td>51.8 ±0.26</td>
<td>120.1 ±0.30</td>
</tr>
<tr>
<td>Bogatyr</td>
<td>4.07-9.07</td>
<td>1.23 ±0.12</td>
<td>24.6 ±0.10</td>
<td>88.11 ±0.06</td>
</tr>
<tr>
<td>Slitza</td>
<td>8.06.-13.06</td>
<td>1.13 ±0.23</td>
<td>22.6 ±0.07</td>
<td>90.02 ±0.10</td>
</tr>
<tr>
<td><strong>Red currant</strong></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Wilder</td>
<td>1.06-10.06</td>
<td>1.18 ±0.41</td>
<td>23.6 ±0.12</td>
<td>68.30 ±0.07</td>
</tr>
<tr>
<td>Red Lake</td>
<td>1.06-8.06</td>
<td>2.21 ±0.88</td>
<td>44.2 ±0.31</td>
<td>57.12 ±0.03</td>
</tr>
<tr>
<td>Stanza</td>
<td>4.06-8.06</td>
<td>2.41 ±0.62</td>
<td>48.2 ±0.42</td>
<td>50.11 ±0.04</td>
</tr>
</tbody>
</table>

Table 1

Collected results from measurements of fruits are presented in table 2

Among the studied red currant cultivars the highest dry matter was found in fruit of the cultivars Stanza(18.41%) and Red Lake (18.13%) while the dry matter of Wilder was lower(16.21%). The same results was obtained by (9) but for the other cultivars. The black currant cultivars presents a hight contents of dry matter compared to red currants. It highlights the Bogatyr variety with a content of 24.55%. Berries of Negre Mari and Slitza cultivars also accumulated large amounts between 22.41% and 23.73 %.

Anthocyanins pigments are responsible for the characteristics red, dark purple colour of red and black currant.

The content of anthocyanins found in this work for the black currant cultivar varies between 166.86 mg/100g FW and 298.22 mg/100g, these values were lower than the content found by (2;13;16). However, similar results with ours for black currant was obtained from (6 and 9). The mean amount of anthocyanins detected in the red currant cultivars was between 20.51 mg/100g FW (Wilder) and 44, 56 mg/100g FW (Red Lake) these values were similar with that found by (2). However, (6;9;10) have obtained a lower content of the anthocyanins for red currants compared to the results obtained by us, but that was higher than that found by (16) (12.09mg/100g FW). The differences can be explained by the fact that in their study used other cultivars.

The total phenolic content of red currant ranged from 95.21 mg GAE/100gFW in cv. Wilder fruit to 150 mg GAE/100gFW in cv. Red Lake fruit.
On the other hand, total phenolic content of the were between 205.20 mg GAE/100gFW and 334.31 mg GAE/100gFW. Phenolic value is higher in black varieties than red varieties.

Table 2

<table>
<thead>
<tr>
<th>Cultivars</th>
<th>Dry matter</th>
<th>SSC °Brix</th>
<th>Titratable acidity g ac. citric /100ml</th>
<th>Ascorbic acid mg/100gFW</th>
<th>Anthocyanins mg/100FW</th>
<th>Phenolic mg GAE/100gFW</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Black currant</strong></td>
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<tr>
<td>Negre mari</td>
<td>22.41±0.61</td>
<td>18.2±0.67</td>
<td>1.35±0.015</td>
<td>160.2±3.13</td>
<td>166.86±0.22</td>
<td>205.20±0.48</td>
</tr>
<tr>
<td>Bogatyr</td>
<td>24.55±0.62</td>
<td>19.3±0.71</td>
<td>2.13±0.041</td>
<td>187.5±1.16</td>
<td>209.18±0.10</td>
<td>258.12±0.48</td>
</tr>
<tr>
<td>Slitza</td>
<td>23.73±0.53</td>
<td>20.1±1.53</td>
<td>1.80±0.035</td>
<td>192.7±1.53</td>
<td>298.22±0.08</td>
<td>334.31±0.20</td>
</tr>
<tr>
<td><strong>Red currant</strong></td>
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<tr>
<td>Wilder</td>
<td>16.21±0.75</td>
<td>13.4±1.65</td>
<td>2.45±0.018</td>
<td>35.4±0.22</td>
<td>20.51±0.54</td>
<td>95.21±0.15</td>
</tr>
<tr>
<td>Red Lake</td>
<td>18.13±0.40</td>
<td>12.4±2.54</td>
<td>3.12±0.018</td>
<td>52.3±0.31</td>
<td>44.56±0.23</td>
<td>150.35±0.20</td>
</tr>
<tr>
<td>Stanza</td>
<td>18.41±0.44</td>
<td>11.2±2.15</td>
<td>2.33±0.011</td>
<td>48.7±0.25</td>
<td>26.90±0.36</td>
<td>110.12±0.29</td>
</tr>
</tbody>
</table>

Value are significantly at P≤0.05 according to Duncan’s Multiple Range Test

C vitamin content varied between 160 mg /100g FW (Negre mari) to 192 mg /100g FW (Slitza) for black currants cultivars. These results are in accordance with the results of (6 and 9). The highest level of C vitamins was recorded at Slitza followed by Bogatyr. However, (13) have obtained a larger content of C vitamin for black currant. The red currant cultivars studied had low content in C vitamins between 35.4 mg /100g FW 52.3 (Willder) and 48 mg /100g FW at Stantza. These data are in agreement with those reported for other red cultivars by (10).

As soluble solids content evidence Slitza cultivars (20°Brix) compared to Negre mari and Bogatyr with slightly lower content. Among red currant cultivars is remarkable Willder cultivar (13.4°Brix) as the other two have slightly lower content. Some authors (6 and 9) reported soluble solids content of about 14.5-15.5 °Brix for the black currant berries against 18.2-20% found in our study. However the cultivars studied by (10) were characterized by lowest soluble content varied from 7.4 to 10.4°Brix. Notice that black currant fruit varieties have a top content higher than those of red currant.

The titratable acidity of red and black currant was expressed as citric acid. The titratable acidity of the red currants investigated in our study varied from 2.33 mg% for Stanza to 3.12mg% for Red Lake. These results are in agreement with (8),however, some authors (9) have obtained a lower content of acidity for the red currants varieties studied. This can be explained by the fact that they used other varieties as well as other climate. Black currants exhibited significant differences in titratable acidity, which varied between1.35 mg% (Negre mari) and 2.13 mg% (Bogatyr). Our results showed that the red currant fruit contain significantly more acidity compared to that of black currant varieties.

Conclusions

Based on fruit weight, dry matter and soluble solids content, it can be concluded that black currants can be considered as the richest ones compared with red cultivars.

Results of this study showed that the black currant cultivars contain significantly more ascorbic acid than the red currant cultivars.

The anthocyanins content is higher in the case of the black currant cultivars compared to red currants. Bogatyr and Slitza genotypes can be recommended to used in breeding programs to increase C vitamin and anthocyanins content.

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