Mid-season peach varieties – physicochemical and sensory profile

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Abstract. Prunus varieties are a major contributor to bioactive compounds in the daily diet in the spring and summer. There is a need to disseminate knowledge about the benefits of consuming fruits and their products to the public and to expand research into the potential for harnessing their health potential. The study aims at evaluating target physicochemical and composition attributes of two mid-season ripening dessert peach varieties: “July Lady” (freestone) and “Laskava” (freestone). Fruit weight, shape and size, as well as colour and firmness were evaluated. Image analysis was used to describe properties such as length, width, thickness, etc. Dry matter (%), ash content (%), total soluble solids, pH, titratable acidity, total sugar content, and protein content were employed to characterize the studied varieties. Total soluble solids varied from 12.52 to 13.52 and dry content from 14.98 to 16.16%. A descriptive sensory method characterised the studied varieties, and the panel lists detected differences in each of the categories (aroma, taste, texture and appearance). These results highlight new data about peach varieties and help to better feature their unique characteristics.

Keywords: peach, physicochemical attributes, sensory evaluation, varieties.

1. Introduction

Prunus varieties are a major contributor to bioactive compounds in the daily diet in the spring and summer. Peaches (Prunus persica L. Batsch) belong to the Rosaceae family and are a species of many crops commonly grown around the world. They are three major types: dessert, nectarines, and canning. “Laskava” is a sustainable dessert peach variety, which was developed at the Fruit Growing Institute, Plovdiv and recognized in 2009. The variety was obtained by double free pollination of selected hybrids from the parent combination “Halle” x (“Elberta” and “Fergana yellow”).

The variety is resistant to one of the most common diseases among fruit crops – branch blight. The fruit is large and the skin is intensely red. The flesh is yellow, with a slight redness around the stone.

“July Lady” is an American dessert peach variety with medium to large fruits. The fruit is round, with a regular shape. The fruit flesh is juicy with a good taste.

Renewed and increased interest in fruit consumption exist and researchers have gained understanding about the physicochemical properties and chemical composition of different fruits. Consumers’
perception to fruit quality is a key feature to postharvest research [1] and extensive research in the field of fruit acceptance exists [2]. There is a need to disseminate knowledge about the benefits of consuming fruits and their products to the public and to expand research into the potential for harnessing their health potential. The study aims at evaluating target physicochemical and composition attributes of two understudied mid-season ripening peach varieties: “July Lady” (freestone) and “Laskava” (freestone). A descriptive sensory method characterised the aroma, taste, texture and appearance of the studied varieties.

2. Materials and methods

2.1. Plants and culture
Two peach varieties were evaluated. “July Lady” (peach, freestone), and “Laskava” (peach, freestone), participated in the study. Fruit was harvested from trees at the Fruit-growing Research Institute, Plovdiv, BG (lat. 42.1038482 8045957 and long. 24.721648814686). Fruit was harvested from tree ranging from 5 to 8 years old that were spaced 3 m apart. No bactericides were applied to plantings during testing.

2.2. Harvest
Peaches were hand harvested in the morning between 6 am and 8 am on two harvest dates at optimal ripeness. They were free from major damages such as blemishes, flaws, etc. “July Lady” was harvested on 8 July 2020, and “Laskava” on 3 August 2020. No rain events within 24 h of harvesting have been registered. Sixty peaches per variety were harvested and transported in pulp trays in an air-conditioned vehicle to the University of food technologies, where the fruit was randomly places in new trays in order to minimize the differences in fruit quality. Extra fruit was harvested in case there was decay or damage during/after the harvest. The fruit was evaluated for physicochemical and sensory attributes at harvest.

2.3. Physicochemical analysis

2.3.1. Fruit and pit weight
Fruit and pit were measured on a digital scale (KERN, EMB 500-1). Fruit was weight intact; afterwards the pit was extracted and evaluated.

2.3.2. Image analysis of shape and size
Thirty peaches of each variety were divided into three groups, and were positioned in three orientations as described by Erçislí et al. [3]. A Nikon D5600 digital SLR camera with 30 mm focal length and shutter speed 1/160 sec. was used to capture the area. The image resolution was 3000x4496p with 300 ppi pixel depth. Photos were saves as colored .tiff image files. The obtained images were processed and analyzed with ImageJ software. The geometric mean diameter and sphericity were calculated following the equations of Mohsenin [4]. Surface area was calculate according to McCabe et al. [5], and shape index was determined following Ozkan and Koyuncu [6].

2.3.3. Firmness
Firmness of the fruit was measured using a FT 327 fruit pressure tester, TR Turoni, Italy. Force to penetrate was expressed in Newtons (N). Firmness was evaluated at 90, 180, and 270 degrees to the right of the suture.

2.3.4. Colour
The colour of the flash and skin was analysed with the use of PCE-CSM 2, PCE-CSM instruments, Deutschland. The L*, chroma, and hue angle were evaluated. Skin colour was evaluated on three locations (90, 180, and 270 degrees to the right of the suture) for each peach/nectarine. Fruit flesh was measured immediately after cutting the peach using the same technique as for the fruit skin.
2.4. Composition
Composition was evaluated by immediately after measuring the inner colour and pit. Each fruit was macerated for 3 min in a porcelain mortar then strained through a cheesecloth. Each experimental unit was an individual peach.

2.4.1. Dry matter
Total moisture content of the samples was determined according to the procedure described in AACC method 44-15A [7].

2.4.2. Ash content
Ash content of the samples was determined according to the AOAC Official Method 942.05 [8].

2.4.3. pH
The pH was measured using Orion 2 Star pH Benchtop (Thermo Scientific) with the electrode standardized to pH 4.0 and 7.0 Sigma buffers.

2.4.4. Titratable acidity (TA)
Titratable acidity was measured with the use of the potentiometric method, using a pH meter Orion 2 Star pH Benchtop (Thermo Scientific).

2.4.5. Total soluble solids (TSS)
TSS expressed as % were measured using ABBE refractometer (Carl Zeiss Abbe Laboratory Refractometer).

2.4.6. Proteins
Total protein content in samples was determined by dye-binding method [9] where 100 µl of sample was mixed with 100 µl Bradford reagent (Biorad, USA). Distilled water was used as blank. The mixture was incubated at room temperature for 5 min before measuring the absorbance at 595 nm.

2.4.7. Total sugars
The total soluble carbohydrate content was estimated by phenol-sulphuric acid method [10]. The absorbance was measured at 490 nm against blank with d. H2O.

2.5. Sensory evaluation
Sensory analysis was performed at the University of food technologies, Plovdiv, Bulgaria. The ten panelists (30% male, 70% female) were trained to use a modified Sensory Spectrum method, and objective method for describing the intensity of attributes using references. A lexicon of attributes was developed for the needs of the evaluation. Each panelist evaluated one fruit per genotype in duplicates. The fruit was served at room temperature (24ºC) on plates labelled with 3-digit codes in a randomized design. Panelists cleansed their palates between samples using water and crackers. The panel evaluated the fruit for external appearance (n=8), internal appearance (n=6), basic taste (n=3), texture (n=4), and aroma (n=4). The fruit attributes were evaluated by a 15-point scale, in which 15 equals more of an attribute.

2.6. Statistical analysis
Data were analyzed using MS Excel software. All assays were performed in at least three repetitions. Results were presented as mean ± SD (standard deviation). Fisher’s least significant difference test at a level of p < 0.05 were used to determine the significance of differences between mean values.

3. Results and discussion
Two dessert peach varieties were subjected to analysis in order to make comparison. “July Lady” is an American variety and “Laskava” is a Bulgarian. The peach varieties were first compared in terms of their physicochemical attributes (Table 1). The July lady peach was 25% heavier than the “Laskava”.
but they were relatively the same in length, width, and thickness (Figure 1). The length varied from 66.75±1.9 to 68.8±3.32 mm, and the width from 74.4±2.22 to 74.58±2.6 mm.

Figure 1. External view of peach varieties.

Image processing is rather unpopular when characterising peach varieties. Few authors have used such technique even though images of shape and size have not been provided [11]. This makes this research one of the first covering these attributes.

The Laskava variety had twice as small pit as the “July Lady”. Firmness is one of the most important indicators of fruit quality and is frequently used [12]. The two studies peach varieties had quite different firmness: one being very soft (“July Lady”) and the other – very hard (“Laskava”). Low firmness shortens the shelf life of fruit which indicates that the “Laskava” variety can be stored much longer than the “July Lady”. The calculated shape index put the studies peach varieties in the oval shape [6].

Table 1. Physical properties of peach varieties.

| Attribute/ Variety | Fruit weight, g | Pit weight, g | Firmness, N | Fruit/pit ratio | Length, mm | Width, mm | Thickness, mm | Shape index | Surface area, cm² |
|--------------------|----------------|--------------|-------------|-----------------|------------|-----------|---------------|------------|------------------|
| ‘July Lady’        | 234.94±31.56   | 16.47±2.68   | 5.87        | 3.5:1           | 66.75±1.9 | 74.58±2.6 | 70.5±2.84     | 72.29      | 105.67           | 156.23 |
| ‘Laskava’          | 175.72±28.80   | 7.48±1.14    | 0.50        | 3:1             | 68.8±3.32 | 74.4±2.22 | 71.9±2.72     | 73.75      | 104.16           | 161.25 |

Consumers usually make use of colour in order to identify the product in terms of safety, freshness, ripeness and overall quality [13]. Colour vision and colour perception are unique for each person. The prototypical colour of peaches is from yellow to dark red. CIE L* a* and b value quantification of colour is used most frequently. The L* values of the skin ranged from 30.18 to 72.11 for “July Lady” and from 30.31 to 52.81 for “Laskava”. The hue angle ranged from 19.71 to 68.91. Differences between flesh and skin colour existed (Figure 2).

Figure 2. LAB colour values of peach varieties.
Detailed information about some chemical and physical properties of the studied peach varieties is presented in Table 2. Significant difference between the two dessert varieties existed in the titratable acidity, where “Laskava” had 0.45 and “July Lady” 0.16. Based on that, Laskava is a high acidity variety, and July Lady is a low. The big difference in the titratable acidity and the very similar total soluble solids determines the very different maturity indices of the studied varieties (27.82 – “Laskava” and 84.50 for “July Lady”). The TSS values correspond to the range (11.94 to 15.19) established in a study conducted by Zhang et al. [14]. The average ash content of peach varieties documented in literature is 0.50 [15], and the currently established results show a 25% higher value for both varieties. Sugar content in fruit is predominantly sucrose, glucose, and fructose. Total sugars in “July Lady” were 3.80 g/100g and 7.08 g/100g in “Laskava”. Authors suggest major differences in the sugar content between varieties [16, 17]. pH is an important quality attribute for peaches and fruit in general. Peaches have naturally and acidity around 3-4 [18], and the studied varieties fall in the range.

### Table 2. Composition attributes of studied peach varieties.

| Attribute/ Variety | Dry content, % | Ash, % | TSS, % | TTA | pH | Proteins, μg/ml |
|-------------------|----------------|--------|--------|-----|----|----------------|
| ‘July Lady’       | 16.16          | 0.75   | 13.52  | 0.16| 3.73| 120.26±3.21    |
| ‘Laskava’         | 14.98          | 0.77   | 12.52  | 0.45| 4.04| 136.22±2.02    |

*Titratable acidity expressed as % malic acid.

Panellists evaluated the peach varieties in five categories with a total of twenty-five attributes. The evaluation was divided into external and internal properties (Table 3 and Figure 3). Colour, deformities, fuzziness, aroma, basic tastes (sweet, bitter, sour) and texture (crispness, hardness, moisture, fibre presence) shaped the sensory profile of the two mid-season varieties.

Uniformity of colour ranged from 6.2 to 10.00. Both varieties were described as such with internal uniformity of the colour and differences in the external view. “Laskava” had more yellowness internally and “July Lady” more redness.

The panellists detected differences between varieties in each of the evaluated categories. Colour uniformity, redness, yellowness, and deformities shaped the appearance of the peach varieties. Fuzziness was evaluated and both varieties were described as such with tender fuzz. Both varieties were considered big in shape with 7.8 and 7.9 in value, respectively for “Laskava” and “July Lady”.

![Figure 3](image-url)
In addition to that, fruit and pit size were evaluated, as well as fuzziness of fruit skin. According to the panellist the pit of “Laskava” and “July Lady” was medium in size, while the shape was characterized as round (“Laskava”) and leafy-like (“July Lady”). Both pits could be detached from the flesh but “July Lady’s” pits tend to split in half, while “Laskava’s” stayed intact.

Both varieties were free of meaningful deformities according to the panellists. Taste was predominantly sweet with an intensity varying from 12.3 to 13.7. The other two evaluated tastes (bitter and sour) could not practically be distinguished in the samples. Sweet taste is often correlated with TSS value, but no value can guarantee a consumer’s satisfaction [19].

### Table 3. Descriptive sensory texture, taste, and aroma attributes of peach varieties.

| VARIETY/ATTRIBUTE | ‘JULY LADY’ | ‘LASKAVA’ |
|-------------------|-------------|-----------|
| AROMA             |             |           |
| Peachy            | 12.5c       | 13.7a     |
| Unripe            | 0.0b        | 0.0b      |
| Overripe          | 0.0b        | 0.0b      |
| Earthy            | 0.0b        | 0.0b      |
| TASTE             |             |           |
| Sweet             | 12.3ab      | 13.7ab    |
| Sour              | 0.0b        | 0.2a      |
| Bitter            | 0.0b        | 3.1a      |
| TEXTURE           |             |           |
| Flesh hardness    | 10.3a       | 13.9ac    |
| Moisture release  | 10.4ac      | 14.6b     |
| Crispiness        | 8.8bc       | 12.2c     |
| Presence of fibers| 1.2b        | 12.7cd    |

*Means with different letter(s) for each attribute within effects are significantly different (P < 0.05) using Fisher’s least significant difference test.

Flesh hardness, moisture release, crispiness, and fibre presence were the attributes described by the panellists. “Laskava” had tender flesh and more moisture release compared to “July Lady”. Moisture release gives the intensity of liquid releasing in the mouth after one chew. These results correspond well to the firmness documented in Table 1. Olmstead et al. [20] have documented that consumers favour sweet, juicy, and round peaches which means that “Laskava” is likely to be more preferred. “Laskava’s” fruit meat is easier to chew compared to “July Lady’s”. The presence of fibres between teeth after chewing the sample several times reveals that “Laskava” had much more fibre presence than “July Lady”. For both varieties, the aroma was considered as peachy and pleasant with a slight difference in the intensity in favour of “Laskava”.

### 4. Conclusion

The present work provides new information about the physicochemical, composition and sensory attributes of “July Lady” and “Laskava” peach varieties comparing two freestone peach varieties, an American and a Bulgarian one, respectively. These results give a detailed profile of two understudied dessert peach varieties. Additional studies can further characterise the varieties in terms of biological activity and a more thorough chemical profile.

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