Scientific Papers. Series B, Horticulture. Vol. LXVIII, No. 1, 2024
Print ISSN 2285-5653, CD-ROM ISSN 2285-5661, Online ISSN 2286-1580, ISSN-L 2285-5653

SENSORIAL ANALYSIS FOR SOME ROMANIAN AND FOREIGN BLUEBERRY VARIETIES

Maria OJOG[1], Mihaela IORDĂCHESCU[2], Adrian ASĂNICĂ[1], Dan POPESCU[1], Liliana BĂDULESCU[1]

University of Agronomic Sciences and Veterinary Medicine of Bucharest,
59 Mărăști Blvd, District 1, Bucharest, Romania:
[1]Faculty of Horticulture
[2]Research Center for Studies of Food Quality and Agricultural Products

Corresponding author email: liliana.badulescu@qlab.usamv.ro

Abstract

Blueberries are considered super-food because of their richness in antioxidants and vitamin C, essential for strengthening the immune system and protecting the brain. Breeders strive to improve the blueberries' fruit quality treats, so these fruits will have flavors and unique tastes, considerable size, and intense colors, which makes them even more appreciated by consumers. The firmness of fruits, their juiciness, taste, aroma, size, and color are all indicators used to appreciate the 30 blueberry varieties used in this study. Eight Romanian varieties and 22 foreign varieties were analyzed in a testing session in August 2023 with 51 accessors. The highest ranking is attributed to the 'Brigitta' variety. The 'Pink Lemonade' variety scored the best results for flavor, taste, firmness, and juiciness. The Romanian variety 'Delicia' was in the top 3 for 3 indicators. The results of the present study could be used by breeders to select promising varieties as genitors in blueberry breeding programs.

Key words: *Vaccinium corymbosum L., organoleptic evaluation, consumer preferences.*

INTRODUCTION

Blueberries are extremely appreciated for their special taste and their benefits for human health. It is well known that these small fruits can reduce the risks of diabetes (Nunes et al., 2021), cancer (Davidson et al., 2018), and cardiovascular diseases (Del Bo' et al., 2022) and because of these effects, they become very popular. This popularity led to the high bush blueberry plantations increased cultivated surface, including the protected area cultivation, with the marked advantage of delaying the last harvest (Asănică et al., 2017) and making the fruits available all year round.

The taste of blueberries is related to their chemical composition, the sugars, and organic acid combinations, whereas the physicochemical characteristics effects on flavor are highly influenced by the environmental conditions (Marina & Niculina, 2020), (Zhang et al., 2020), (Hera et al., 2022) (Shi et al., 2023). Some fruit production can be delayed by climatic characteristics and some years do influence the development of blueberry vegetation phenophases (Cosmulescu et al., 2022) and that can change the quality of accumulated compounds in fruits.

Although bigger fruits seem more appealing to consumers, small blueberries are known to have higher polyphenols, lycopene, and β-carotene than big ones (Hera et al., 2023).

Studies confirm that the amount of sugar contained in blueberries has a high impact on consumers' preferences, especially for children, and that can change the way people choose their fruits (Mennella et al., 2017).

In recent years, the surfaces cultivated with highbush blueberry increased all over the world for their nutritional values, being worldwide recognized as a 'superfruit' (Yan et al., 2023). Being an important source of minerals and antioxidants (flavonoids, polyphenolic compounds, especially anthocyanins) (Diaconeasa et al., 2015), (Okan et al., 2018) with proven effects on human health (Ferrão et al., 2022), these fruits are included in the everyday diet and the demand can influence the prices, the markets, and also the surfaces cultivated with highbush blueberry. Being highly perishable, blueberries have a seasonal availability and is a global race to find new ways

of using these super-fruits so a large number of people benefit from their nutraceutical capacity (Duan et al., 2022).
Traditionally, the fruits' taste has been evaluated by people specialized to distinguish aspects of flavor, texture, and taste through sensorial tests, although this method is expensive and takes time. E-tongue systems (electronic tongue) have been developed in a way that can mimic the mechanism of human taste and they've been successfully used for testing juices, tea, and wine, starting to be recognized as a promising low-cos technique (Zeng et al., 2020).
Even though e-tongue systems have several advantages over human capabilities, not showing fatigue and with a range of multiple substances (Marx et al., 2021), human subjectivity should be taken into consideration by the breeders to breed specific varieties of fruits in answer to consumers' demands.
The present study proposes to assess the consumers' preferences regarding 30 blueberry varieties, 8 of them Romanian varieties, to have a bigger picture of the people's demand in this field.

MATERIALS AND METHODS

The testing session took place on August 4, 2023, and 30 varieties of blueberries were analyzed, from which 8 were Romanian varieties, 'Delicia', 'Vital', 'Lax', 'Prod', 'Augusta', 'Compact' and 'Simultan', and 22 foreign varieties: 'Pink Lemonade', 'Patriot', 'Northland', 'Coville', 'Reka', 'Hortbleu petit', 'Blueray', 'Sunshine blue', 'Legacy', 'Titanium', 'Spartan', Putte', 'Gupton', 'Brigitta', Huron', 'Jersey', 'Ozark blue', 'Hardy blue', 'Draper', 'Denise blue', and 'Bluecrop'.
The indicators used for expressing quality were: size, color, firmness, juiciness, taste, and flavor. The criteria used for evaluation involved grades from 1 to 5; '1' meaning 'I don't like it' (insufficient), and '5' meaning 'I love it' (excellent).
The age of the responders ranged between 11 and 71 years old, with an average of 41, showing a large range age-wise, with a total of 51 accessors.
The graphs were made with the Microsoft Excel software, version 2401.

RESULTS AND DISCUSSIONS

Total scores for the tested varieties revealed that the values are close with small differences between varieties. In the first figure, all varieties were ranked by the highest score after summing all the indicator averages. The highest scores went to 'Brigitta' with 25.6 points out of 30 possible, and Pink Lemonade with 25.1 points. Five different varieties scored 24 points, one of them being a Romanian variety ('Delicia').
The lowest score was acquired by the Romanian varieties 'Lax' and 'Simultan' with only 20.1 and 19.6 points.

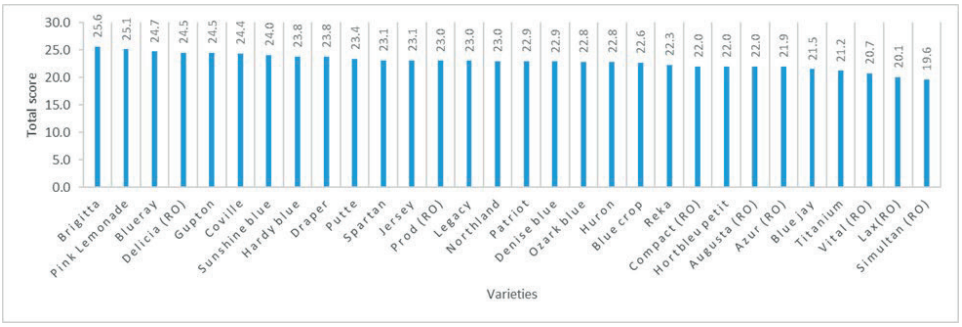

Figure 1. Total scores for the tested varieties. Error bars represent standard error of the mean.

Firmness is an indicator related to blueberry texture and freshness. The highest ranked varieties were 'Brigitta' with 4.6 points, followed by 'Gupton' with 4.3 points. (Figure 2)
The Romanian variety with the best firmness ranking is 'Delicia' with 4.2 points, followed by 'Prod' with 4.0 points.

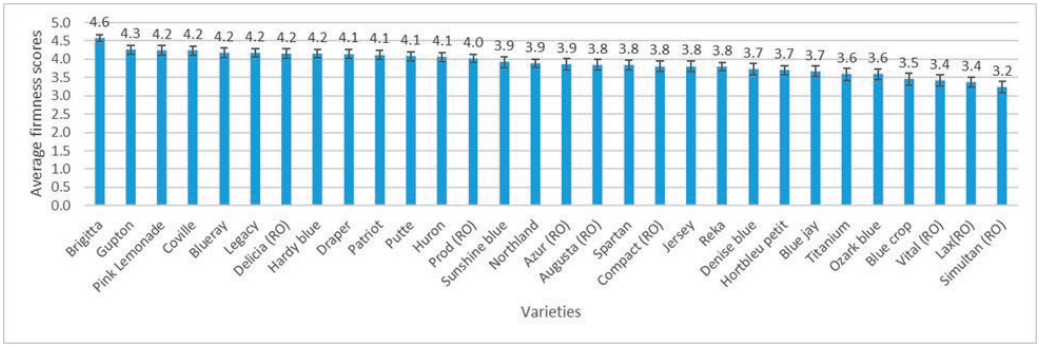

Figure 2. Firmness appreciation. Error bars represent standard error of the mean.

The highest score for juiciness was received by 'Brigitta' with 4.5 points, followed by 'Pink Lemonade' with 4.1 points, and the Romanian variety 'Delicia' with 4.0 points (Figure 3). Another Romanian variety with a good ranking is 'Prod' with 3.8 points.

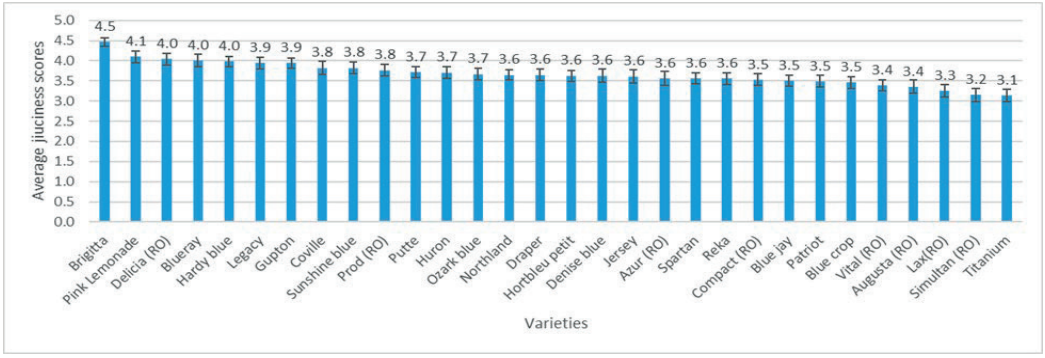

Figure 3. Juiciness appreciation. Error bars represent standard error of the mean.

Taste and flavor are very important traits in a sensorial test and Figures 4 and 5 show that 'Pink Lemonade' was the favorite for both taste and flavor.

With 4.1 points for taste and 4.2 points for flavor 'Pink Lemonade', is the most appreciated variety of blueberry. Both 'Brigitta' and 'Blueray' varieties are also at the top for taste and flavor but with an inversed ranking. The taste was appreciated with 3.9 points for 'Blueray' and 3.8 points for 'Brigitta' and the flavor was appreciated with 4.0 points for 'Brigitta' and 3.9 points for 'Blueray'.

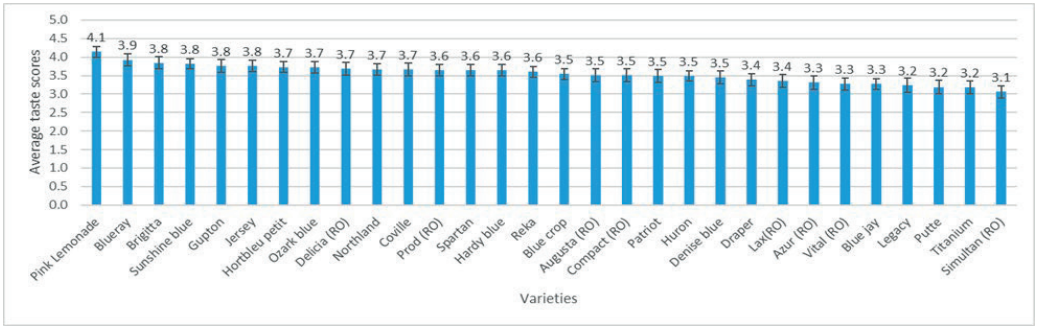

Figure 4. Taste appreciation. Error bars represent standard error of the mean.

The Romanian varieties that impressed with their taste was 'Delicia' ranked 3.7 points and 'Prod' 3.6 points (Figure 4). As for flavor, 'Prod' ranked 3.8 points and 'Delicia' 3.6 points, both in top 10 (Figure 5).

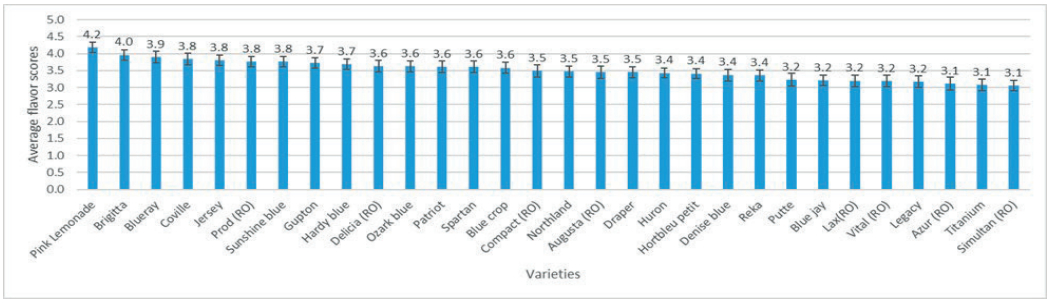

Figure 5. Flavor appreciation. Error bars represent standard error of the mean.

The size and the color of blueberries are also important traits for consumers because the fruits are seen first, and thereafter are bought and tasted. Figure 6 shows that in the sensorial test the best appreciation for size was won by the 'Putte' variety with 4.7 points, followed with a small difference, by 'Draper'. Also 'Denise blue' and the Romanian variety 'Delicia' scored both 4.5 points.

Other Romanian varieties were appreciated with 4.2 points ('Azur') and with 4.1 points ('Augusta').

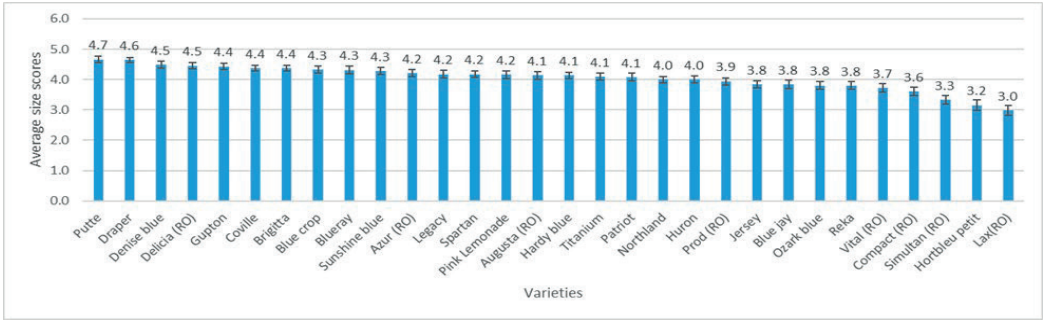

Figure 6. Size appreciation. Error bars represent standard error of the mean.

For the fruits color, the top is reached by 'Putte', 'Delicia', and 'Draper' with the same score – 4.5 points, followed by seven varieties with the same rank, each with 4.4 points (Figure 7). Except 'Delicia', no other Romanian variety was on top 10.

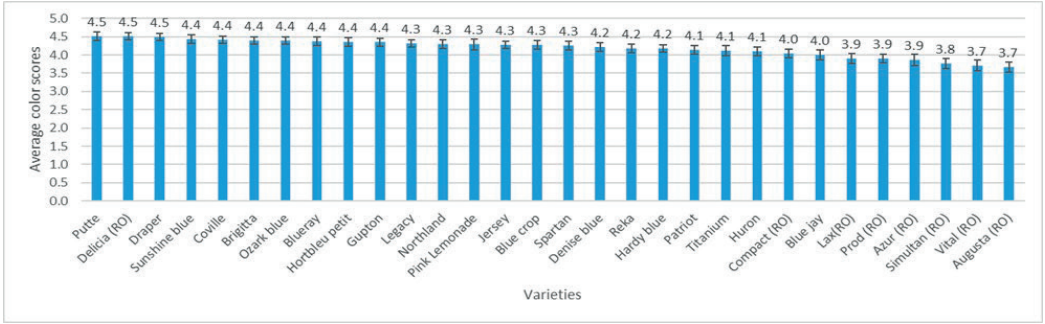

Figure 7. Color appreciation. Error bars represent standard error of the mean.

In 2017, a similar sensorial study was conducted with 26 blueberry varieties (Asănică, 2018) and from those 26 varieties, 15 are also found in the present study. The big surprise was 'Pink Lemonade' variety that had the lowest ranking in 2017 for all indicators, and after 6 years, was the most appreciated for 4 out of 6 indicators (flavor, taste, firmness and juiciness). Also, in 2017 'Delicia' was in top 3 only at firmness, but now was in the top 3 for 3 indicators (color, size and juiciness).

That shows an important evolution of consumer's taste. 'Pink Lemonade' is a variety with a soft pink color but in this study was highly appreciated for taste, flavor, juiciness, and firmness, pointing that at least for the present study, the color, although important, was superseded by the taste and flavor.

CONCLUSIONS

The only Romanian variety that was high ranked in this sensorial study was 'Delicia' reaching the top for 3 out of 6 indicators: juiciness, firmness, color and size.

'Brigitta' had the highest total score at this sensorial test. 'Pink Lemonade' had the highest score at taste and flavor. 'Putte' had the highest score at size and color.

The most overall appreciated varieties of blueberries were 'Brigitta', 'Pink Lemonade', and 'Putte' with high scores for almost all indicators.

Sensorial tests show shifts that can appear in consumers choices. The consumers preferences can change easily in time and these sensorial tests are important for breeders because they can use their results for selecting traits that are important for consumers, improving the fruits variety by using as genetic donor varieties that rank high in consumer preferences, and also are important for farmers, giving them the information they need to cultivate the varieties that are appreciated by consumers.

ACKNOWLEDGEMENTS

This research work is supported by the Romanian Ministry of Agriculture and Rural Development (MADR-Bucharest), under the agricultural research and development program 2023-2026, ADER 6.1.4. project.

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