AVANCES EN LA POSTCOSECHA DE FRUTAS Y HORTALIZAS

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L. Zacarías, A.R. Ballester, J.F. Marcos y M.B. Pérez-Gago
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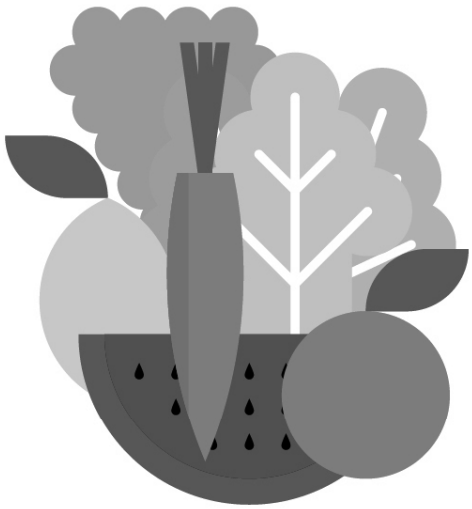

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Evaluation of the physical-chemical properties of blueberries from different geographic origins

S. Matos[1], R. P. F. Guiné[1,2], F. J. Gonçalves[1,2] y D. T. Costa[3]*

[1] Dep. Indústrias Alimentares, Escola Superior Agrária de Viseu, Portugal,
[2] CI&DETS, Instituto Politécnico de Viseu, Portugal,
[3] Dep. Ecologia e Agricultura Sustentável, Escola Superior Agrária de Viseu, Portugal.
*raquelguine@esav.ipv.pt

ABSTRACT
Blueberries are very popular for their potential health benefits around the world, from USA to Asia and to the Mediterranean. In the present work blueberries from cultivar Bluecrop harvested in different regions of Portugal (Estarreja-ES, Vouzela-VZ, Vila Verde-VV, Sever do Vouga-SV and Oliveira do Hospital-OH) were analysed to evaluate their physical-chemical properties: moisture content, total soluble solids (ºBrix) acidity, calibre, colour and texture. Moisture was evaluated by drying until constant weight, sugar content by refractometry and acidity by titration. Calibre was evaluated with a caliper rule, colour with a colorimeter in the CIELab colour space, and texture with a texturometer by measuring force in compression with a 2 mm probe P/2.
The results showed that the sample VV had the highest moisture content as compared to all other varieties (83%), whereas the sample OH showed the highest acidity (0.79 mg citric acid/100g) and the sample ES the highest total soluble solids content (14,65 ºBrix). The average calibre ranged from 0.90 cm for sample SV to 1.17 cm for sample OH. Regarding the colour parameters it was observed that lightness (L*) was under 50, thus indicating that the samples are dark, whereas a* was around 0, so neither red nor green and b* was negative in all cases, so the colour is blue instead of yellow. The values of L* ranged from 31.07 to 36.79, respectively for samples VV and VZ; a* ranged from -0.02 to 0.62, respectively for samples VZ and VV; b* ranged from -7.76 to -5.02, respectively for samples ES and OH. The skin firmness varied from 11.0 N to 15.1 N, respectively for samples VZ and SV, while elasticity varied from 2.18 mm in the sample ES to 2.54 mm in the sample SV.

Keywords: acidity, blueberry, colour, texture, total soluble solids.

INTRODUCTION

In Portugal, the blueberry crop has assumed prominence and gaining interest from consumers and producers. The consumption of berries has become popular among health conscious consumers due to their high levels of phenolic compounds with antioxidant properties (You *et al.*, 2011).

In Blueberry, the texture is associated with the general concept of freshness and quality of the fruit (Matiacevich et al., 2011; Saftner et al., 2008), constituting a critical factor in determining their economic success (Giongo, Poncetta et al., 2013).

Anatomical features such as layers of tissue and cell size, water content and cell wall composition itself can affect the texture of blueberries (Chiabrando et al., 2009). For the variety of its reliefs and exposition of its slopes and valleys, Portugal presents very different microclimate conditions (Fonseca and Oliveira, 2013), reason why this study aims to determine the geographic influence on the physical and chemical composition of highbush blueberries (*Vaccinium corymbosum L.*) cv. Bluecrop.

MATERIALS AND METHODS

In this work were used samples of a Highbush blueberry cultivar, the Bluecrop, manually picked in the state of commercial maturity and transported to the laboratory on the same day. Samples from five locations in Portugal (Estarreja – ES, Oliveira do Hospital – OH, Sever do Vouga – SV, Vila Verde – VV and Vouzela – VZ), were analysed to evaluate their physical-chemical properties: moisture content, total soluble solids (TSS) (ºBrix), titrable acidity (TA), calibre, colour and texture.

From each of the five samples used, 60 fruits were randomly chosen from a lot of 1 kg, for determining the color and texture. For determining the surface color of blueberries a colorimeter Chroma Meter CR-400 from Konica Minolta (Tokyo, Japan) was used being calibrated with a white tile. For the determination of skin firmness and elasticity was used a Texture Analyser TE.XT.Plus from Stable Micro Systems (Surrey, UK), that measured the compression force with a probe of 2 milimeters (P/2). To determine moisture was used Halogen Moisture Analyser HG53 from Mettler Toledo (Columbus, OH, USA), and the acidity was determined according to the Portuguese Standard NP-1421. The analysis of the total soluble solids (° Brix) was performed by refractometry and the dimensions were measured using a caliper rule.

RESULTS AND DISCUSSION

By analyzing Table 1, it can be verified that the moisture content was similar in samples ES, OH, SV and VZ. In turn, the sample VV has proved to have a higher humidity, about 82.79%. In the same table, one can also verify that the sample ES presented the lowest acidity (0.56 mg citric acid/100g FW) and simultaneously the highest value of Total soluble solids (14.65 °Brix). The sample OH showed the highest value for the acidity, and the lowest value for TSS, 0.79 mg citric acid and 9.30 °Brix, respectively. As regards the size, the sample obtained an

OH higher value (1.17 cm) and SV sample obtained the lowest value (0.90 cm).
Table 2 shows the colorimetric analysis performed on the pellicle of all blueberry samples. The results obtained show that the values of brightness (L*) are lower than 50 in all cases, thus indicating that the blueberries are dark. The samples VZ and ES were those that presented higher values of L* and sample VV that which showed lower values, around 30. Regarding the colour coordinate a*, the values are positive, indicating a predominance of red coloring in detriment of green, with just the exception of sample VZ, which showed values very closer to 0. The sample VV was the one that showed highest values of a* (arround 0.6). It is also observed that the values for b* are negative, that is, the supremacy of blue color in detriment of yellow. The samples ES, OH and VZ had the highest negative values, .i.e., these blueberries showed a more intense skin blue coloration. These results are in agreement with Saftner et al. (2008) and Matiacevich (2011).
With respect to texture (Table 2), it was observed that for elasticity the samples OH, SV, VV and VZ had similar values, between 2.41 mm and 2.54 mm, whereas the sample form Estarreja (ES) obtained the lowest value, 2.18 mm. These results are in agreement with Chiabrando et al. (2009). In Table 2, is still possible to observe the results for the firmness of the skin of blueberries. The sample SV showed the highest firmness (15.43 N), followed by the sample OH (14.39 N). On the other hand, samples VV and VZ were those who obtained lower values for firmness, 11.83 N and 11.24 N, respectively.

CONCLUSIONS

This study highlights the differences in moisture content, titrable acidity, TSS, size, color and texture, found in blueberries cv. Bluecrop, from five Portuguese geographical locations. The results showed that the sample from Oliveira do Hospital had the biggest fruits, but also more acid and less sweet. On the contrary, the sample from Estarreja was the sweetest and least acid and the size was among the biggest. Regarding color, the samples from Estarreja and Vouzela were clearer while the samples from Vila Verde and Sever do Vouga were darker (lower L*) but also with less intense blue (higher b*). Regarding texture, the sample from Sever do Vouga was the most elastic and also with the highest firmness.

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TABLES

Table 1. Chemical and morphologic properties of the blueberries analysed.

Samples*	Moisture content (%)	Titrable acidity (mg citric acid/100g FW)	Total soluble solids (ºBrix)	Calibre (cm)
ES	76.17±1.64	0.56±0.07	14.65±0.48	1.05±0.15
OH	76.59±0.88	0.79±0.04	9.30±1.09	1.17±0.12
SV	76.82±3.48	0.70±0.06	11.78±0.54	0.90±0.13
VV	82.79±0.17	0.75±0.10	13.05±0.26	0.95±0.18
VZ	77.59±3.61	0.62±0.07	13.64±0.88	1.00±0.17

*ES: Estarreja; OH: Oliveira do Hospital; SV: Sever do Vouga; VV: Vila Verde and VZ: Vouzela.

Table 2. Color coordinates and texture parameters (firmness and elasticity) of the blueberries analysed.

Samples*	Color			Texture	
	*L**	*a**	*b**	*Skin firmness (N)*	*Elasticity (mm)*
ES	36.38±2.54	0.09±0.38	-7.77±1.20	12.19±1.65	2.18±0.41
OH	34.56±2.01	0.31±0.47	-7.76±0.88	14.39±2.06	2.51±0.42
SV	33.88±4.18	0.52±0.93	-6.19±1.85	15.43±2.75	2.54±0.53
VV	31.08±2.67	0.62±0.91	-5.02±1.51	11.83±1.79	2.47±0.63
VZ	36.79±3.14	-0.02±0.46	-7.32±1.20	11.24±1.90	2.41±0.41

*ES: Estarreja; OH: Oliveira do Hospital; SV: Sever do Vouga; VV: Vila Verde and VZ: Vouzela.