



# RESEARCH ON THE BIOCHEMICAL QUALITY OF FRUITS ON SOME Highbush BLUEBERRY CULTIVARS

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**Abstract:** The highbush blueberry (*Vaccinium corymbosum* L.) is found in the flora of the North-Eastern United States and South-Eastern Canada. Blueberries are an important source of antioxidants. These compounds concentration vary according to the cultivars. This study objective was to determine biochemical composition of fruits at optimal harvest maturity on nine varieties. The biochemical indicators studied were: total dry matter content, soluble dry matter, total titratable acidity, sugar content, vitamin C, anthocyanins and polyphenols. Vitamin C was analyzed iodometrically, total sugars by Fehling-Soxhlet method, total acidity was measured by titratable method and the soluble dry matter content was determined using a refractometer. Total polyphenols and anthocyanins content of the fruits were analyzed with colorimetric methods. The experimental plot was established in the year 2020 inside a farm from the Arges Meadow. The results of chemical composition analyses showed that the fruits of 'Compact' has a the highest total soluble solid content (16.6%). The highest vitamin C level (15.31 mg/100 g FW) was determined in the fruits of 'Blueray'. 'Elliot' fruits presented higher values of titratable acids content (1.18%), total polyphenol and anthocyanins contents (6383.76 mg GAE/kg FW, respectively 3120.54 mg/kg FW). 'Elliot' variety is distinguished by the highest content of antioxidant compounds.

## Introduction

Originally from North America, growing in the hilly and forested regions of northern Europe, blueberries have been noticed and used by the local population since the 16th Century (Cantuarias-Avilés et al., 2014; Skupień, 2006). The major growing areas of highbush blueberries are in the USA followed by California, Florida, Georgia, Michigan, New Jersey, North Carolina, Oregon, Washington, and in some provinces in Canada; gradually they are being propagated all around the world - South America, Australia and New Zealand (US Highbush Blueberry Council, 2020), and more recently have become a popular commercial crop in Europe (Kader et al. 1996). The highbush blueberry (*Vaccinium corymbosum*) was brought to Romania in 1968 by Stefan Nicolae (Botez et al., 1984). The interest for these fruits has increased in Romania in recent years, so that in 2018 a blueberry production of 684 tons was registered in our country (FAO, 2020).

Blueberry fruits are excellent table fruits with very high value for maintaining health, treatment and prevention of many diseases, due to the rich content of flavonoids, phenolic acids (REquE, et al., 2014; Vrhovsek, et al., 2012), anthocyanins, polyphenols (Vizzotto, et al., 2009), tannins and stilbenes. Blueberries include also nutritional compounds such as sugars, vitamins and minerals (FAO, 2020).

Consumption of blueberry products has potential health benefits in preventing development of obesity, chronic inflammation, type 2 diabetes, (Shi, et al., 2017). Anthocyanins contributes to the health-beneficial effects of blueberry against several chronic diseases including cardiovascular disorders, neurodegenerative diseases, cancer (Routray at Orsat, 2011; Smith, et al., 2000). It also have been reported that blueberries have a antioxidant, anti-inflammation, antimicrobial, reno-protective, ophtalmo-protective, hepato-protective, gastro-protective, anti-osteoporotic and anti-aging role (Patel, 2014). The objective of this study was to biochemically determine the anthocyanins, polyphenols total and other compounds with beneficial properties for health, on some blueberry varieties grown in Southern Romania.

## Material and method

The blueberry fruits were analyzed are five Romanian varieties ('Compact', 'Delicia', 'Safir', 'Simultan', 'Vital') and other four varieties frequently cultivated on the Romanian territory ('Blueray', 'Duke', 'Elliot', 'Hanna'h Choise'). The experience was place at a farm in the Arges Meadow on a three yearold blueberry culture. The experimental field was placed, on the flat terrain, clay-brown soil with a loamy to loamy-clayey texture in the first 60-70 cm, and in depth the texture becomes sandy. Along the plants rows the soil was enhanced by adding 30 t/ha acid peat moss. The groundwater was about 1.5 m. The fruits of nine highbush blueberry cultivars were obtained from commercial plantation in 2020. The samples were harvested at the optimal stage of maturity.

Biochemical analyzes and laboratory determinations consisted in determining the total content of dry matter, total content of soluble dry matter, titratable acidity, vitamin C, total sugar, total polyphenols and anthocyanin pigments. All biochemical determinations were performed in three repetitions.

Total dry matter content was determined by a gravimetric method (drying 10 g of fruit tissue at 105 °C to constant weight) according to Krelowska-Kulas [1993], (FAO, 2011). Vitamin C content was estimated with iodometric method [Sapožnikova and Dorofiejeva 1966] and expressed in mg / 100g FW. The soluble dry matter content (% Brix) was determined using a refractometer. Total sugar content was estimated by the Fehling-Soxhlet method, 1968 (JAOAC, 1968). Titratable acidity (%): total acidity was determined by titratable method (Ermakov et al., 1987). The principle of the method is to neutralize a volume of aqueous fruit extract with a solution of NaOH 0.1N in the presence of phenolphthalein as indicator. The determination of total polyphenols was performed spectrophotometrically, with the Folin-Ciocalteu reagent (Singleton and all., 1999) and were expressed as mg GAE /kg FW. For the extraction of polyphenols was used as solvent methanol (70%). The dosage of total anthocyanin pigments in fruits was performed by the Fuleki method (1968). The method consists in the extraction of anthocyanins with appropriate extractive solutions and the measurement of the absorbance of the extract, spectrophotometrically at the wave length  $\lambda = 535$  nm. The determined total anthocyanins were expressed as cyanidin-3-glucoside mg / kg fresh weight (FW).

Statistical analysis: Data were analyzed employing the variance (ANOVA), using SPSS software. The pair wise comparisons between different parameters were done using Duncan's test ( $P < 0.05$ ).

## Results and discussions

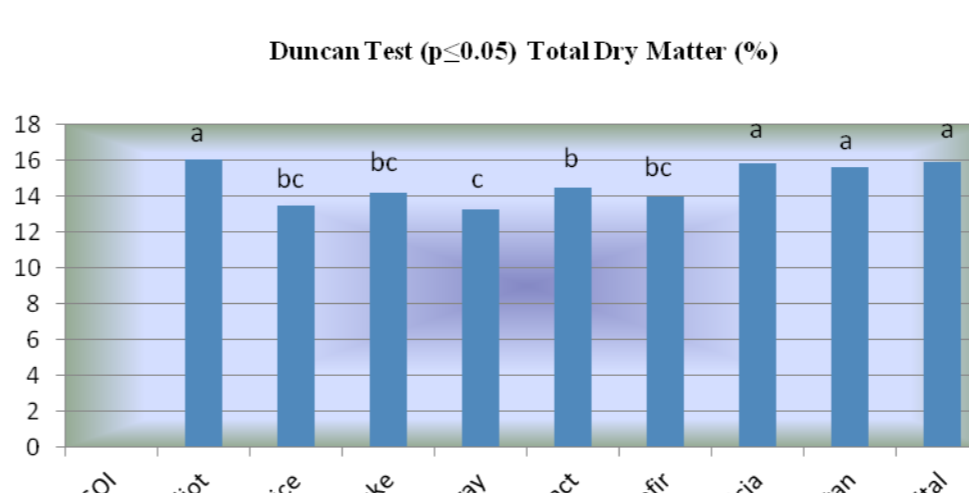


Fig. 1. Total dry matter content (%) of the fruits on the blueberry varieties

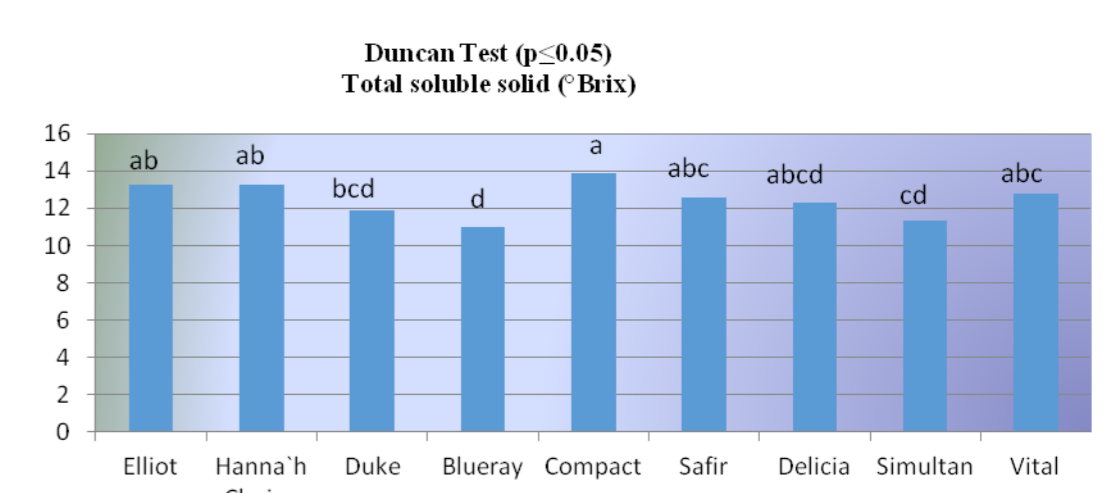


Fig. 2. Total Soluble solid (°Brix) of the fruits on the blueberry varieties

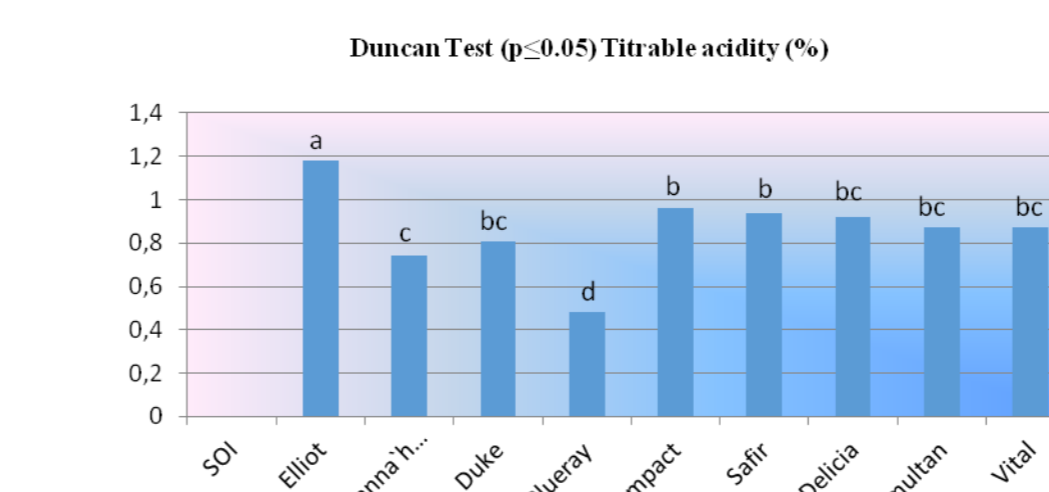


Fig. 3. Total titratable acidity (%) of the fruits on the blueberry varieties

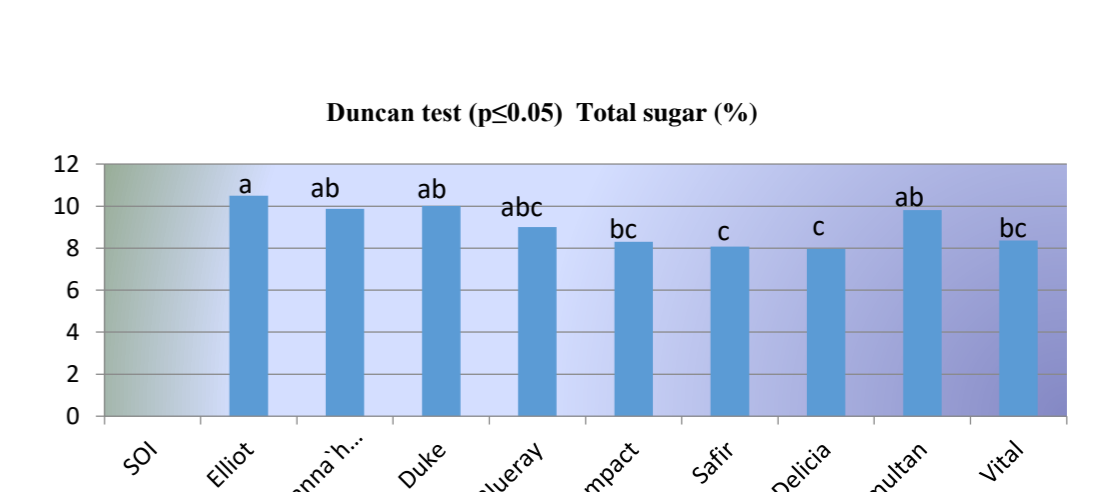


Fig. 4. Total sugar content (%) of the fruits on the blueberry varieties

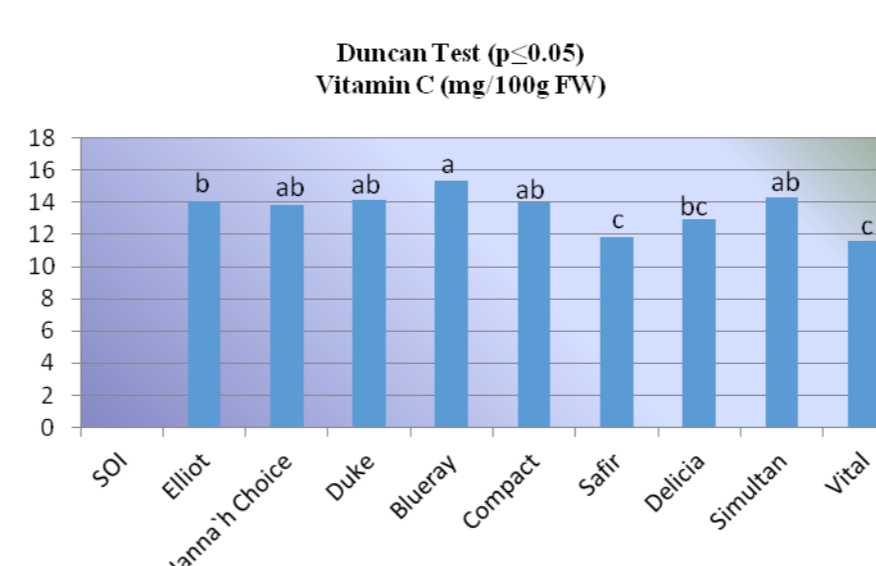


Fig. 5. Vitamin C content (mg/100g FW) of the fruits on the blueberry varieties

Moisture content (%)	Total dry matter content	Total soluble solid (°Brix)	Juice pH	Titratable acidity	Total sugar content	Ascorbic acid content (vitamin C)	Polyphenol content	Anthocyanins content
1	-0.985**	-0.085	.406**	-.348**	-0.119	0.161	-0.153	-0.071
	1	0.108	-.388**	-.337**	0.089	-0.157	0.145	0.069
		1	-0.13	0.165	0.035	0.027	0.141	0.184
			1	-.560**	0.019	.371**	-0.22	-0.06
				1	-0.014	-.275*	.358**	-.286*
					1	.286*	.258*	.374**
						1	.370**	0.222
							1	.617**

Table 1. Blueberry quality indicators correlation matrix

## Conclusions

1. The assessment of blueberry fruits quality reveal some strong correlations between some active biochemical compounds.
2. The blueberry fruits harvest at the right time is a prerequisite of their quality and content in active ingredients.
3. Among the 9 studied varieties 'Elliot' was distinguished by the highest content of antioxidant compounds.