REZULTATE PRELIMINARE PRIVIND COMPORTAMENTUL UNOR GENOTIPURI DE MUR ÎN ZONA MOARA DOMNEASCĂ (JUDEȚUL ILFOV)
PRELIMINARY RESULTS REGARDING THE BEHAVIOR OF SOME BLACKBERRIES GENOTYPES IN MOARA DOMNEASCĂ (ILFOV COUNTY) AREA CONDITIONS

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Abstract

Blackberries are an important commercial fruit crop, widely grown. The blackberries contain significant amounts of polyphenol antioxidants such as anthocyanin pigments linked to potential health protection against several human diseases, so the demand is increasing. In order to identify the most suitable varieties for the Vlasia Plain area, in 2020 an experimental plot with 6 stable accessions was established. The cv. 'Chester', 'Dar 8', 'Navaho','Polar', 'Thornfree', 'Triple Crown', were planted in a plantation scheme 3.0 m × 1.0 m. For each variety, during 2021, ripened fruits were harvested and biometric determinations have been done in the laboratory, being measured fruit weight and diameter, firmness, titratable acidity and pH, all fruit quality indicators. The preliminary results showed that blackberry varieties without thorns are larger than thorny varieties and more suitable for fresh fruit consumption, while the 'Dar 8' fruit are not so fragrant, their pulp is stronger, so they are more suitable for processing. The study will continue so statistical analysis can be performed.

Cuvinte cheie: cultura murului, indicatori biometrici, rezultate preliminare.
Key words: blackberry cultivation, biometric indicators, preliminary results.

1. Introduction

Blackberry is one of the 740 species of the genus *Rubus* in the *Rosaceae* family and it grows spontaneously in Europe, the Middle East, North Africa and North America, being introduced into culture in America at the beginning of the XIX Century and in Western Europe in the second half of the century XIX (Bălan et al., 2013). In Romania, blackberry bush with thorns is growing in the wild flora from the low altitudes in the lowland areas till over 900 m altitude in highlands (Ancu et al., 2014). Paulina Mladin is one of the researchers who studied this species in Romania and among the results of her work have been the obtaining of varieties 'Dar 8' and 'Dar24', descendants of the 'Darrow' variety (Ancu et al., 2014).

Throughout history, the blackberry has had significance in medicine and has been used in many ways. Today, the demand for blackberries is increasing, this fruit being defined as functional foods in the medical terminology and the public awareness of this issue is also growing (Eskimez et al., 2019). Blackberries can be consumed, either fresh or processed in the form of juice, syrup, jam, sherbet, liqueur and these fruits present rich biochemical content. Numerous studies draw attention to the properties and benefits of these biochemical constituents and provide further encouragement that selection in breeding can be utilised to increase the levels of beneficial compounds in these fruit (Cho et al., 2004; Clark and Finn, 2008; Mladin et al., 2008). Anthocyanins, ellagitannins, phenolic acids, flavonoids, vitamins, minerals as well as other compounds contribute to blackberries high antioxidant capacity (Diaconeasa et al., 2014; Kaume et al., 2012; Vlad et al., 2019) and also have anti-carcinogens, anti-neurodegenerative and anti-inflammatory effect (Milosevic et al.,2012).

Considering the demand for these fruit is increasing and the fact that they can be processed and consumed in different ways, they can be valorised on a high price (Eskimez et al., 2019). The potential production of blackberries could be 13-15 t/ha, depending on the variety and the duration of profitable exploitation is 12-15 years, with a rate of net annual profit of 62% (Sumedrea et al., 2014). This crop also has other advantages, among which a low ecological selectivity and regularly yields products (Clark and Finn, 2011; Eduyran et al., 2008; Eskimez et al., 2019; Milosevic et al., 2012).

The aim of this paper is to identify the most suitable varieties for the Romanian plains areas, in order to establish assortment for the southern part of our country and to promote the results among farmers, by a comparative study of 6 blackberry cultivars ('Chester', 'Dar 8', 'Navaho', Polar', 'Thornfree', 'Triple Crown'), on the influence of pedo-climatic conditionsof our Experimental Base Moara Domnească. In this sense we performed fruit quality analysis of the mentioned varieties.

2. Material and methods

The study was conducted at Experimental Base Moara Domnească, located N-E of Bucharest (in the Vlasia Plain, a subunit of the Romanian Plain), in Ilfov county, right about 17 km from Bucharest. The farm belongs to the Research and Development Station for Fruit Growing (RDSFG) Băneasa.

The experimental plot was established in the early spring of the 2020 by planting 6 different blackberries cultivars 'Chester', 'Dar 8', 'Navaho', Polar', 'Thornfree', 'Triple Crown', spaced 3.0 m apart between rows and 1.0 m apart in the row. In Table 1 there is a description of each variety that has been used in our study. The plantation was provided with a training system, drip irrigation and standard cultural practices were applied.

The soil type at Experimental Base Moara Domnească is a reddish preluvosoil. Soil profile analyses were performed within the internal laboratory for agrochemical and biochemical analyses in order to determine its physical and chemical properties. The soil has the following characteristics determined by granulometric analysis for determination the soil content in clay, dust and sand: a high percentage of clay ranging from 40.55% in the upper horizon 0-40 cm, to 41.63% at a depth of 41-53 cm and 47.39% at depths greater than 54 cm (Table 2). The clay texture determines a low mobility of nutrients and a poor permeability of the water in the soil. The soil content in humus is good in the first 40 cm of profile, where most of the roots of young trees are located, reaching the value of 3.26%, then suddenly decreases up to 1% in the Bt horizon profile (Table 3). The pH is slightly acidic at the soil surface (6.4), reaching alkaline in the C horizon (8.3). Other indicators like the nitrogen index (NI), hydrolytic acidity, humus, organic carbon and so on were determined during 2019 (Table 4) and 2020 (Table 5).

The climate area where Moara Domnească is located is temperate continental. The annual mean temperature is 12° C and the total annual amount of precipitation is ranging between 550 and 600 mm. For this study have been taken in to consideration the average values of temperature, precipitation and relative humidity (Fig. 1, 2, 3) related to the blackberry harvesting period (July - August of 2021) but also the average values (Table 6) starting with the date when the weather station was installed (June 5, 2020).

In order to establish the assortment for the Southern part of Romania and identify the best adapted cultivars, a sample of 20 harvested fruit from each were collected at 4 different moments and analysed under biometric and biochemical aspects. Fruit length and width were measured with a digital calliper and the size index was calculated using the formula: (height + 2 × diameter)/3 (Ancu et al., 2014). Fruits weight was measured with an electronic scale (Precisa Balance XT 620M). Soluble solid content was determined using a digital refractometer (Hanna Instruments - HI 96800) and the fruit pH with a digital pH meter.

3. Results and discussions

The highest average fruits weight (Fig. 4) was recorded by 'Polar' variety (7.44g/fruit), at the second time of harvesting (T2, 03.08.2021) and (5.48g/fruit) at first time of harvesting (T1, 27.07. 2021). At the third harvest (T3, 09.08.2021) the 'Navaho' variety records the highest value (7.36 g/fruit) and the lowest values of this biometric indicator were recorded by 'Dar 8' at all times of harvesting. Also, the highest average value of the average fruits weight was recorded at the first harvest (5.51 g/fruit).

Regarding the size index (Fig. 5), the highest values (24.35 mm and 22.52 mm) were recorded by 'Navaho' variety at the first (T1, 27.07. 2021) and third (T3, 09.08.2021) time of harvest. The highest value at the second harvest (T2, 03.08.2021) was recorded by 'Thornfree' (22.34 mm), while the lowest values were recorded by 'Dar 8' at all harvesting times. The average value of this indicator decreases with each harvest, 20.92 mm was the average value for the first harvest, 19.71 mm for the second and 18.92 mm for the third.

The highest values of soluble solid content (% Brix) were recorded to 'Dar 8' variety (15.39% and 12.85%) (Fig. 6) at the second and third harvest and the lowest values 9.84% and 11.49% were recorded at 'Chester' variety at the third and first harvest. The highest value (15.15 % Brix) at first harvest was recorded by 'Triple crown' and the lowest value (11.27 % Brix) at the second harvest was recorded at 'Thorn free'. The average value of this indicator decreases also with each harvest, 13.62% was the average value for the first harvest, 12.87% for the second and 11.38% for the third.

The highest pH (Fig. 7) values were recorded to the following varieties 'Thornfree' with pH value 4.74 on the second harvest, 'Navaho' with pH value 4.41 on the first harvest and 'Polar' with pH value 4.39 on the third harvest. The lowest pH values were recorded by 'Chester' variety 3.59 and 4.19 on the third and second harvest and on the second harvest by 'Dar 8' variety with 3.72 pH value.

This indicator shows a clear trend of growth from the first to the second harvest, where it reaches its maximum potential, after which it decreases, in some varieties, even below the values recorded at the first harvest.

4. Conclusions

Romanian blackberry variety 'Dar 8' recorded the lowest values for average weight and size index but the highest values of soluble solids content 15.39 %, which makes it suitable for processing.

The preliminary results of our study showed that the fruits of the foreign thornless blackberry varieties are much more suitable for fresh consumption, being noted for the high values of the weight 'Polar' (7.44 g/fruit), the size index 'Navaho'(24.35 mm), the soluble solid content 'Triple Crown' (15.15% Brix), the pH 'Thornfree'(4.74).

The study should continue and more determinations will be done doubled by statistical analysis of the data in order to determine the most suitable blackberry variety for the cultivation in Vlasia Plain, county Ilfov area.

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Tables and Figures

Table 1. Varieties description

No.	Variety	Origin	Bush Shape	Ripening period	Fruit Weight (g)	Fruit Shape	Fruit colour	Observations
1.	Dar 8	Romania	bushes have semi-erect canes	the middle of June	6.0 - 7.0	conical elongated	black	Thorny High cold resistance Productive
3.	Chester	USA	bushes have semi-erect canes	the end of July	5.0 - 6.0	rounded	black	Thornless Floricane fruiting Good cold resistance Productive
4.	Triple Crown	USA	bushes have semi-erect canes	the end of July	8.0 - 10.0	rounded	black	Thornless Floricane fruiting Good cold resistance Productive
5.	Polar	Poland	bushes have erect canes	the end of July	8.0 - 10.0	oblong	black	Thornless Floricane fruiting High cold resistance Low heat tolerance
6.	Navaho	USA	bushes have erect canes	beginning of July	7.0	conical	black	Thornless Floricane fruiting Moderate cold resistance Productive
7.	Thorn-free	USA	bushes have erect canes	early August	7.0 - 8.0	conical-ovular	black	Thornless Floricane fruiting Good cold resistance Productive

Table 2. The granulometric composition of the soil (Experimental Base MoaraDomnească, 2019)

Horizon	Depth (cm)	Clay (%)	Coarse sand (%)	Fine sand (%)	Dust (%)	Texture
Ao	0-40	40.55	0.36	34.33	24.75	Clay loam
Ao/Bt	41-53	41.63	0.52	21.54	56.28	Clay loam
Bt	54-200	47.39	0.37	27.59	30.34	Clay loam
C	Over 200	36.18	0.42	32.04	32.04	Clay loam

Table 3. Physical and chemical properties of the profile soil (Experimental Base Moara Domnească, 2019)

Properties / Horizons	Ao	Ao/Bt	Bt	C
Humus (%)	3.26	1.87	1.0	1.0
Soluble Ca (mg/100g soil)	55	32	32	30
Hydrolitic acidity (meq)	2.8	2.04	1.72	0.18
Exchangeable Bases (meq)	22.6	23.62	26.28	-
Total cation exchange capacity (meq)	28.65	28.04	30.01	-
Degree of saturation in bases (%)	78.94	84.28	87.53	-
pH	6.4	6.6	6.8	8.3
Total N (%)	0.144	0.102	0.075	0.07
Soluble P (mg / 100 g soil)	50	40	40	30

**Table 4. Soil's characteristics determined before planting (Experimental Base Moara Domnească, 2020)**

Date	2020
Plot	Shrubs (*Rubus* ssp.) – CP1E5
Depth (cm)	0 – 20
pH	6.33
Exchangeable Bases (meq) $Ca^{2+}+Mg^{2+}+K^{+}+Na^{+}$	13.30
Hydrolitic acidity (meq)	5.60
Humus (%)	5.27
Organic Carbon	3.03
Total cation exchange capacity (meq)	18.9
Degree of saturation with bases (%)	68.83
Nitrogen Index	3.63
P (ppm)	51.96

Table 5. Soil's characteristics determined after planting (Experimental Base Moara Domnească 2020).

Date	2020
Plot	Shrubs (*Rubus* ssp.) – CP1E5
Depth (cm)	0 – 20
pH	7.3
Exchangeable Bases (meq) $Ca^{2+}+Mg^{2+}+K^{+}+Na^{+}$	12.29
Hydrolitic acidity (meq)	2.77
Humus (%)	4.46
Organic Carbon	2.59
Total cation exchange capacity (meq)	23.57
Degree of saturation with bases (%)	98.35
Nitrogen Index	4.39
P (ppm)	60.1

Table 6. Average weather data of Moara Domnească during the experimental study

Temperature (º C)			Precipitation (mm)			Humidity (%)
2021 (July – August)	2020-2021	normal	2021 (July-August)	2020-2021	normal	2021 (July-August)
25.7	14.5	12.0	6.8	623.4	600	68.3
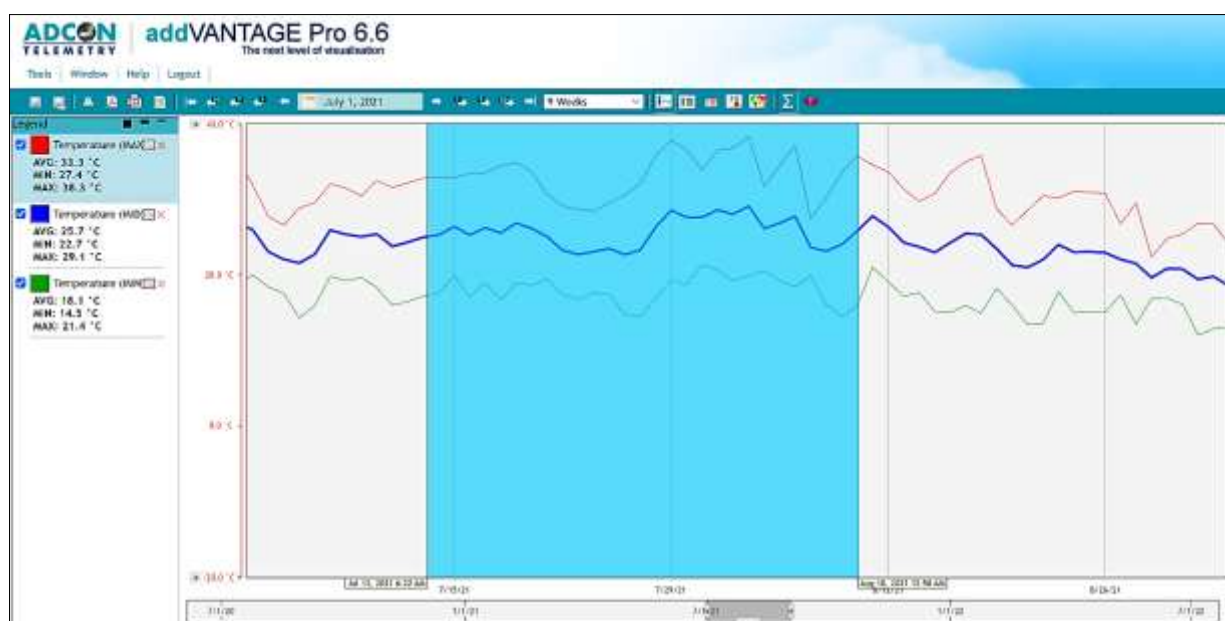
Fig. 1. Average temperature dynamics (max, mid and min) during the harvest period (July - August) 2021.
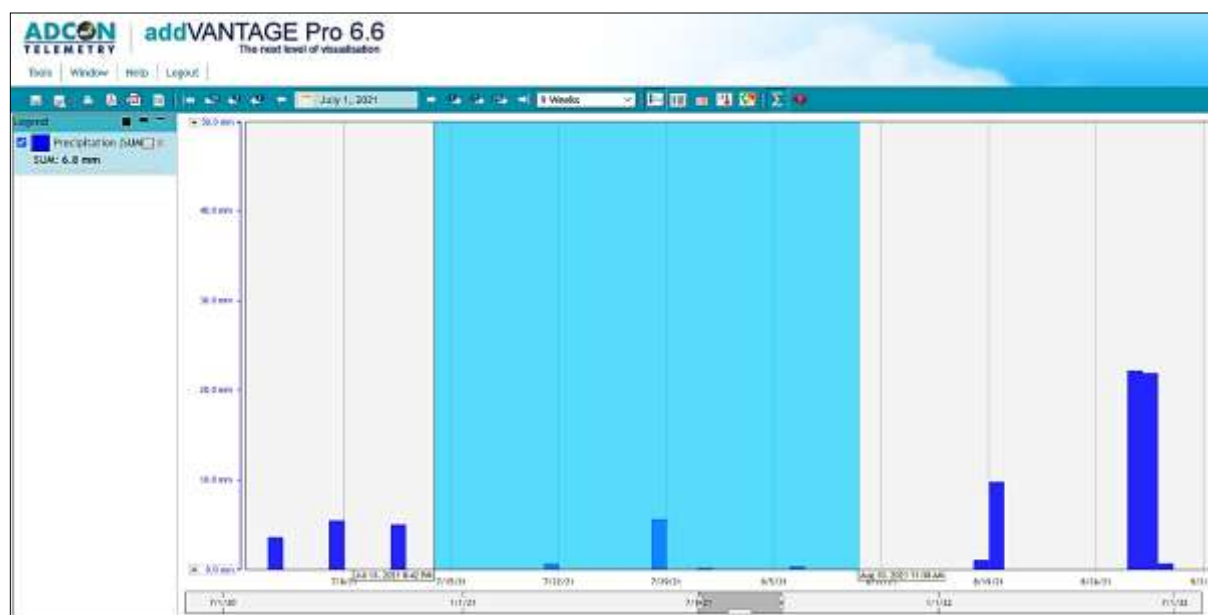
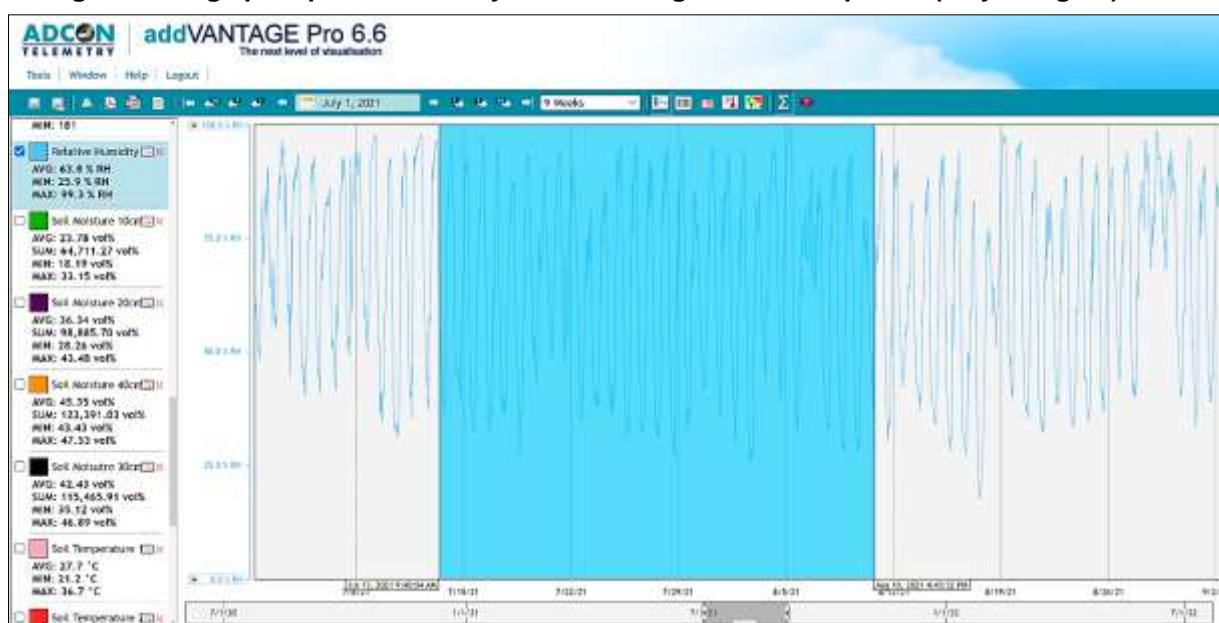**Fig. 2. Average precipitation sum dynamics during the harvest period (July - August) 2021.**

Fig. 3. Average relative humidity dynamics during the harvest period (July - August) 2021
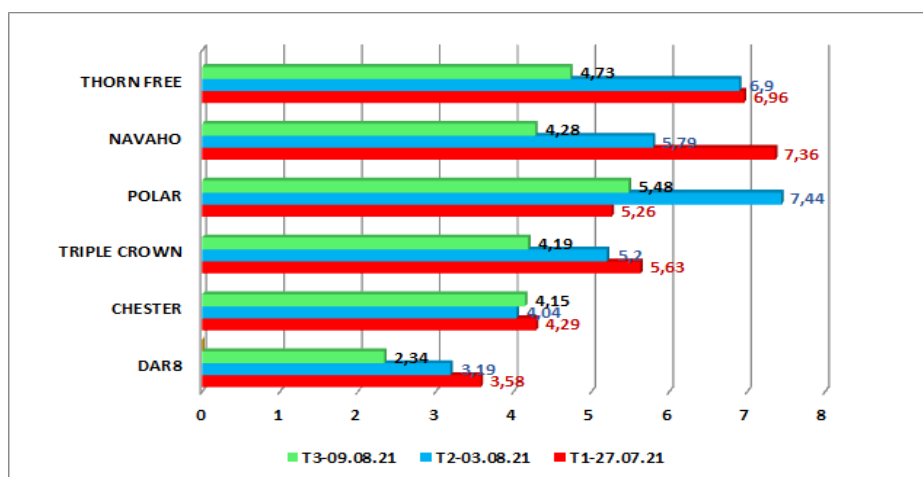

**Fig. 4. Average fruit weight, depending on the time of harvest (T1, 27.07.2021),
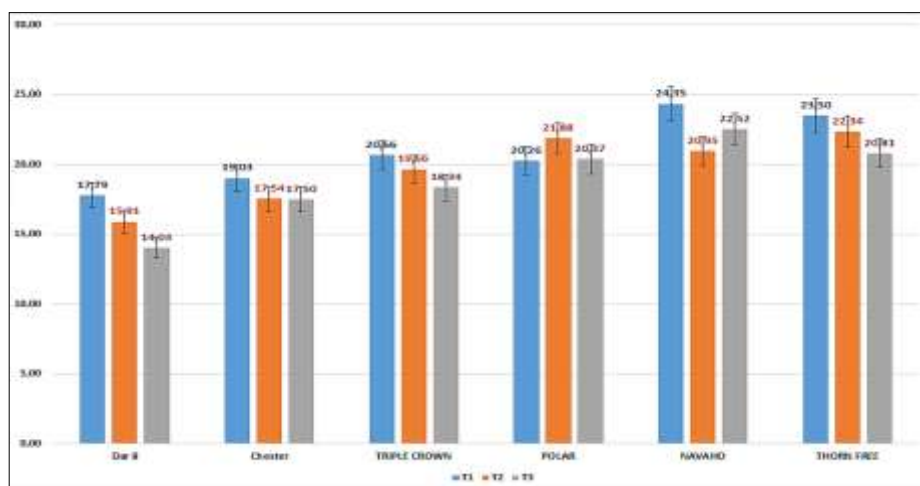(T2, 03.08.2021), (T3, 09.08.2021)**

Fig. 5. Size index, depending on the time of harvest (T1, 27.07.2021), (T2, 03.08.2021), (T3, 09.08.2021)
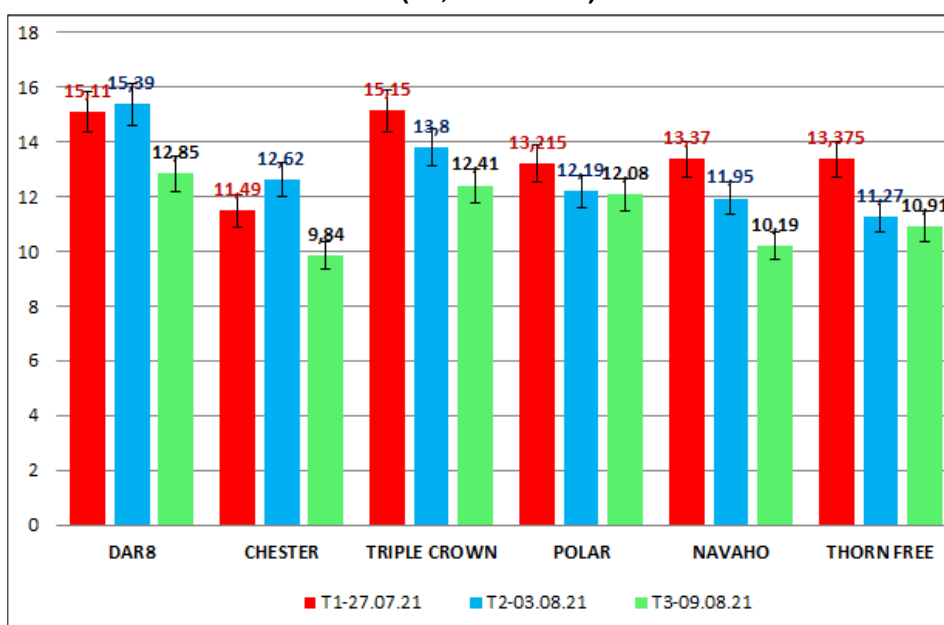

Fig. 6. Fruits soluble solids contents depending on the time of harvest (T1, 27.07.2021), (T2, 03.08.2021), (T3, 09.08.2021)
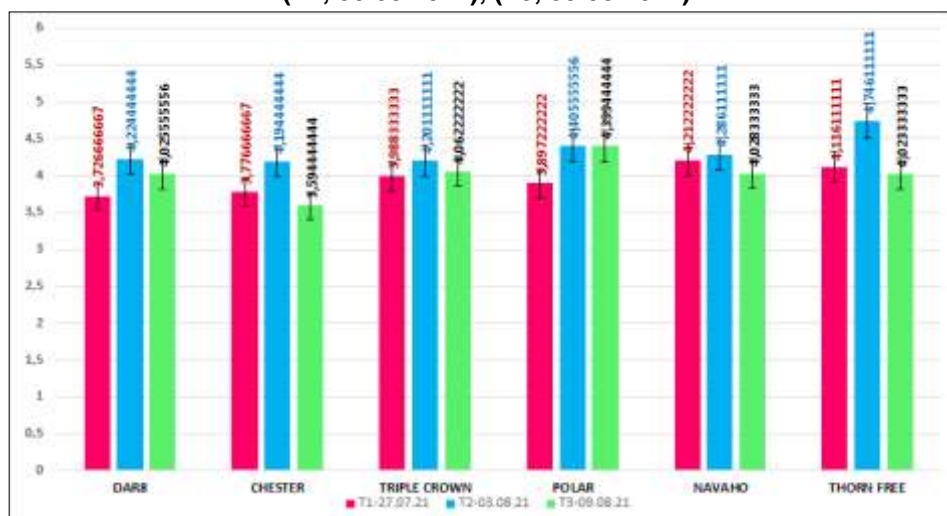

Fig. 7. Fruit pH contents depending on the time of harvest (T1, 27.07.2021), (T2, 03.08.2021), (T3, 09.08.2021)