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SOME FRUIT QUALITIES CHARACTERISTICS OF STRAWBERRY SELECTION FROM QUEEN ELISA X PREMIAL

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Abstract

During 2013-2015 period at Research Institute for Fruit Growing Pitesti, Romania (RIFG) a strawberry field trial with ten selections was organized having the objective to compare some of fruit characteristics from 'Queen Elisa' and 'Premial' cvs. selections: fruit weight (g), fruit length (mm), fruit diameter (mm), the soluble solids (% Brix), fruit acidity (pH) and five color indicators (L*, a*, b*, C* and hue angle). The results showed significant differences between genotypes regarding the following fruit quality parameters: the fruit weight of different genotypes varied significantly and ranged between 10.90 g ('08-10-27') and 20.47 g ('Queen Elisa'); the highest value of content in total soluble solids was recorded by '08-10-13' genotype (9.68 % Brix), followed by 'Premial' (9.43 % Brix); the fruit acidity ranged between 3.30 (08-10-10) and 3.60 (08-10-16) and the color of the fruits, determined by chroma (C*) recorded values ranging between 25.49 ('Queen Elisa') and 38.57 ('08-10-5' genotype) and the hue angle (hº), values between 21.15 ('08-10-13') and 26.71 ('Queen Elisa'). 'Queen Elisa' had the highest fruit weight and the most orange-colored.

Cuvinte cheie: greutatea medie a fructului,lungimea fructului, diametrul fructului, culoarea fructului
Keywords: average fruit weight, fruit length, fruit diameter, fruit color

1. Introduction

Strawberries (*Fragaria x ananassa* Duch.) are highly appreciated having desirable taste, attractive color, excellent flavor, excellent dietary sources and medicinal value. The genotype is the main source of variation and one of the main factor that influenced the growth, yield and quality of fruits. Numerous breeding programs aim at improving strawberry taste (Hancock, 1999). Three major components of fruit organoleptic quality are flavor, sweetness, and acidity. For any breeding program one of the basic requirements is the germplasm fund with good variability for the desirable characters (Singhania et al., 2006, Rahman et al., 2015). The consumers prefer red bright and sweet strawberries. Sweetness is positively correlated with soluble solid contents, total soluble sugars, and fructose (Shaw, 1990). Fruit soluble solids, titratable acidity, and organic acids at fruit maturity are quantitatively inherited (Shaw, 1987; 1988).

In Romania, the major breeding program objective is the development of new varieties well adapted to climatic and soil conditions and able to provide a highly productivity and good fruit quality. The objective of the present study was the evaluation of the fruits quality characteristics of strawberry genotypes and selecting superior ones.

2. Material and methods

The research was conducted in 2013-2015 period, in an experimental plot of the Research Institute for Fruit Growing Pitesti, in a monofactorial trial with twelve graduations (genotypes): 'Premial' (Romanian origin), 'Queen Elisa' (Italian origin) and ten selections between the two cvs. (08-10-5, 08-10-7, 08-10-8, 08-10-10, 08-10-13, 08-10-16, 08-10-17, 08-10-21, 08-10-23 and 08-10-27) which were used as planting material. Ten hybrids among 203 genotypes were selected from the breeding program considering their high yield potential, general appearance and good fruit taste.

The study trial was arranged as subdivided plots in three repetitions (ten plants per each replicate). The planting distance was 0.25 m along the rows and 0.90 m distance between rows.

The fruits of experimental genotypes were harvested at commercial maturity and fruits samples were analyzed immediately after picking. The optimum moments for harvesting strawberries fruits were considered when the entire surface was red (Voca et al. 2008).

The average fruit weight was determined by weighing 20 fruits per sample using HL-400digital balance.

The length and diameter of the fruits were determined by measurement 20 fruits per sample using digital caliper.

The soluble solids content was determined with digital refractometer (ATAGO PR-32, Japan).

The pH of the juice samples was determined using a pH-meter (ISFET pH Meter, IQ 125, Japan) using the fruit juices of ripe strawberry genotypes.

External fruit color was determined with a colorimeter Konica Minolta CR 400, based on system Huntel L*, a*, b* on both sides of the fruit (L* corresponds to brightness, a* and b* chromaticity coordinates from green to red and from blue to yellow, respectively). Chroma index was determined by the formula $C = (a^{*2} + b^{*2})^{1/2}$ and hue angle by the formula hº = arctangent (b*/a*), where 0º= red-purple, 90º= yellow, 180º= bluish-green and 270º =blue (McGuire, 1992).

Statistical processing of data was conducted using SPSS 14.0 software and the test for determining the significance of differences between the variants was multiple range test DUNCAN, for error probability of ≤0.05.

3. Results and discussions

The results showed significant differences between all genotypes and all investigated parameters.

The average weight of the fruit varied significantly different for genotypes and ranged between 10.90 g (‘08-10-27’) and 20.47 g (‘Queen Elisa’) fig.1, the results confirming the genetic determinism of this trait, influenced also by the technical-cultural conditions. The average fruit weight recorded in the present study was similar to the findings of Rahman et al. (2015), showing that genotype FA 006 produce the highest fruits (18.73 g) and genotype ‘FA 014’ produced the smallest ones (5.11 g). Present findings are also confirmed by Chowhan et al. (2016): the average fruit weight of five similar genotypes ranged from 11.64 g to 21.83 g.

Regarding of length and diameter of the fruits all the genotypes varied significantly (fig. 1). The highest values of the fruit length were registered by the genotype 08-10-17 (48.74 mm), followed by 08-10-5 (43.93 mm), 08-10-8 (43.47 mm) and the lowest value for genotype 08-10-23 (33.60 mm). The highest values of the fruit diameter were obtained by the genotype 08-10-8 (42.55 mm) and the lowest value by the genotype 08-10-21 (32.94 mm). Rahman et al. (2015) found in different genotypes, that the fruit length ranged from 1.30 cm to 5.10 cm and the fruit diameter ranged from 1.30 cm to 4.20 cm, values being similar with the present study.

The statistical analysis of the recorded values of the soluble solids of the fruits from different genotypes, highlighted large differences in statistical terms (fig.2). The highest value of the soluble solids (% Brix) was recorded by the genotype ‘08-10-13’ (9.68 % Brix), followed by ‘Premial’ (9.43 % Brix). The lowest value was recorded by the genotype 08-10-23 (6.92 % Brix). Lovatti and Nuzzi (2009), found for 'Queen Elisa' a value of the soluble solids of 8.27 % Brix, similar with our study results: 8.99 % Brix. Also Lovatti and Nuzzi (2009) show using different genotypes, that the soluble solids ranged from 6.31 % Brix to 8.55 % Brix.

During the study, there were significant differences between genotypes regarding the fruit acidity and ranged between 3.30 (08-10-10) and 3.60 (08-10-16), fig.2.

Colorimetric characteristics of the fruits are of great importance because influence the consumer priority in choosing the fruits. Generally, there are preferred the fruits with a bright light red color. L*, C*, and h^o values of the 12 strawberry genotypes were significantly different. L* values increased from 28.65 to 35.84 (fig. 3), C* from 25.49 to 38.57 (fig. 4), and h^o from 21.43 to 26.71 (fig. 4). Within this area on the solid color sphere, the lower L* and h^o values represent darker sample color with a bluish-red hue, while higher values are lighter and more orange. It can be concluded that 08-10-23 was the bluish genotype and ‘Queen Elisa’ and 08-10-5 genotype the most orange-colored, which is affirmed by the results described above. Present findings are also confirmed by Ngo et al. (2007): L* values ranged from 21.30 to 29.10, C* from 24.30 to 41.90, and h^o from 24.40 to 32.60.

In Table 1 are presented the correlations between indicators from different groups.

The fruit weight was negatively correlated with one fruit quality indicator (a*), distinctly significant positive with two fruit quality indicators (fruit length and hue angle) and was significantly positive with two fruit quality indicators (soluble solids and pH, tab. 1).

The fruit length was distinctly significant positive correlated with two quality indicators (fruit diameter and fruit weight) and significantly positive with pH.

The fruit diameter was distinctly significant positive with two fruit quality indicators (fruit length and pH).

The soluble solids were significantly positive correlated with two fruit quality indicators (fruit weight and pH).

According to the ten studied indicators, the pH was correlated distinctly significant and positively with fruit diameter and significantly positive with three fruit quality indicators (fruit length, fruit weight and the soluble solids).

L* was distinctly significant and positively correlated with all indicators of fruit color (a *, b *, C *, hº). Also, the chroma index was distinctly significant and positively correlated with three fruit quality indicators (L*, a* and b*) tab.1, the hue angle only with three fruit quality indicators (fruit weight, L* and b*).

4. Conclusions

Among the twelve studied genotypes, ‘Queen Elisa’ cv. had the highest fruit weight and the most orange-colored compared to others genotypes. Genotype ‘08-10-5’ had the highest fruit brightness.

The strawberry genotypes showed remarkable variation in nutrient as well as chemical components of fruits. Considering the total soluble solids and fruit acidity, the genotypes ‘08-10-13’ and ‘08-10-16’ were superior to others.

5. Acknowledgements

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Figures and Tables

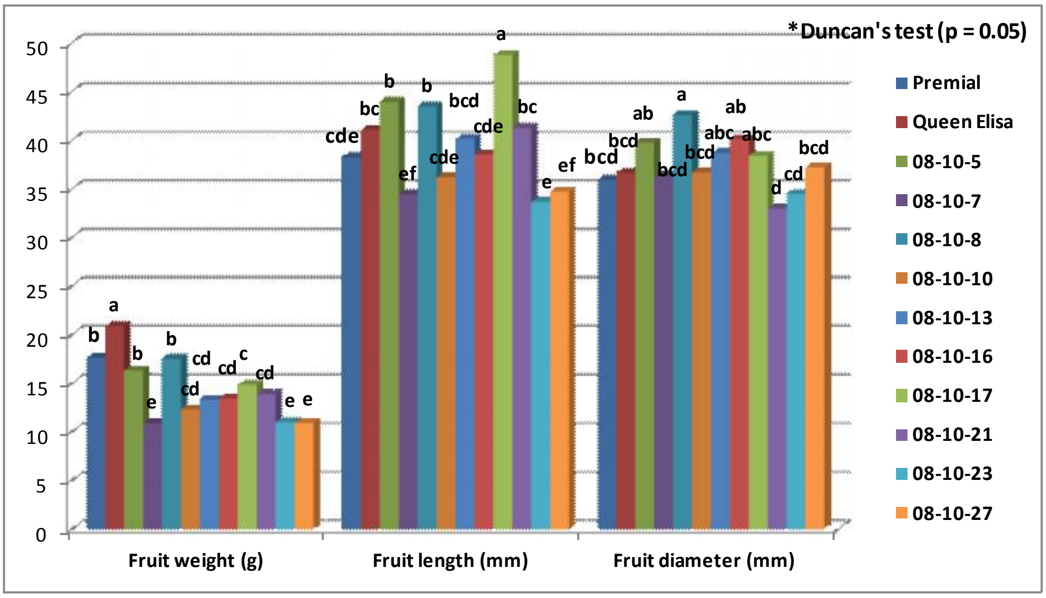

Fig. 1. Fruit physical characteristics

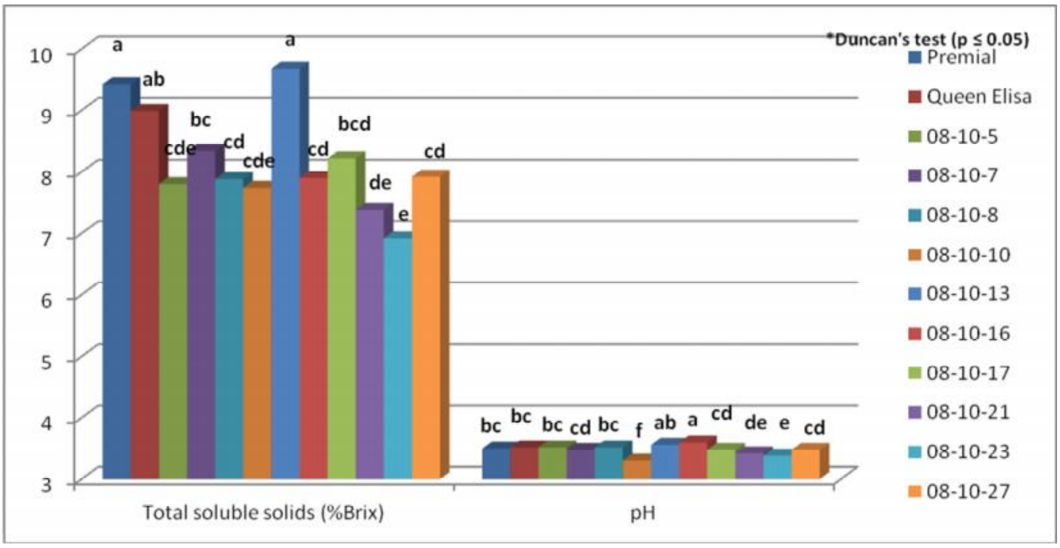

Fig. 2. Fruit chemical characteristics

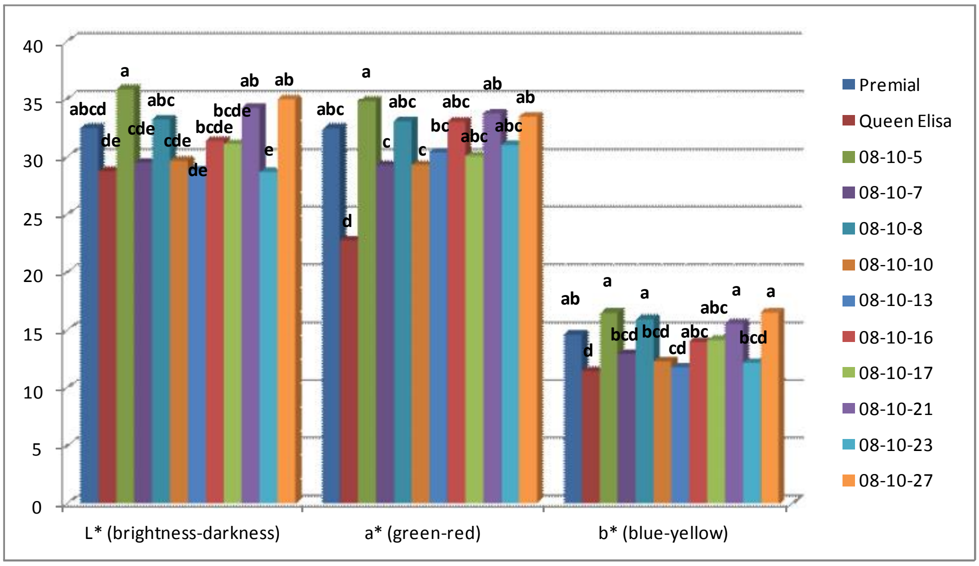

Fig. 3. Fruit color parameters (L*,a*,b*)

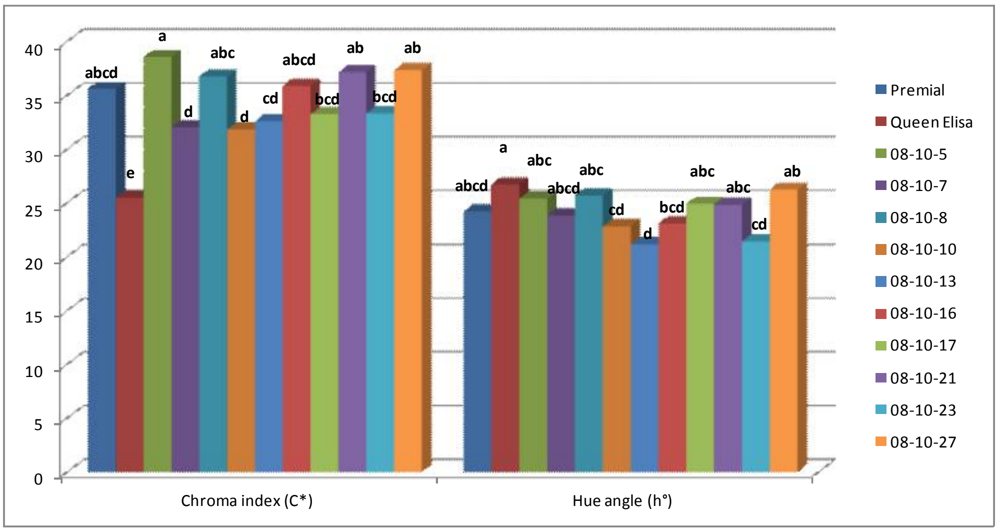

Fig. 4. Fruit chroma and hue angle color values

Table 1. The correlations between strawberry fruit quality indicators (simple Pearson correlation coefficient - r)

	Fruit length (mm)	Fruit diameter (mm)	Fruit weight (g)	The soluble solids (% Brix)	pH	L* (brightness-darkness)	a* (green-red)	b* (blue-yellow)	hue angle (h°)	chroma index (C*)
Fruit length (mm)	1	0.448(**)	0.435(**)	0.050	0.285(*)	0.138	0.014	0.193	0.236	0.056
Fruit diameter (mm)	0.448(**)	1	0.175	-0.009	0.367(**)	-0.009	0.046	0.065	0.035	0.055
Fruit weight (g)	0.435(**)	0.175	1	0.308(*)	0.287(*)	0.055	-0.271 (*)	0.003	0.340(**)	-0.226
The soluble solids (% Brix)	0.050	-0.009	0.308(*)	1	0.305(*)	-0.068	-0.111	-0.100	-0.023	-0.114
pH	0.285(*)	0.367(**)	0.287(*)	0.305(*)	1	0.093	0.069	0.105	0.081	0.081
L* (brightness-darkness)	0.138	-0.009	0.055	-0.068	0.093	1	0.633 (**)	0.922(**)	0.585(**)	0.733(**)
a* (green-red)	0.014	0.046	-0.271(*)	-0.111	0.069	0.633(**)	1	0.702(**)	-0.126	0.987(**)
b* (blue-yellow)	0.193	0.065	0.003	-0.100	0.105	0.922(**)	0.702 (**)	1	0.614(**)	0.808(**)
hue angle (h°)	0.236	0.035	0.340(**)	-0.023	0.081	0.585(**)	-0.126	0.614(**)	1	0.034
chroma index (C*)	0.056	0.055	-0.226	-0.114	0.081	0.733(**)	0.987 (**)	0.808(**)	0.034	1