

Physicochemical and sensorial characterization of a new variety of apple (cv. Jonagored)

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INTRODUCTION

Fruit composition can be strongly influenced by the variety and ripeness and storage conditions. The major constituents are sugars, polysaccharides and organic acids, while N compounds and lipids are present in lesser amounts. Minor constituents include pigments and aroma substances of importance to organoleptic quality, and vitamins and minerals of nutritional importance (Belitz and Grosch, 1987).

Studies of the various compositional changes in plant organs during their developmental stages are essential to determining their optimum horticultural (harvest) maturity that would result in the best quality, and also the use of such information in relating sensory characteristics to composition of the commodity and in developing means of controlling the rate of compositional changes (Kader, 1990).

The main objective of this study was to evaluate a new variety of apple 'Jonagored' grown in Portugal in terms of several physicochemical and sensorial parameters, aiming to evaluate its stability during storage.

MATERIAL AND METHODS

Plant material

'Jonagored' apples grown at Estação Regional de Fruticultura e Vitivinicultura - Quinta de Sergude, Felgueiras, Portugal, were harvested in 23 of September 1993 (normal harvest date every year). 'Jonagored' is a red mutant of the variety 'Jonagold' obtained by a controlled cross between 'Golden Delicious' and 'Jonathan' (Trillot et al., 1993). 'Jonagold' has achieved wide popularity because of its high yield and excellent dessert quality. 'Jonagored' has a potential to obtain even higher success among consumers, since its chemical characteristics are similar to 'Jonagold' and it has a more attractive red colour. The fruits were stored in air at 4°C for 1 and 3 months to be used in the experiments.

Treatment and storage conditions

The apples for each experiment were initially washed in chlorinate water (0.75% of active chlorine during 5 minutes) (Wardowski and Brown, 1991) to prevent from surface contamination. After peeling and coring each apple was cut in cubes then randomly selected for different experiments. Three replicates were used for each experiment.

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Samples were evaluated in terms of several quality attributes listed 15 days after harvest. The same evaluation was performed 2 months later in order to verify the influence of storage time on apple quality.

Quality evaluation

Colour assessment.

Cut fruit surface colour was measured with a hand-held tristimulus reflectance colorimeter (Minolta CR - 300, Minolta Corp., Ramsey, New Jersey, USA) (Francis, 1980).

Firmness.

Fruit firmness was measured by compression mode with an Instron Universal Testing Instrument (model 4501, Instron Corp., Ohio, USA) (Kader, 1982). Results are expressed as the load for a compression of 5 mm (newton).

Titrateable acidity

The apple cubes from each of the three replicates were smashed, and 20 - 30g were diluted with 250 mL of recently boiled water. 25 mL of the prepared juice were titrated with 0.1N NaOH, beyond pH = 8.1, and data was interpolated. This potentiometric titration was performed with a pH combined electrode Ingold U402-57/120 and a Crison MicropH 2002 (Crison Instruments, S. A. Barcelona, Spain) potentiometer. The results were calculated to percent malic acid (mL NaOH * 0.1N (NaOH)/ weight of sample titrated) * 0.067 * 100).

pH.

The pH was measured in the juice of the crushed apple, using a pH meter Crison, model Micro pH 2002 (Crison Instruments, S. A. Barcelona, Spain) and a xerolyt electrode Ingold Lot 406 - MG - DXK - 57/25.

Sugars

The sugars analyses (sucrose, D glucose and D fructose) were carried out using a high performance liquid chromatograph SP 8800 (Spectra Physics), with a NH₂ column, 5μ / Spherisor - Biochrom. The components were detected by a refractive index detector HP 1047 (Hewlett Packard). The peaks were quantified by an external calibration method.

Soluble solids content.

The soluble solids content of the non diluted juice from crushed apple cubes was determined at 20C with a hand held sugar refractometer, model Atago - ATC1. Results are expressed in degrees brix.

Sensorial analyses

In order to select a sensorial panel, tests were performed for recognition of basic tastes, ability to determine the intensity of basic tastes, odor recognition, and texture rating (Stevens and Albright, 1980). Twenty eight panelists were valuated and the best fifteen judges were chosen. The panelists were graduate students aged between 24 to 34 years old. Samples were evaluated by 15 panelists. a 5 point hedonic scale was used: 1= dislike extremely; 3 = neither like or dislike; 5 = like extremely. The cut off values were considered below 3. Samples were presented randomly to the judges at room temperature. Tasting was performed in a sensory testing room with individual booths and controlled lighting (white), with samples presented in plastic transparent boxes. Each

panelist was asked to rate three main components of apple quality: colour, firmness and flavour and also the overall fruit quality, in terms the degree of liking of each sample.

Statistical analyses.

The statistical analyses computer system package (SAS Institute, Inc. 1986) was used for analyses of the data. Statistical significance was assessed by two-way analyses of variance (sources of variation were chemical treatments and time of storage). Significant differences were detected using Duncan's multiple range test.

RESULTS AND DISCUSSION

Physicochemical characteristics

The skin is green and red, the flesh is white-green (Hunter colour parameters: $L^* = 74.4 \pm 3.9$; $a^* = -4.2 \pm 1.5$; $b = 27.85 \pm 3.8$; hue = 98.71 ± 3.4 ; chroma = 28.21 ± 3.8), dense, firm and, extremely juicy. The flavour is sweet (13% of soluble solids), the predominant sugar is fructose (6.7%) followed by sucrose (4.3%) and glucose (2.1%). It has an acid balance (0.40% in terms of malic acid content). Its pH value is about 3.5. 'Jonagored' is perceived to be a crisp, crunchy apple (fruit firmness 78N).

Sensorial characteristics

The apple samples were scored for all parameters by panelists, using an hedonic scale of 5 points, always with a score ≥ 4.2 (table 1).

Table 1. Sensorial evaluation of apple samples (hedonic scale 1 - 5)

Sensorial parameters	Colour	Firmness	Flavour	Overall quality
	4.6	4.7	4.3	4.7

* Means of 15 panelists

Comparison between several apple varieties

Concerning firmness 'Jonagored' apple was considered quite firm (table 2). The soluble solids content is the highest among these varieties. This variety showed mean values of titratable acidity.

Table 2. Comparison of several qualitative parameters of apple varieties

Parameters Varieties /	Firmness (N)	Soluble solids content (%)	Titratable acidity (% malic acid)
Cortland**	79	11.6	0.73
Golden Delicious*	61	-----	0.39
Miller Spur*	73	12.5	0.26
Red Spur*	55	10	0.21
Rome Beauty*	58	-----	0.42
York Imperial*	74	-----	0.45
McIntosh**	69	11.1	0.87
Jonagored	79	13	0.40

(* Values of Watada et al, 1980; ** Values of DeEll and Prange, 1992)

Influence of storage time after harvest

The storage time affected negatively the firmness of apples (table 3). After 75 days of storage at 4C apple samples showed values of firmness lower than 50% comparing to the first evaluation (15 days of storage). No significant changes were observed on the other quality parameters (table 4).

Table 3. Physical parameters of apple after different periods of storage at 4C

Storage period (days)	L*	a*	b*	Hue	Chroma	Firmness (N)
15	74.4 (3.9)	-4.2 (1.52)	27.9 (3.9)	98.7 (3.35)	28.2 (3.8)	78.8 (9.8)
75	78.8 (1.9)	-5.1 (0.81)	26.81 (3.7)	100.9 (1.9)	27.3 (3.7)	36.5 (11)

(Values in parenthesis are standard deviation)

Table 4. Chemical parameters of apple after different periods of storage

Storage period (days)	Fructose	Glucose	Sucrose	Sol. sol. content	Titrat. Acidity	pH
15	6.72 (0.21)	2.10 (0.18)	4.34 (0.10)	13.0 (0.2)	0.40 (0.04)	3.46 (0.05)
75	7.09 (0.34)	1.89 (0.44)	3.88 (0.13)	13.2 (0.3)	0.42 (0.02)	3.55 (0.04)

(Values in parenthesis are standard deviation)

Significant differences were observed on sucrose and fructose contents of apple stored during different periods at 4C, probably due to interconversion of sugars, namely of sucrose into fructose (Ackerman et al., 1992).

CONCLUSION

'Jonagored' apple has a potential to obtain great success among consumers because of its characteristics of flavour and colour.

Physicochemical characteristics at harvest are intended to be preserved through storage time to ensure consumer's acceptance.

According to data the critical parameter for apple quality at 4C was firmness.

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