Physical and chemical characterization of banana "prata ceraíma"

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ABSTRACT

The banana tree is one of the main fruit trees of popular consumption in Brazil and is distributed throughout the national territory, being among the main crops, in planted area, volume produced and production value. Physicochemical analyses are of great importance to characterize the quality of fruits in the commercial standard, when it comes to a new variety. The objective of this study was to describe the physical and chemical characteristics of 'Prata Ceraíma' banana fruits. The fruits were harvested in the municipality of Janaúba and were taken to the Physiology and Postharvest Laboratory of the State University of Montes Claros, UNIMONTES, on the Campus of Janaúba – MG. Analyses were performed to determine the physical and chemical characteristics of the banana, such as fruit weight, diameter, length, firmness, color, pH, soluble solids, titratable acidity and soluble solids/titratable acidity ratio. The Prata Ceraíma variety characterized in this work presented important characteristics, such as soluble solids, titratable acidity and pH are within the quality standards desired in the commercialization.

Keywords: *Musa spp.*, Commercialization, Quality.

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INTRODUCTION

Brazil has been standing out in the foreign market as a major supplier of fruits. Because it has a wide variety of climates, Brazil produces fruits from temperate climates to typically tropical fruits. The production of bananas in the country is surpassed only by oranges; in volume, however, it is of great relevance in food, the country is the fourth in banana production in the world (FAO, 2018). In 2017, the Brazilian banana crop had a harvested area of 474,054 hectares, reaching a production of 6,962,134 tons of bananas, according to data from the 2017 Brazilian Fruit Yearbook. In Minas Gerais, banana cultivation has a production of around 800 thousand tons (IBGE, 2018).

The five main banana-producing municipalities in Minas Gerais are: Jaíba, Nova Porteirinha, Delfinópolis, Janaúba and Matias Cardoso, which add up to 34% of production, four of which are in the northern region of the state and one in the southern region (IBGE, 2018). According to Silva et. al. (2008), the 'Prata' banana was introduced in Brazil by the Portuguese and, for this reason, Brazilians, especially those from the Northeast and North, showed a great preference for flavor, presenting small fruits, with a sweet to mildly acidic flavor.

The cultivars considered resistant have a whole agronomic characterization, but the information regarding the physical and chemical aspects of their fruits is very incipient. The most commonly used chemical references to classify the postharvest characteristics of bananas are pH, titratable acidity, soluble solids, ratio between soluble solids and acidity or ripeness index, reducing sugars, non-reducing sugars, total sugars, pectic substances and starch content (CHITARRA, 2000). The change in the color of the epidermis in bananas is one of the most important parameters of differentiation during the ripening phases and serves as a basis for analyzing the stage of ripening of the fruit (PALMER, 1971). Thus, the objective of this study was to chemically and physically evaluate the banana 'Prata Ceraíma' in the commercial standard.

MATERIAL AND METHODS

The present study was carried out at the Laboratory of Physiology and Postharvest of the State University of Montes Claros, UNIMONTES, at the Center for Exact and Technological Sciences, Department of Agricultural Sciences, at the Campus of Janaúba – MG. The bunches of banana (*Musa* spp.) 'Prata Ceraíma' were harvested at maturity stage 2, according to the Von Loesecke (1950) maturation scale (Figure 1), obtained from a commercial farm in the municipality of Janaúba, Minas Gerais.

Figure 1 - Banana ripening scale.

Fonte: VON LOESECKE (1950).

The fruits were sent to the laboratory where the bunches were selected and divided into bouquets of four fruits. Then, the fruits were washed with water and 0.2% neutral detergent for latex coagulation and surface cleaning. Malformed, diseased or mechanically damaged fruits were selected and discarded and air-dried (Figure 2). Subsequently, the fruits were placed in expanded polystyrene trays (Figure 3). The analyses were performed when the fruits reached stage 6 on the Von Loesecke (1950) maturation scale (Figure 1), as shown in Figure 4. A treatment with fourteen replications was used, with four fruits per replication. The data were submitted to descriptive statistical analysis in order to identify the internal consistency of the samples, the mean and standard deviation.

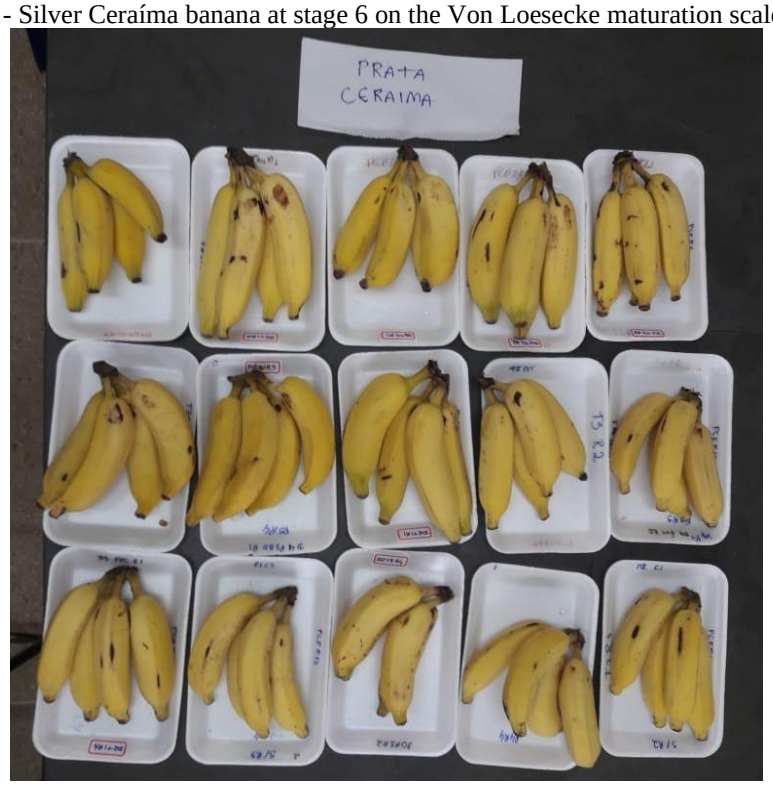
Figure 2 - Fruits selected and discarded those that are malformed, diseased or with mechanical damage, and placed to dry in the air.

Source: Authors

Figure 3 - Fruits packed in expanded polystyrene trays.

Source: Authors

Figure 4 - Silver Ceraíma banana at stage 6 on the Von Loesecke maturation scale (1950).



Source: Authors

PHYSICAL ANALYSIS

Fruit length

The length of the fruit was evaluated (cm) with measurements using a tape measure on the external curvature of the fruit, from the base of the peduncle insertion to the end of the peduncle.

Fruit diameter

The diameter of the fruit (cm) was obtained with the aid of a digital caliper, in the median region of the fruits.

Bark staining

Color analysis was performed using a Color Flex 45/0(2200) colorimeter, stdzMode:45/0 with direct reflectance reading of the coordinates L* (luminosity), a* (red or green hue) and b* (yellow or blue hue), from the Hunterlab Universal Software system, measured in the median region of the fruit. From the values of a* and b*, the hue angle (°h*) and the chroma saturation index (C*) were calculated.

$$°h^* = \text{actg}\,(a^*/b^*)\,(-1) + 90 \text{ for } a^* \text{ negative}$$

$$°H^* = 90 - (\text{Actg}\,(A^*/B^*)) \text{ for positive } A^*$$

$$C^* = (a^{*2} + b^{*2})0.5$$

Average Weight

The fruit bouquets were weighed individually and the weight was averaged with the aid of an analytical scale. The result was expressed in grams (g).

Firmness of the Fruits

Firmness was performed with a Brookfield CT3 10 KG digital texturometer. The measurements will be performed in the median region of the fruit, being determined by the penetration force, measured in Newton (N), necessary for the 4 mm diameter tip to penetrate the fruit pulp at a depth of 7 mm.

CHEMICAL ANALYSIS

For the chemical analyses, samples composed of four crushed fruits were used.

Soluble solids (SS)

The determination of soluble solids was obtained by refractometry, using an ATAGO benchtop refractometer, model N-1α, with readings in the range of 0 to 95 °Brix and the result will be expressed in °Brix (IAL, 2008).

pH

The pH was determined using a bench peagameter with a glass membrane electrode calibrated with pH 4.0 and 7.0 solutions (IAL, 2008).

Titratable acidity (TA)

Titratable acidity was determined by titration using 10 g of pulp diluted in 90 mL of distilled water, followed by titration with 0.1 M NaOH solution, using phenolphthalein as indicator. The result was expressed in grams of malic acid per 100 g of sample (IAL, 2008).

Soluble Solids / Titratable Acidity Ratio

The soluble solids/titratable acidity ratio was obtained by dividing the percentage of soluble solids by the titratable acidity.

RESULTS AND DISCUSSION

PHYSICAL CHARACTERISTICS

Ceraíma silver had an average diameter of 3.16 cm and an average length of 16.14 cm. According to Chitarra and Chitarra (2005), bananas of the Silver group are classified as Extra type

when they have a minimum diameter of 2.8 cm and a minimum length of 15 cm, which indicates that Ceraíma Silver fits into the Extra group, when both dimensions are considered. The evaluation of these parameters is very important for the classification, packaging and transportation of fruits and in processing operations, as they facilitate the operations of cutting, peeling or obtaining uniform products (CHITARRA and CHITARRA, 2005).

The physical aspects of diameter and length are of great importance for fruits that are intended for the processing of dehydrated products, which influences the drying process.

Prata Ceraíma, presented the value for fresh mass of 91.95g. The values of fresh fruit mass of this study were lower than those presented by Martins, *et al*. (2013), studying the postharvest quality of 'Prata Anã' and BRS Platina bananas stored under refrigeration at 15 °C, which found a fresh mass value of 'Prata Anã' banana equal to 157.25 g.

The average firmness of Ceraíma silver was equal to 8.14 N. According to CHITARRA and CHITARRA (2005), firmness is a texture characteristic and corresponds to the degree of resistance of plant tissues to compression.

The firmness found in this study was similar to the values found by Silva *et al*. (2009), in stage 7 bananas in Terra type banana fruits, whose average value was equal to 8.8 N. One of the changes observed during the ripening of tropical fruits is the reduction in firmness due to the softening caused by the progressive solubilization of protopectins into pectins or pectic acid (Proctor; Caygill, 1985).

The characteristics of the color of the peel of the fruits (Luminosity, Hue Angle and Chromaticity) are presented. The mean luminosity value found was 62.22. Being luminosity on a scale of 0 (totally black) to 100 (totally white).

According to Ribeiro (2006), in a study with 'Prata Anã' bananas, stored for 10 days at 15oC, he found average luminosity values of 50.29 to 62.05.

The variations in the color of the banana peel that occurred during fruit ripening would possibly be related to degradative processes related to the respiratory metabolism of the fruits. According to Silva *et al*. (2006), during the ripening of bananas, the degradation of the green color is intense, and the preexistence of carotenoid pigments, of yellowish to orange color, is visible.

The mean value of Hue Angle found in the peels of the fruits was 80.66. Fonseca (2013), in a study with Prata-Anã bananas, found an average Hue angle value of 81.46.

The values of Chromaticity are presented, obtaining an overall average of 46.93 in the waxy silver fruits. Rodriguez *et al*., (2015) working with banana of the Prata-anã cultivar 'Clone Gorutuba', found a value of 47.8 after refrigerated storage for 25 days at 14.5°C. Chromaticity indicates the intensity of the color, that is, it stands out in terms of the pigments of this color (MENDONÇA *et al*., 2003), assuming lower values for more neutral colors (gray) and higher values

for vivid colors.

TABLE 1- Average values of physical characteristics evaluated in Banana Prata Ceraíma (2019)

CHARACTERISTICS	MEDIUM	CV (%)
Length (cm)	16,14	9,10
Diameter (cm)	3,16	3,29
Fresh mass (g)	91,95	12,34
Luminosity	62,22	8,19
Hue Angle	80,66	0,68
Chromaticity	46,93	7,22
Firmness (N)	8,14	16,34

Source: Authors

CHEMICAL CHARACTERISTICS

As for the chemical characteristics (Table 2), the soluble solids content indicates the amount of solids that are dissolved in the pulp and during maturation its content tends to increase due to the biosynthesis of soluble sugars or the degradation of polysaccharides (CHITARRA and CHITARRA, 2005). The mean SS value found was 25.61 oBrix. Lopes (2011) found similar values by studying Prata Anã bananas produced under conventional and alternative management, where they obtained the averages of 26.45oBrix and 27.77oBrix, respectively. High values of SS are desired, both for fresh consumption, as it provides better flavor, and for the industry, as it increases the yield in the preparation of products (PAIVA et al., 1997).

For the variable pH of the fruit, the mean found was 4.42. The pH of ripe banana pulp ranges from 4.2 to 4.7 (MATSUURA; FOLEGATTI, 2001).

The analysis of titratable acidity for the banana cultivar Prata ceraíma showed an average of 0.63% of malic acid per 100 g of pulp. According to the evaluated, the value is within the range suggested by several authors, which is between 0.22% and 0.65% (CHITARRA AND CHITARRA, 1994; FAGUNDES et al. 1999; CERQUEIRA, 2000 and MATSUURA et al., 2002).

The mean value between soluble solids and titratable acidity (SS/TA) ratio was 41.62. The values are included in the range analyzed by CERQUEIRA (2000), from 33.7 to 109.2, when he evaluated different banana genotypes. The SS/TA ratio is related to the taste of the fruit and is a more representative indicator than the isolated measurement of sugars or acidity, which results in the taste presented by the fruit (CHITARRA and CHITARRA, 2005).

TABLE 2- Average values of the Chemical characteristics evaluated in Banana Prata Ceraíma (2019).

CHARACTERISTICS	MEDIUM	CV (%)
SS	25,61	2,67
ph	4,42	1,50
AT[1]	0,63	13,83
SS/AT interface	41,62	15,47

Titratable acidity: 100mg of malic acid for 100mL-1 of pulp.
Source: Authors.

CONCLUSION

The Prata Ceraíma variety characterized in this work presented important characteristics, such as soluble solids, titratable acidity and pH are within the desirable quality standards in commercialization.

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