

Suitability of peduncles of new cashew tree clones for commercial purposes¹

Aptidão de pedúnculos de novos clones de cajueiro para fins comerciais

Ailane Souza de Freitas², Beatriz dos Santos Dantas³, Ídila Maria da Silva Araújo⁴ and Deborah dos Santos Garruti^{4*}

ABSTRACT - Due to its richness in bioactive compounds, exotic flavor, fleshy pulp, soft skin, and high sugar content, the cashew apple is consumed as fresh fruit and intended for industrialization in the form of juices and derivatives. The objective of this study is to evaluate the chemical and sensory qualities of peduncles of five new cashew tree clones and compare them with two commercial clones, thus assisting the selection of new materials that are suitable for commercialization either as fresh fruit or for processing. Titratable acidity, pH, soluble solids, brix/acid ratio, ascorbic acid, and total polyphenols were evaluated. The sensory profile was determined by classical quantitative descriptive analysis. The results were submitted to Anova, Tukey test, Hierarchical Cluster Analysis (HCA), Principal Component Analysis (PCA), and Pearson correlation. The new clones have different chemical and sensory characteristics, which allow the selection of cultivars according to commercial purposes. Clone PRO 555/2 has chemical and sensory characteristics similar to CCP 76 (quality reference) and may be suitable for table consumption. The HAC 276/1 and SLC 12-20 clones have high astringency; and clones CAPI 17 and PRO 805/4 stand out for their high fibrosity, low softness, and juiciness. Therefore, these materials are most suitable for juice processing.

Key words: *Anacardium occidentale*. Quantitative Descriptive Analysis. Multivariate analysis. Characterization.

RESUMO - Devido a sua riqueza em compostos bioativos, sabor exótico, polpa carnuda, pele macia e alto teor de açúcares, o pedúnculo do cajueiro é consumido, tanto na forma *in natura* quanto destinado à industrialização na forma de sucos e derivados. O objetivo deste trabalho foi avaliar a qualidade físico-química e sensorial de pedúnculos de cinco novos clones de cajueiro e compará-los com dois clones comerciais, de forma a auxiliar a seleção de novos materiais adequados para a comercialização como fruta ou para processamento. Foram avaliados acidez titulável, pH, sólidos solúveis, relação Brix/acidez, ácido ascórbico e polifenóis totais. O perfil sensorial foi determinado por análise descritiva quantitativa clássica. Os resultados foram submetidos à Anova, teste de Tukey, Análise de Agrupamentos Hierárquicos (AAH), Análise de Componentes Principais (ACP) e correlação de Pearson. Os novos clones possuem características físico-químicas e sensoriais diferentes, permitindo a seleção de cultivares de acordo com o interesse comercial. O clone PRO 555/2 apresenta características físico-químicas e sensoriais semelhantes ao CCP 76 (material de referência), podendo ser indicado para o consumo de mesa. Os clones HAC 276/1 e SLC 12-20 apresentam elevada adstringência, e os clones CAPI 17 e PRO 805/4 destacam-se pela elevada fibrosidade e baixas maciez e suculência. Portanto, esses materiais são mais indicados para o processamento de sucos.

Palavras-chave: *Anacardium occidentale*. Análise Descritiva Quantitativa. Análise multivariada. Caracterização.

DOI: 10.5935/1806-6690.20200050

*Author for correspondence

Received for publication on 11/10/2019; approved on 06/01/2020

¹Parte da Dissertação de Mestrado da primeira autora, apresentado ao Curso de Pós-Graduação em Ciências Naturais, Universidade Estadual do Ceará/UECE

²Centro de Ciências e Tecnologia, Universidade Estadual do Ceará/UECE, Av. Dr. Silas Munguba, 1700, Itaperi, Fortaleza-CE, Brasil, 60.714-903, ailanefreitas@yahoo.com.br (ORCID ID 0000-0001-5463-3784)

³Centro de Ciências Agrárias, Faculdade de Engenharia de Alimentos, Universidade Federal do Ceará/UFC, Campus do Pici, Av. Mister Hull, s/n - Pici, Fortaleza-CE, Brasil, 60455-760, biadantas0797@hotmail.com (ORCID ID 0000-0002-9748-9257)

⁴Embrapa Agroindústria Tropical, Av. Sara Mesquita, 2270, Pici, Fortaleza-CE, Brasil, 60.511-110, idila.araujo@embrapa.br (ORCID ID 0000-0001-5258-5248), deborah.garruti@embrapa.br (ORCID ID 0000-0003-4850-2651)

INTRODUCTION

The geographical distribution of the cashew tree (*Anacardium occidentale* L.) is mainly concentrated in the tropics, which is of great socioeconomic importance for the underdeveloped countries of Africa (Mozambique, Tanzania, Kenya) and Asia (Vietnam, Indonesia e Thailand), and for developing countries such as Brazil and India (MACEDO; SOARES, 2015). The nut, the cashew's true fruit, is the main export product, but the hypertrophied peduncle (accessory fruit), the pulposus, fibrous, and juicy part of cashew, also known as cashew apple, is considered functional food (TEIXEIRA *et al.*, 2019).

The cashew pulp is rich in ascorbic acid, phenolic compounds, carotenoids, and minerals (CUNHA *et al.*, 2017; SOUZA *et al.*, 2018), a combination of nutrients that provides it with a high antioxidant power, which is associated with the treatment of several degenerative diseases and major maladies such as cancer, inflammations, diabetes, and obesity (BAPTISTA *et al.*, 2018; DIONISIO *et al.*, 2015; ONUH *et al.*, 2017). Due to its diverse biological activities and pleasing sensory characteristics (sweet, acid, aromatic and tasty), the peduncle reached the highest Priority Index value (PI = 8) in the study performed by Teixeira *et al.* (2019), which aimed to identify valuable species from the Brazilian biodiversity, stimulate direct consumption, and promote scientific research that is connected to the development of new food products.

Despite being highly astringent, the cashew peduncle has good potential for industrialization due to its fleshy pulp, soft skin, high sugar content, and exotic flavor (ANDRADE *et al.*, 2018), being largely consumed as fresh fruit and in the form of juice and derivatives. Brazil is the only country with the technology, experience, and praxis for the commercialization and consumption of fresh cashew peduncles, as well as for their transformation into juice and food, which enables the diversification of the cashew agribusiness (MOURA; ALVES; SILVA, 2013). Nevertheless, the peduncle is poorly used, less than 20% of the entire production. This colossal waste is partly the result of a reduced postharvest stability, a short harvest period, and the industry's low absorption capacity (LIMA *et al.*, 2015).

The cashew tree's genetic breeding program has the objective of increasing cashew diversity, alongside the agribusiness expansion, thus enabling the attainment of stable and more productive genotypes that can adapt to different environments and present a better performance in regard to the quality of the peduncle (CARVALHO *et al.*, 2016; SILVA *et al.*, 2014). Quality is not defined as a single attribute, but rather as a set of specific characteristics of each product. It includes sensory properties (appearance, aroma, flavor, and firmness), nutritional and functional

values, mechanical properties, and the absence of defects (CHITARRA; CHITARRA, 2005). For fresh fruit consumption, quality is associated with sugar content, low astringency, external color, shape, and firmness. For the industrial process, quality is associated with sensory aspects, firmness (bruise resistance during transportation), nutritional value, and yield (SILVEIRA *et al.*, 2018).

The objective of this study is to evaluate the chemical and sensory qualities of peduncles of new cashew tree clones and compare them with commercial clones so as to assist the selection of new materials required by the fresh fruit and juice industrialization sectors.

MATERIAL AND METHODS

Collection and Preparation of Samples

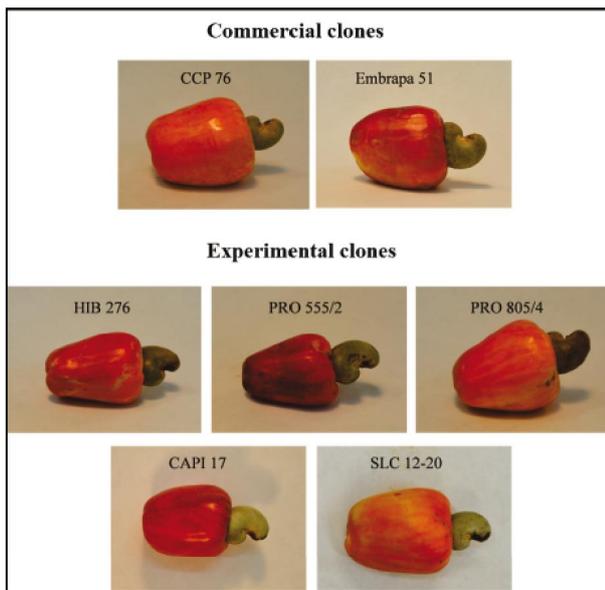
Peduncles of five new cashew tree clones were analyzed: PRO 805/4, CAPI 17, PRO 555/2, SLC 12-20, and HAC 276/1; besides the commercial clones Embrapa 51 and CCP 76 (quality reference, according to Pereira *et al.* (2011)), which came from Embrapa Agroindústria Tropical's Experimental Field, in Pacajus - Ceará (S 04°10'22", O 38°27'39") (Figure 1). Cashew was manually harvested during harvest season 2018 (August to October), detached from the nut, and sent to the laboratory for sensory analysis in Fortaleza, Ceará, Brazil. Harvest was carried out in 3 batches, one batch per week, considered as an experimental repetition to be studied. At the laboratory, peduncles were washed with running water and selected to remove peduncles that were either damaged or unripe (ripe, stage 7, according to Alves, Bezerra and Abreu (1999)). Peduncles were then disinfected in a 200-ppm sodium hypochlorite solution (2.7×10^{-3} M) for 15 minutes. Peduncles were stored in a cold chamber (4 °C) for a maximum of 24 hours, until sensory tests were carried out, and five units of each clone were stored under freezing temperature (-18 °C) for subsequent chemical analyses.

Chemical analyses

Peduncles thawed at ambient temperature (25 °C), cut and processed in a home centrifuge to obtain the pulp. The determinations of titrable acidity (TA), pH, soluble solids (SS), ratio (SS/TA), and the bioactive compounds ascorbic acid (vitamin C) and total extractable polyphenols (TEP) were carried out according to the Association of Official Analytical Chemists (2005).

Titrable acidity, expressed in malic acid percentage, was determined by titration with NaOH 0.1M. pH was determined directly in the pulp by using a glass membrane electrode (Five Easy™ F20 -Toledo)

Figure 1 - Peduncles of the cashew tree clones used in the analysis



calibrated against buffer solutions with pH 4.0 and 7.0. To determine the soluble solids content, a small amount of pulp was filtered in paper filter and dripped on the refractometer prism (N50E - Atago). Direct reading was expressed in °Brix. The ratio value was obtained through the division of variable SS by TA.

To determine the vitamin C content, extracts were filtered in a 0.45- μ m nylon membrane and analyzed in liquid chromatography (HPLC 20A Proeminence - Shimadzu). The results were obtained by comparing the retention time and the area of the absorption peak at 245 nm with the standard ascorbic acid curve values. Values were expressed in mg of total vitamin C in 100 g of fresh fruit pulp. The polyphenol content was obtained by reading the absorbance of samples in a spectrophotometer (Genesys 10S UV-Vis - Thermoscientific) at 700 nm. The result was given in mg of gallic acid equivalent in 100 g of sample.

Sensory analysis

The sensory testing protocols were previously approved by Santa Casa de Sobral Research Ethics Committee under CONEP report n° 3,117,036 of 21/01/2019. Before carrying out the sensory tests, judges were asked to sign an Informed Consent Form (ICF).

The sensory profile of the fresh peduncles was determined by Quantitative Descriptive Analysis (ADQ) (STONE *et al.*, 1974). Embrapa Agroindústria Tropical's panel of trained assessors was used. Nine individuals were

selected according to their normal taste and olfactory acuity (ASSOCIAÇÃO BRASILEIRA DE NORMAS TÉCNICAS, 2016) and trained on descriptive terminology, and its respective intensity references, according to the quality assessment of peduncles of cashew tree clones Protocol (GARRUTI *et al.*, 2019). A randomized complete block design was used, in which the judges evaluated all samples in three repetitions for each clone, being each repetition a different batch.

Fruit evaluation was carried out in individual acclimatized booths (24 °C), under controlled lighting (white fluorescent light), and equipped with computer terminals to register/collect data automatically by means of the software FIZZ (Biosistemas). Judges were asked to evaluate the intensity of the descriptors cashew aroma, sweet aroma, sulfurous aroma, cashew flavor, sweet taste, acidic taste, softness, juiciness, fibrosity, astringency, residual mouth harshness, and residual throat irritation using a unstructured 9-cm intensity scale anchored at its extremities with terms describing intensity. Judges respected a minimum interval of 20 minutes between samples.

Statistical Analysis

Data was submitted to Variance Analysis (ANOVA) and Tukey's Test at 5% significance level, Hierarchical Cluster Analysis (HCA), Principal Component Analysis (PCA), and Pearson's Correlation test using the statistical software XLSTAT Addinsoft, New York, NY: Version 2015.

RESULT AND DISCUSSION

Chemical quality of peduncles

The means of the chemical characteristics and the Tukey's test results are shown in Table 1. The peduncles of the commercial clone CCP 76, used as reference for good quality, presented malic acid titrable acidity (TA) of 0.16%, pH 4.66, and soluble solids (SS) 11.17 °Brix, values that are below those found in the literature for this clone (MOURA *et al.*, 2011; SENA *et al.*, 2019; SOUZA *et al.*, 2016). Due to the low TA value, the Brix/acidity ratio was higher (68.84) than the values reported by Moura *et al.* (2011) and Sena *et al.* (2019). Low pH and high acidity values are results that favor product preservation and prevent the growth of yeasts. Peduncles with high acidity are important for the agribusiness, given that there is no need to add citric acid to preserve the product, which is a common procedure to make the medium improper for microorganisms (LIMA *et al.*, 2002). Hence, peduncles of 'CCP 76' becomes less interesting for the processing sector.

Table 1 - Mean values of the chemical characteristics evaluated in peduncles of cashew tree clones harvested in Pacajus-CE during harvest season 2018 (3 batches)

Characteristics	Clones						
	CCP 76	Embrapa 51	SLC 12-20	CAPI 17	PRO 555/2	HAC 276/1	PRO 805/4
pH	4.66 c	4.53 d	3.70 g	4.24 e	4.88 b	5.24 a	3.84 f
Titrate acidity (% in malic ac.)	0.16 e	0.20 d	0.44 a	0.27 c	0.12 f	0.16 e	0.41 b
Soluble Solids (°Brix)	11.17 d	14.07 a	14.46 a	12.90 b	12.93 b	12.20 c	9.03 e
Ratio	68.84 c	69.75 c	32.57 e	47.62 d	111.40 a	76.43 b	21.90 f
TEP (mg/100 g)	237.95 d	375.28 b	535.50 a	313.76 c	200.60 e	194.61 e	402.15 b
Ascorbic Ac. (mg/100 g)	247.20 a	240.34 ab	213.44 bc	259.19 a	129.52 d	102.76 d	197.28 c

Means followed by the same letter in the column do not differ from one another by the Tukey's Test at $\alpha=0.05$. TEP = total extractable polyphenols

Clone CCP 76 presented peduncles with an ascorbic acid content (247.20 mg/100 g) that is compatible with the result obtained by Sena *et al.* (2019) for the same clone, when subject to hydrocooling at zero time of storage (245 mg/100 g). However, this characteristic was low when compared with the results achieved by Souza *et al.* (2018), which reached a range from 319 to 330 mg/100 g in different treatments carried out with clone CCP 76. On the other hand, the polyphenol content (237.95 mg/100 g) was high when compared with that found by Souza *et al.* (2016) and Souza *et al.* (2018). The high variability frequently found, both for vitamin C content and polyphenols, is the result of intrinsic factors, like the ripening stage; and extrinsic factors, such as weather and soil conditions (MOURA *et al.*, 2013).

Clone Embrapa 51, another commercial clone, has been barely studied as to its chemical characteristics. In this study, its peduncle presented higher TA (0.20%) and lower pH (4.53) than the 'CCP 76' ($p \leq 0.05$). The SS content was very high (14.07 °Brix), but ratio (69.75) was not significantly different from 'CCP 76.' The vitamin C and polyphenols contents were high, with values 375.28 mg/100 g and 240.34 mg/100 g, respectively, within the variations found in the literature for other commercial cashew tree clones (MOURA *et al.*, 2011; SOUZA *et al.*, 2016).

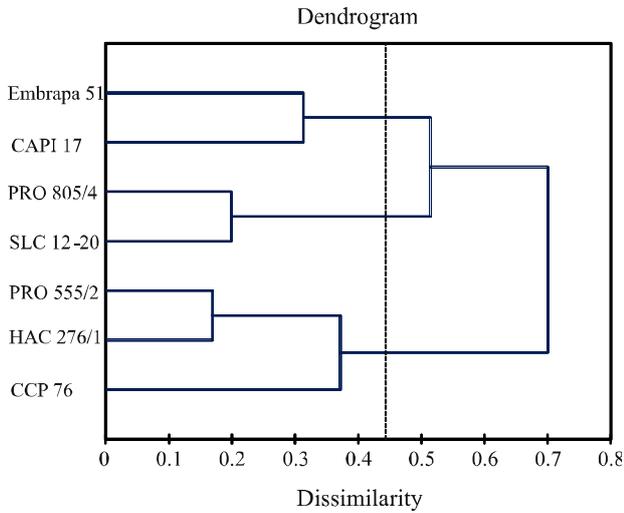
In general, the experimental clones presented significant differences among one another and from the commercial clones for all parameters analyzed. The clones SLC 12-20 and PRO 805/4 presented low pH (3.70 and 3.84) and ratio (32.57 and 21.90) values, respectively, as well as higher acidity (0.44% and 0.41%) and TEP (535.50 and 402.15 mg/100 g) contents, differing from the two commercial clones. Peduncles with these characteristics are seldom appreciated by consumers, who prefer sweeter and less acid fruits.

Peduncles of clone CAPI 17 presented medium acidity, pH, SS and TEP values, which were closer to clone Embrapa 51's, but with significant statistical differences. This clone stood out for its high vitamin C content (259.19 mg/100 g), being statistically similar to the commercial clones. Peduncles with high ascorbic acid content can be recommended for fresh fruit consumption as well as for industrialization due to the importance of a daily intake of this micronutrient for the good performance of the body's vital functions (BAPTISTA *et al.*, 2018; DIONISIO *et al.*, 2015; ONUH *et al.*, 2017). However, this clone's lower ratio (47.62), which denotes low sweetness, may limit its consumption as fresh fruit, being said clone more suitable for the processing sector. The clones PRO 555/2 and HAC 276/1 presented low titrate acidity (0.12% and 0.16% of malic acid, respectively), and very high pH (4.88 and 5.24) and ratio (111.40 and 76.43) values, surpassing those obtained for the commercial clone CCP 76, which indicates that these peduncles are very sweet and with low acidic taste.

Figure 2 presents the Hierarchical Cluster Analysis result based on the chemical similarities among peduncles of different cashew tree clones, and Figure 3 shows a graphical representation of the Principal Component Analysis for the same chemical parameters. In both analyses there was the approximation of clones with similar chemical characteristics. Cluster 1 was formed by clones PRO 805/4 and SLC 12-20 (node 0.199). Cluster 2 (node 0.372) included clones PRO 555/2, HAC 276/1, and the commercial clone CCP 76. Cluster 3 (node 0.313) was represented by clones CAPI 17 and Embrapa 51.

In Figure 3, principal components F1 and F2 accounted for 84.14% of the variation among samples, whereas component F1 alone accounted for 62.46% of such variation. The descriptors are represented by vectors, and the bigger the component of a vector the greater the importance of such descriptor to explain the differences

Figure 2 - Cluster Analysis based on the chemical dissimilarities of peduncles of cashew tree clones harvested in Pacajus-CE during harvest season 2018

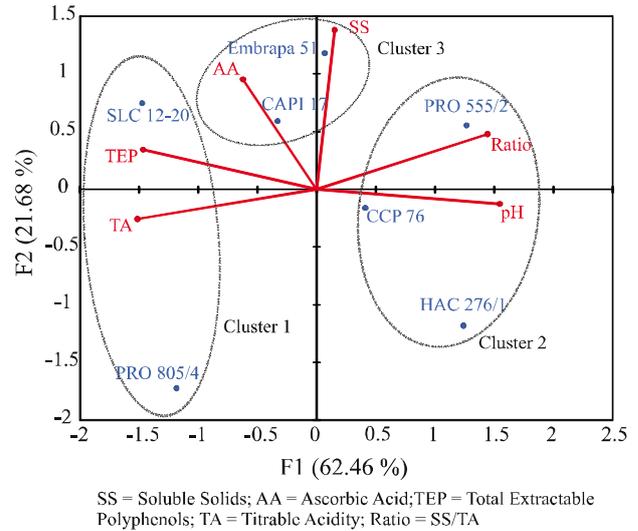


among samples. Since components of all vectors presented virtually the same size, they were all considered relevant.

Clones PRO 555/2, CCP 76 and HAC 276/1, Cluster 2, placed on the right side of Figure 3, were characterized as having the highest ratio and pH, besides presenting low titrable acidity and total polyphenols. Cluster 1, represented by clones PRO 805/4 and SLC 12-20, and placed on the left side of Figure 3, presented a chemical profile opposite to Cluster 2, being the most acid and with the highest polyphenol content, besides presenting the lowest pH and a lower ratio than the other clones. Cluster 3 (clones Embrapa 51 and CAPI 17) stood out for its high vitamin C content, samples of which, along with clone CCP 76, presented the highest values for this parameter, not differing statistically among one another. Samples were also separated in component F2 as to the soluble solids content, being 'Embrapa 51' and 'SLC 12-20' the peduncles with the highest Brix values, whereas the clones placed at the bottom of Figure 3 were the peduncles with the lowest Brix values.

The chemical parameters were correlated to significance level $\alpha = 0.05$. It was observed that pH and ratio were variables directly correlated to each other ($r = 0.84$), whereas ratio and titrable acidity (TA) were inversely correlated ($r = -0.91$). Certainly, a smaller TA denominator value in SS/TA promotes an increase in ratio, as much as a higher pH value is correlated to lower titrable acidity ($r = -0.92$). It was also observed that total polyphenol content is positively correlated to TA ($r = 0.90$) and negatively correlated to ratio ($r = -0.77$), showing that

Figure 3 - Principal Component Analysis based on the chemical variability among peduncles of cashew tree clones harvested in Pacajus-CE during harvest season 2018



peduncles with higher polyphenol content are also more acidic and less sweet, which may reflect in their sensory characteristics of astringency, acidity, and sweet taste.

Sensory quality of peduncles

Table 2 presents the means of the descriptors, the terms used to describe the sensory quality of the peduncles, and the Tukey's test result. The sensory profile was also illustrated in Figure 4, in which the mean of each descriptor is found on axes that share the point zero of the scale used by the assessors to evaluate the intensity of each term.

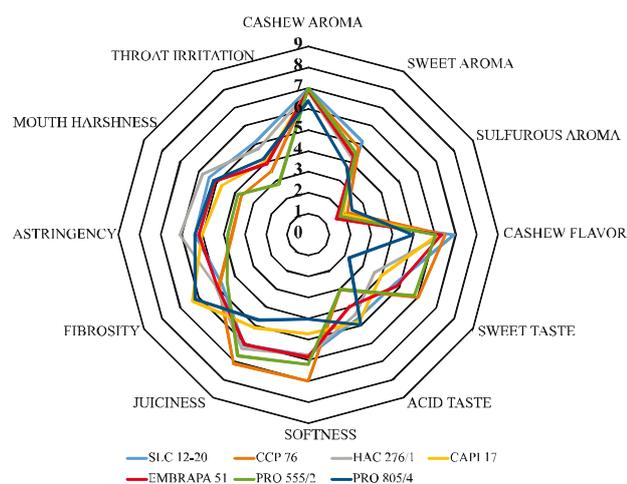
It was observed that there was a significant difference among samples for all descriptors evaluated, except for cashew aroma. The commercial clones CCP 76 and Embrapa 51 presented strong cashew aroma and flavor. Peduncles of CCP 76 (quality reference) showed the highest intensity for descriptors softness and juiciness, and presented low intensity for astringency and their subqualities, which are mouth harshness and throat irritation. Different results were obtained for commercial clone Embrapa 51, which presented lower intensity for descriptors softness and juiciness, and high intensity for astringency and their subqualities.

Clone PRO 555/2 presented very similar profile to quality reference clone CCP 76, not differing significantly from it regarding all descriptors analyzed. Clone SLC 12-20 presented high intensity for acidic taste and astringency, and their subqualities, showing more similarity to the commercial clone Embrapa 51. The same happened to

Table 2 - Mean intensity values of the sensory descriptors evaluated in the peduncles of cashew tree clones harvested in Pacajus-CE during harvest 2018 (3 batches)

Descriptors	Clones						
	CCP 76	EMB 51	SLC 12-20	HAC 276/1	CAPI 17	PRO 555/2	PRO 805/4
Cashew aroma	6.89 a	6.90 a	6.99 a	6.84 a	6.90 a	6.98 a	6.40 a
Sweet aroma	4.78 ab	4.32 ab	5.13 a	4.19 ab	4.33 ab	4.52 ab	3.69 b
Sulfurous aroma	2.14 ab	1.53 b	1.55 b	1.69 ab	1.90 ab	1.76 ab	2.39 a
Cashew flavor	6.49 a	6.33 a	6.91 a	6.41 a	6.16 a	6.05 a	4.96 b
Sweet taste	6.01 a	4.88 abc	4.73 bcd	3.61 d	3.97 cd	5.80 ab	2.23 e
Acidic taste	3.02 b	3.95 ab	4.64 a	4.44 a	4.81 a	3.02 b	4.98 a
Softness	6.99 a	5.85 b	5.77 b	5.76 b	4.73 c	6.20 ab	4.04 c
Juiciness	7.10 a	6.06 bc	6.09 bc	6.28 ab	5.13 cd	6.68 ab	4.71 d
Fibrosity	4.88 b	4.97 b	4.71 b	5.02 b	6.33 a	4.45 b	6.18 a
Astringency	3.62 c	5.20 a	5.36 a	6.09 a	5.03 ab	3.83 bc	5.37 a
Mouth harshness	3.67 c	5.12 ab	5.44 a	5.78 a	4.72 abc	3.85 bc	5.18 ab
Throat irritation	3.49 bc	3.92 abc	5.07 a	4.74 ab	4.05 abc	2.79 c	4.10 ab

Means with the same letter on the same line do not differ significantly from one another ($p > 0.05$)

Figure 4 - Sensory profile of peduncles of cashew tree clones harvested in Pacajus-CE during harvest season 2018

clone HAC 276/1, which was significantly similar to 'SLC 12-20' and, consequently, to 'Embrapa 51'. Peduncles of clones SLC 12-20 and HAC 276/1 presented lower intensity for sweet taste than the commercial clones.

The peduncles of clone CAPI 17 presented high intensity for the descriptors acidic taste, astringency, and their subqualities, with characteristics that are closer to 'Embrapa 51.' However, these two clones showed differences from one another when the other descriptors were analyzed. 'CAPI 17' was the most fibrous peduncle, with a mean of 6.33 in the 9-cm scale, and presented sweet

taste, softness, and juiciness with less intensity than the commercial clones. 'PRO 805/4' was the only clone with descriptor cashew flavor significantly lower than the other clones. It was also the clone with the least intense sweet taste, also presenting low intensities for softness and juiciness.

Figure 5 presents the Hierarchical Cluster Analysis based on the dissimilarity among sensory profiles of the cashew peduncles, and Figure 6 shows a graphic representation of the Principal Component Analysis of the same data. In both analyses there was the approximation of clones with similar characteristics, which formed three distinct clusters. Cluster 1 was formed by clones PRO 555/2 and CCP 76, which were very similar to one another (node 0.058). Cluster 2 (node 0.193) included clones PRO 805/4 and CAPI 17; and Cluster 3 (node 0.296) was represented by clones Embrapa 51, SLC 12-20, and HAC 276/1.

Principal components F1 and F2 (Figure 6) accounted for 87.39% of the variation among samples, whereas component F1 alone accounted for 60% of this variation. Clones PRO 555/2 and CCP 76 (Cluster 1), placed on the positive side of F1, were characterized for their high intensity of descriptors cashew flavor, cashew aroma, sweet aroma, softness, juiciness, and sweet taste; and low intensity for descriptors throat irritation, harshness, astringency, acidic taste, fibrosity, and sulfurous aroma. Cluster 2, represented by clones CAPI 17 and PRO 805/4, placed on the left side of the chart (negative F1), presented a sensory characteristic profile opposite to Cluster 1, with the clones being acidic, astringent, fibrous, and with low intensity for descriptors sweet taste, softness and juiciness.

Figure 5 - Cluster Analysis based on the sensory profile dissimilarities of peduncles of cashew tree clones harvested in Pacajus-CE during harvest season 2018

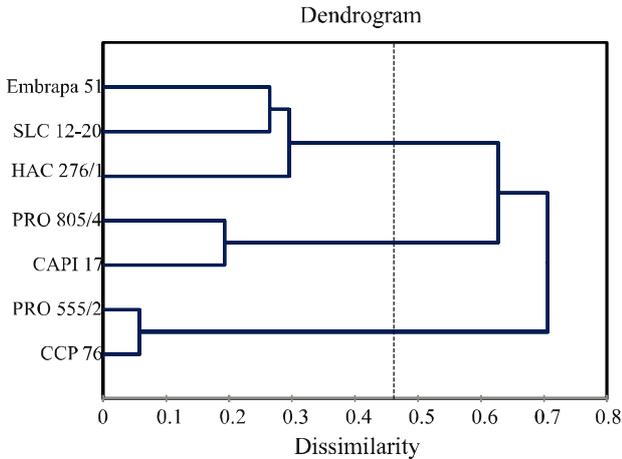
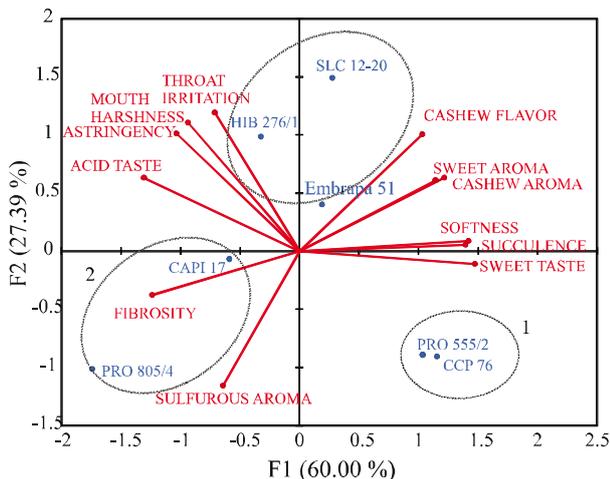


Figure 6 - Principal Component Analysis of descriptors generated for cashew clones



Cluster 3, formed by clones Embrapa 51, SLC 12-20, and HAC 276/1, stood out for high intensities of acidic taste and astringency, and their subqualities, being the clones with the highest means for these parameters (Table 2), although they did not differ statistically among one another. Samples were also separated in F2 as to astringency, being 'SLC 12-20' and 'PRO 805/4' the clones with the highest intensity for this descriptor. Samples placed at the bottom of the chart, which are 'CCP 76' and 'PRO 555/2', were less astringent.

The sensory attributes were correlated to significance level $\alpha = 0.05$. It was observed that softness and juiciness are variables directly correlated to each other ($r = 0.99$). It was also observed that there is a positive

correlation of cashew aroma to sweet aroma ($r = 0.80$), cashew flavor ($r = 0.88$), and sweet taste ($r = 0.80$). Consequently, the aroma of the fruit is also perceived as sweet and it is responsible for its characteristic flavor. The correlation of these descriptors to sweetness indicates that peduncles with higher intensity of characteristic aroma and flavor are also the sweetest. The descriptors sweet taste and the acidic taste presented negative correlations between one another ($r = -0.87$), which were already expected, given that sweeter fruits are generally less acid.

The descriptor sulfurous aroma showed negative correlation to cashew aroma ($r = -0.771$). Acidic taste had negative correlations to softness ($r = -0.850$), juiciness ($r = -0.863$), and sweet taste ($r = -0.870$), which characterized the softer and juicier fruits as the least acid fruits as well. The descriptors astringency, harshness, and throat irritation were positively correlated to one another and to acidic taste.

In view of the comparative analysis of results, it can be observed that clones CCP 76 and PRO 555/2 presented high intensity for sweet taste and lower values for astringency and its subqualities. Clone PRO 805/4 presented low intensity for cashew flavor, sweet taste, softness, and juiciness, and, on the other hand, high intensity for sulfurous aroma, acidic taste, fibrosity, astringency, and their subqualities.

A positive correlation ($\alpha = 0.05$) of cashew aroma and cashew flavor to the soluble solid content was observed. There was also a negative correlation of the descriptor sulfurous aroma to this parameter. This correlation might have occurred due to the fact that SS content measures not only carbohydrates, the principal components, but also the fruit's organic acids, proteins, fats, and minerals, which are essential in the formation and composition of the characteristic aroma and flavor. As expected, the descriptor acidic taste had a positive correlation to titrable acidity and a negative correlation to ratio, for once acidity reaches low levels, the perception of the acidic taste also diminishes and the fruit's sweetness intensifies. The polyphenol and vitamin C parameters correlated to no sensory descriptors.

CONCLUSIONS

1. The cashew tree clone PRO 555/2 presented peduncles with chemical and sensory characteristics similar to the reference commercial clone CCP 76, with low titrable acidity and high ratio, sweet taste, and characteristic cashew flavor and aroma, besides being soft and juicy, and commercially suitable for table consumption;

2. Peduncles of clones SLC 12-20, CAPI 17, and PRO 805/4 have more intense acidic taste, astringency, mouth harshness, and throat irritation; they also presented higher indexes of acidity and polyphenol content. Clone HAC 276/1 has high astringency and its subqualities. Peduncles with these characteristics are not indicated for fresh fruit consumption but can be used in the juice industry.

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