PHYSICAL-CHEMICAL CHARACTERIZATION OF ATEMÓIA FRUIT IN DIFFERENT MATURATION STAGES.

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ABSTRACT - In sight of scarcity of references and information on the atemóia, this work considered to evaluate some chemical and physical analyses in intention to characterize two maturation stages. The used fruits in the experiment had been gotten in the Agropólo Mossoró-Assú, in the state of the Great River of the North. For this, the following analyses had been carried through: length and diameter of the fruit, total firmness of the pulp, soluble solids, pH, titulável total acidity and vitamin level C total. Differences between stadiums of maturation with degradation of the cellular components and the reserves of the fruits had been observed, thus reducing the firmness of the pulp and liberating simple sugars, respectively. It occurred increment in the acidity and consequence decrease in the value of pH. The vitamin C level didn't suffer significant alterations between such stages.

KEYSWORDS: *Annona cherimola* Mill. X *Annona squamosa* L., physiologic ripeness, chemical and physical characterization.

CARACTERIZAÇÃO FISICA E QUIMICA DE ATEMÓIAS EM DIFERENTES ESTÁDIOS DE MATURAÇÃO

RESUMO - Devido à escassez de referências e informações sobre a atemóia, este trabalho se propôs avaliar algumas análises químicas e físicas no intuito de caracterizar dois estádios de maturação. Os frutos usados no experimento foram obtidos no Agropólo Mossoró-Assú, no estado do Rio Grande do Norte. Para isso, foram realizadas as seguintes análises: comprimento e diâmetro do fruto, firmeza da polpa, sólidos solúveis totais, pH, acidez total titulável e nível de vitamina C total. Observaram-se diferenças entre os estádios de maturação com degradação dos componentes celulares e das reservas dos frutos, reduzindo assim a firmeza da polpa e disponibilizando carboidratos simples, respectivamente. Ocorreu incremento na acidez e conseqüente decréscimo no valor do pH. O teor de vitamina C não sofreu alterações significativas entre tais estádios.

Palavras-Chave: *Annona cherimola* Mill. X *Annona squamosa* L, maturidade fisiológica, caracterização química e física.

INTRODUCTION

The Annonaceae are comprised of a great number of genus and species, the majority native to tropical or subtropical regions. Many species show interest as commercial fruiting, mainly grown in several countries. In Brazil, the interest in the production of these fruits, mainly sugar-apple and atemoia fruit, is increasing. (DONADIO, 1997).

The atemoia fruit, originated from Antilles and belonging to Annonaceae family, is a hybrid of the cherimoya (*Annona cherimola* Mill.) with the sugar-apple (*Annona squamosa* L.), obtained in the beginning of the century by crossing.

This hybrid has received special attention by the producers because it has some good characteristics of the cherimoya associated to others of the sugar-apple, with qualities even better as it presents smaller number of seeds, better conservation after harvest, absence of cracking and resistance to weeds and to biological control. It has high content of sugar and proteins, potassium and vitamin C, being easily digested (SIQUEIRA, 2002). The fruit can also be consumed as pulp, liqueur, ice cream, juice, sweet and fruit in syrup (Frutas, 2002).

With aspect similar to the sugar-apple, the sugar content is approximately 20 to 25°Brix, when ripe. The fruit harvest in suitable stages of maturation is determining in the quality after-harvest. Fruits picked prematurely do not present the skill to develop the complete ripening, thus damaging the final quality (Chitarra e Chitarra, 1990).

Picking the fruit during the physiological maturity, the respiratory activity increases on the first two days, from which the synthesis of ethylene is provoked (BRUINSMA & PAULL, 1984). Changes in the colour, texture, flavour and aroma of most of the fruits during the ripening are associated to the climacteric (BIALE & BARCUS, 1970), and some are dependent of ethylene (AYUB et al., 1996). Bruinsma & Paull (1984) e Worrell et al. recorded changes in the development of flavour, in the darkening of the peel and in the softening of the pulp during the self-catalytic production of ethylene.

Because it is a climacteric fruit, the changes that cause the firmness loss and the fruit darkening are due to the rapid rise on the rate of ethylene biosynthesis in the beginning of the process of maturation (MARTINEZ et al., 1993). The increase in the respiratory activities in the Annonaceae is followed by the fast modification on the chemical composition, making the flavour and aroma very enjoyable; in the other hand, there is a very fast decrease in the pulp firmness (ALVES et al., 1997).

Having in mind the scarce information in the literature about the atemoia fruit, this work had as purpose the evaluation of some chemical and physical analysis in order to characterize the initial and final maturation stages.

MATERIALS AND METHODS

The atemoia fruits were randomly picked, originating from a commercial planting of Irrigated Perimeter of Baixo-Açu, during the harvest from November/2005. The fruits were picked according to their maturation stage. Afterwards the same fruits were carried to the Laboratory of Irrigated Agriculture of the Federal Rural University of Semi-Arid – UFERSA, where the analysis have been carried out.

The fruits evaluation has been done immediately after the sample collection. The characteristics analysed were: diameter and length (cm): pulp firmness, measured by the resistance to penetration using a penetrating device (Mc Cormick model FT 327; maximum value of reading 30 Ib/pol2), in equatorial regions (three determinations/ fruit) of the fruit surface free of peel. The results were converted in Newton (N). The content of soluble solid has been determined in the juice by a digital refractometer model PR-100 Palette (Attago Co. Ltd, Japan), the results being expressed in percentage (%); total titratable acidity, by means of titration of 5 ml of filtered, adding 45 ml of distilled water and 2 drops of phenolphthalein with sodium hydroxide in 0,1 N. The results were expressed in percentage (%) of citric acid; pH and vitamin C by the method 43.064 described by A.O.A.C (1992) and expressed in mg/100mL.

It was used experimental outline entirely randomized with three repetitions and parts constituted of 3 fruits, being two treatments, which comprised of different maturation stages (green-ripened and completely ripened).

The results were subjected to variance analysis and the average values were compared by the Tukey test, to the level of 5% probability. The analysis were carried out by the computational software Sistema para Análise de Variância - SISVAR (FERREIRA, 2000).

RESULTS AND DISCUSSION

It has been observed differences in the variables analysed in different maturation stages of atemoia fruit (Table 1).

The increase in firmness during the fruits development is associated to enzymes action that causes the adhesion of pectic substances of cell wall during the expansion of tissues, according to Stolle-Smits et al. (1999).

It has been observed a reduction in fruits length and diameter between the maturation stages, what can be related to degradation of cell constituents and their stocks, causing, consequently, reduction of pulp firmness and increase in the soluble solids content, respectively.

It may be noted that during the ripening of atemoia fruit the firmness of pulp was sharply reduced. Lima et al. (2003) observed that in the physiological maturity of the soursop the firmness was near 60N, but in the ripe fruit this value was only 0.9 N. The loss of firmness is due to degradation of pectic substances from the cell wall of the fruit by the action of pectinases, while the increase of the content of soluble solids is due to degradation and availability of simple carbohydrates to the cellular catabolism and production of energy.

The explanation for the decrease in firmness, according to Kays (1991) and Awad (1993), is associated to chemical and biochemical reactions that occur during the maturation of fruits where takes place synthesis and activation of hydrolytic enzymes that act in the depolymerization of pectic substances that confer rigidity to the cell wall of the fruits.

The ATT has increased during the period, from 0,48 to 1,00% citric acid. Other studies has already highlighted this accumulation in ATT, atypical for most fruits (WILLS et al., 1998), but typical of some Annonaceae

(PAULL, 1982; BRUINSMA & PAULL, 1984; AZIZ & YUSOF, 1994; MUÑOZ et al., 1997. According to Ramos, the soursop 'Morada' has a sub acid to acid flavour, while other types can vary from sub acid to sweet.

Tabela 1 – Average values obtained from the variables analysed in different maturation stages of atemoia (*Annona cherimola* Mill. x *Annona squamosa* L.).

MATURATION STAGE	CF	DF	FIRM	PH	SST	ATT	VITC
1	108,55 A	92,00 A	66,70 A	6,20 A	5,23 B	0,48 B	19,71 A
2	87,33 B	80,78 B	17,16 B	5,23 B	23,40 A	1,00 A	15,84 A

- CF – fruit length; DF- fruit diameter; FIRM – pulp firmness; SST – total soluble solids; ATT – total titratable acidity; VITC – total vitamin C.
- 1 – Maturation stage green-ripened (Initial); 2 – Completely ripened fruit (Final).
- Values with the same letter in the same column do not present significance in the level of 5% probability.

According to Chitarra & Chitarra (2005), the acidity of fruits, usually tends to decrease because of using organic acids in the respiratory activity, which is intense as the growth and the ripening of the fruit proceed.

Regarding the content of TSS, it has been observed a large increase between the two stages of atemoia fruit harvesting. The enhancement between the two stages was 18.17 ° Brix. Neves (2003) noted that for the variety of atemoia fruit 'African Pride' the soluble solids content was 16.4 ° Brix and for the variety 'Thompson' 26.1 ° Brix.

Despite the reduction in the total content of vitamin C in atemoia, the differences observed in the various stages of maturation showed no significant difference in the statistical point of view. The values obtained in this work are higher than those obtained by Castro et al. (1984), which were 10.59 mg/100g of vitamin C for soursop.

CONCLUSION

It can be concluded that between the initial and the final stage of maturation of the fruits, different chemical reactions occur, causing alterations in the cell structures and degradation of fruits energy stocks, what characterizes the differences observed in the variables analysed.

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