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Updating the Economic Profile of Açaí (*Euterpe precatoria* Mart. and *E. oleraceae*) Fruit in the states of Amazonas and Pará

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Abstract **-** *This study aimed to updatethe açaí (E. precatoria Mart.and E. Oleraceae) fruit economic profile using secondary data. According with secondary data analyzed, Brazilian total production(1,621,034 tons in 2019) and production value (R$ 3,615,468.00 in 2019) have been growing steadily with upward trend in the last years, pushing prices to rise. Cultivated açaí has been consolidated as the major productive system in Amazonas, with 60.7% of total state production, according to IBGE. Fruit origin has also been changing more recently, with Amazonas state remaining in second position with 111,612 tons and R$ 195,924.00 worth production in 2019, sharing 20.9% of Brazilian extractive açaí production.*

I. INTRODUCTION

The Amazon and its rich biodiversity hold an enormous potential in developing a variety of products of singular nature, which are under increasing demand both in the national and international markets (Bayma, Wadt, Sá, Balzon, & Sousa, 2008; Nogueira, De Santana, & Garcia, 2013). In this scenario, the palm trees of the *Euterpe* genus attract attention. The species *E. precatoria* (Mart.) and *E. oleraceae* (Mart.) are, in particular, considered the most important of the genus due to the great commercial use of the fruit for açaí pulp production. Although *E. oleracea* dominates much of this market, the Central and Western Amazonia are home to a high density of *E. precatoria*, from which the fruit properties have aroused great interest from different industry segments (Costa, Garcia-Diaz, Jimenez, & Silva, 2013; Yamaguchi, Pereira, Lamarão, Lima, & Da Veiga-Junior, 2015).

It is known that açaí has been undergoing structural changes in production and marketing system as well as in the consumption pattern. In this sense, the lack of information systematization and quality standards can lead to consumers being mistakenly purchasing certain products found on the market (Bezerra, Freitas-Silva, & Damasceno, 2016). Therefore, it is necessary to seek for quality standardization that can meet market specifications and requirements, ensuring the public health of final consumers.

Researches on the economic activityof *E. precatoria*fruit commercialized in the state of Amazonas remain restricted.Thus, this study aims to analyze the açaí fruit production and update market profile for later suggestion on strategies and plans for improvements in the production chain of *E. precatoria*.

II. BIBLIOGRAPHICAL REVIEW

2.1 Genus and species description

The *Euterpe* genus (*Arecaceae*) is composed of native tropical palm species abundantly distributed in South and Central America (Andrew Henderson & Galeano, 1996; L.

C. Oliveira, De Oliveira, Davide, & Torres, 2016). There are two predominant species that are commercially used for fruit production and found widely dispersed in the Amazon: *Euterpe precatoria* (Mart.) and *Euterpe oleracea* (Mart.) (Bussmann & Zambrana, 2012; Blair e Matos et al., 2017; A. O. Silva et al., 2020; Ter Steege et al., 2013; Zambrana et al., 2007).

As it is popularly known, Açaí solteiro, Açaí de terra-firme or Açaí-do-Amazonas, *E. precatoria* is a solitary, single-stemmed, monocaule palm that can reach about 20 m in height and 25 cm in diameter (Avalos & Schneider, 2011). It is considered a hyperdominant species, the most abundant palm tree in the Amazon (Ter Steege et al., 2013). It can be found widely distributed across Central America and northern South America, especially in Central and Western Amazonia (Bovi, Castro, Clay& Clement, 1993; A Henderson, 1995). In Brazil, it occurs in the federal states of Amazonas, Acre, Rondônia and Roraima (Ferreira, 2005), growing naturally on terra-firme (upland areas), in non-floodable areas, as well as on river banks, várzeas (lowland areas), alongside streams, lakes and high floodplains, with higher density in low floodplains when compared to plateaus.

The spherical fruits measure from 1.0 to 1.3 cm in diameter, of violet black colour with a fine white layer when ripe (Gordon et al., 2012), presenting considerable variation in size and weight between plants of the same origin, given the species plasticity. Each fruit contains a single globose seed, with a solid endosperm (Ferreira, 2005; A Henderson, 1995).

2.2 Usage and applications

There are several possibilities for using and taking advantage of all parts of açaí palm trees (Bussmann & Zambrana, 2012; Nogueira, 1998; da Silva, Souza, & Berni, 2005). Most commercially important, the pulp represents about 15% of the fruit total weight (Pessoa, Arduin, Martins, & de Carvalho, 2010; Yuyama et al., 2011), from where the vinho – as the energetic açaí juice is known in the Amazon region – is produced. It is a food of singular importance for the development of the Amazon region and traditionally present in the diet of traditional local populations (Brokamp et al., 2011; Brum, 2019; Zambrana et al., 2007). It is also used in the manufacture of ice cream, liquor, jelly, nectar, gelatin, among others.

Industrially, it can be used for cosmetics production (Bravo et al., 2020; Funasaki, Barroso, Fernandes, & Menezes, 2016), as well as dye (Teixeira-Neto, Izumi, Temperini, Ferreira, & Constantino, 2012) and anthocyanin extraction. The latter stands out due to the high antioxidant activity as scientific research evidences its power to fight free radicals, decrease aging, increasing cell life, promoting blood circulation and protecting the body against accumulation of lipids in the arteries (Duarte-Almeida, Santos, Genovese, & Lajolo, 2006; Galotta, Boaventura, & Lima, 2008; Kang et al., 2012; Odendaal & Schauss, 2013; Schauss, Wu, Prior, Ou, Huang, et al., 2006). Also due to its ability to decrease the effect of Alzheimer's disease (Rogez, 2000).

Other parts of the plant are also useful: fibres are used in the manufacture of furniture, plywood, acoustic panels, tree fern, as well as in the automobile industry and others (Barbosa, Rebelo, Martorano, & Giacon, 2019; de Oliveira et al., 2019; Martins, Pessoa, Gonçalves, Souza, & Mattoso, 2008; Quirino, 2010; Wataya, Lima, Oliveira, & Moura, 2016); the heart of palm, obtained from the region close to the apical meristem, is consumed naturally, preserved, in the form of cream and others (Vallejo, Galeano, Valderrama, & Bernal, 2016); Leaves are used against muscle pain and snake bite; the leaf straw can be used to cover houses and walls (Galotta & Boaventura, 2005), in the manufacture of baskets, rugs, shakers and others; the seed can be used to produce seedlings, but it can also be used as raw material for making handicrafts and bio jewels, also as a fertilizer, or even in the preparation of oil, popularly used as an anti-diarrheal (Schauss, Wu, Prior, Ou, Patel, et al., 2006a); from the trunk it is possible to obtain slats and rafters for rural buildings, in addition to firewood and cellulose; the roots are used as dewormer. For instance, (Macía et al., 2011). bring together these mentioned studies and others that describe 89 different uses for *E. precatoria* in Brazil, Colombia, Ecuador and Peru.

2.3 Fruit production and market

Due to the evident nutritional value, the commercialization of açaí fruit has been one of the main potentialities for the management of non-timber forest products (NTFPs). Under increasing demand (Bayma et al., 2008. Nogueira et al., 2013; Pagliarussi, 2010), açaí became the most collected NTFP of extractive origin in Brazil, with the highest revenue in the Brazilian Amazon, reaching a production of over 220,000 tons (IBGE, 2019). This new market dynamic has been characterized by a demand greater than supply Nogueira et al., 2013; Santana, 2004), which pressures prices to raise, especially with the increase in exports (Binois & Reis, 2012; Dos Santos Bentes, Oyama, & Nunes dos Santos, 2017; Tavares & Homma, 2015) for international consumer markets, such as NAFTA, European Union, Asian Tigers and MERCOSUR (D'Arace et al., 2019; Nogueira et al., 2013). As *E. precatoria* occurs in the off-season of *E. oleraceae*, the management of *E. precatoria* could contribute to the permanence of the supply and consequently reduce the

variation in prices throughout the year (Blair e Matos et al., 2017).

To guarantee the supply of the domestic and foreign markets, with the perspective of developing socioeconomic and environmentally sustainable activities, the extractive management of açaí in native forests presents itself as a potential alternative for valuing standing forests and maintain their ecosystem services provider capability. However, while two decades ago the production of açaí was almost entirely from the extractive sector, currently the increase in production is mainly due to the establishment of rational plantations, with or without the presence of irrigation (Nogueira & Santana, 2009; Nogueira et al., 2013). Traditionally, *E. oleraceae* occurs in flooded areas and alongside floodplains. Despite that, the Brazilian Agricultural Research Corporation (Embrapa)breeding program developed the cultivar "BRS Pará" which was launched in 2005 and "BRS Pai D'égua" in 2019. These cultivars are grown on dry land with using irrigation system. As a result of this, production was mechanized and made more productive when compared to the traditional way (Rufino et al., 2010). Since the market has been growing fast and steadily, the use of domestication technologies may become inevitable (Homma, 2012; Kingo et al., 2006).

III. STUDY DELIMITATION

3.1 Economic profile analysis

Gathering secondary data, it was possible to trace the açaí fruit apparent production and market profile, structure and its general characteristics.

The updating of the economic profile of açaí production follows the economic analysis framework proposed by Blair & Matos (2017), who used, for the first time, as a econometric analysis, the parallel between the two açaí species (*E. precatoria* and *E. oleracea*), for two production systems (cultivation and extractivism) and between two Brazilian states (Amazonas and Pará), evidencing the commercial dynamics of national fruit production.

Was based on secondary data, from to the following official agencies: Brazilian Institute of Geography and Statistics (IBGE); National Supply Company (CONAB); Agricultural and Sustainable Forest Institute (IDAM); Brazilian Agricultural Research Corporation (Embrapa); and others studies, from which the variables analyzed were the amount produced, production value and price per amount produced, using the historical data series available.

IV. RESULTS AND DISCUSSION

4.1 Economic profile results

The economic data accessed allowed a better understating of behaviour and trends regarding production, in terms of amount, value, prices and origin in Brazil and its federal estates. Fig. 1 shows extractive production historicalseries in Brazil from 1994 to 2019. An upward and mostly steady growth is notice when analysing the entire series. The amount produced has become slightly more two times the initial records, reaching 222,706 tons (IBGE, 2020). Production value have also been increasing, especially after a boom in 2011 followed by a strong growth until 2018. Prices were also forced to grow given that scenario.

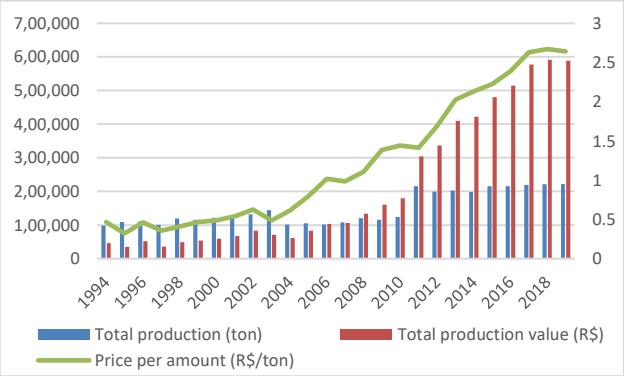

Fig.1 – Extractive production in Brazil from 1994 to 2019.

According to CONAB (2019), açaí prices have risen 308% between 2006 and 2014. In addition, the amount produced grew 95% in the same period and other 11% from 2015 to 2017. Those are clear indicators that demand for açaí is greater than supply. This great demand even stimulates traders to seek the product from increasingly distant regions, as well as promotes the açaí cultivation.

In Brazil, Pará State has always been the largest producer of açaí in Brazil as well as the largest exporter. Until 1990, Pará accounted for 95% of Brazilian extractive production(CONAB, 2019). However, in 2013, this share dropped to 54.9%(Blair e Matos et al., 2017). This switch happened due to development of açaí activity in other Brazilian states, such as Amazonas and Maranhão, since açaí has become a promising business opportunity and given the local and global demand(CONAB, 2019). Fig. 2shows the current açaí extractive production by states, with Amazonas in second place sharing 20% of Brazilian extractive production(IBGE, 2020).

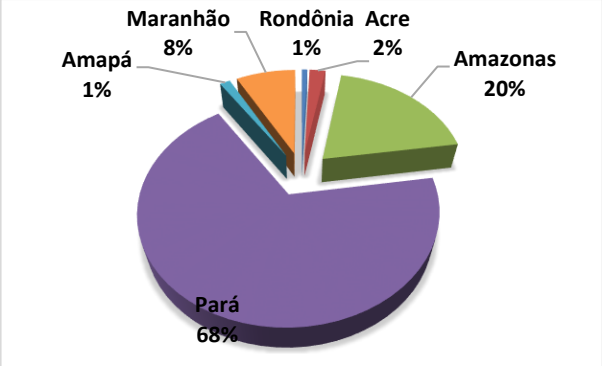

Fig. 2 – Percentage of extractive production of açaí by Brazilian states.

A study (Marinho, Paula, Miranda, & Barbosa, 2013) comparing the extractive amount produced between 2006 and 2011, observed that Amazonas occupied the third place in the national production in 2006. In 2011, Amazonas moved to second place, the position it remains nowadays. Pará is the largest producer with 151,793 tons, followed by Amazonas with 43,855 tons, as can be seen on Fig. 3 (IBGE – SIDRA, 2020).

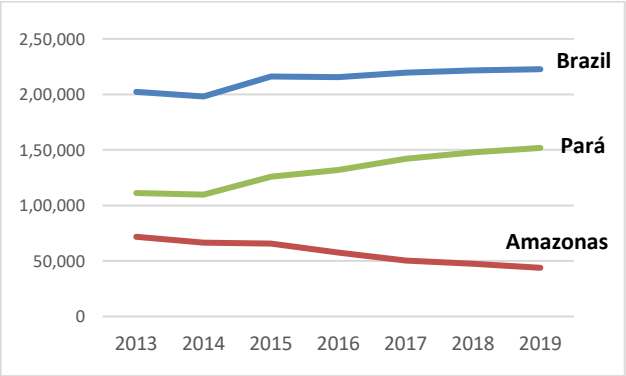

Fig. 3 – Extractive production in Brazil and the federal states of Amazonas and Pará.

(Blair e Matos et al., 2017) observed that Amazonas açaí extractive production accounted for 71,783 tons back in 2013. That represents nearly 40% drop in production and may suggest a change in the production system.

Açaí production does not only come from extractivism but also from cultivation, which for the Brazilian Institute of Geography and Statistics (IBGE) data accounts for plantations and native açaí managed areas. For instance, cultivated açaí showed a 32% increase in production from 2015 to 2017 (Fig. 4). Total cultivated production value oscillated and accounted for R$ 3,026,873.00 and price per amount remained stable and over R$.kg^{-1} 2.00 after 2018 (IBGE, 2020a).

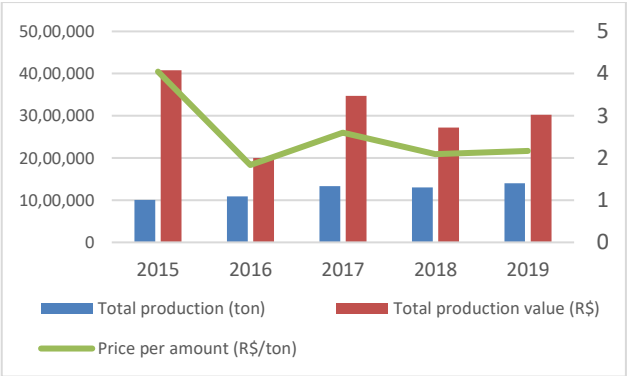

Fig. 4 – Cultivated production of açaí in Brazil.

Overall, the data points towards a more accentuated growth in cultivated production, which reflects a greater influence of management and agricultural practices more recently adopted for açaí. Such growth also shows a tendency to commoditize the fruit, with prices being the only competitive differential in the market (CONAB, 2019c).

The figure below (Fig. 5) shows the variation in production growth from both extractivism and cultivation by Brazilian states Amazonas and Pará from 2016 to 2019. Amazonas remained slowly growing throughout the analysed period, with excepting 2018 after dropping 3%. While in 2017 Amazonas showed an increase by 17% in production, Pará surpassed it with much greater 54% growth, followed by a severe fall in 2018 accounting for only 6% growth(IBGE, 2020; 2020a).

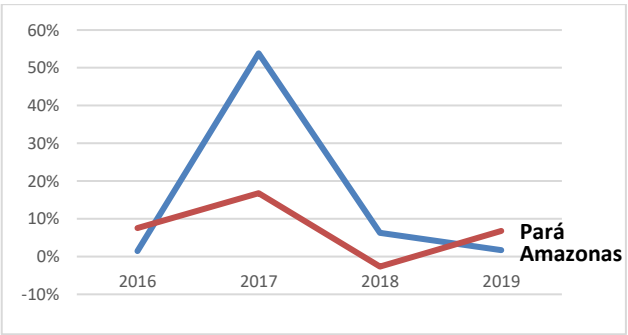

Fig. 5 – Rate of total açaí production growth by Brazilian States Amazonas and Pará.

According to CONAB (2020), the later consecutive increases in the production of açaí are result of the intensification in cultivated areas, and also in the growth of productivity which is also consequence of the continuous improvement of management techniques. And the recent stabilization in the escalation of açaí production is likely to be reflection of the growing popularization of the fruit consumption and the consequent increase in confidence of

investors involved in the açaí production chain (CONAB, 2019b).

The Fig. 6 presents the effective participation of extractive and cultivated açaí production both in Pará and Amazonas states. It is clear the difference in as Pará already accounts roughly 90% of its production by cultivated açaí. Meanwhile, in Amazonas cultivated açaí accounts for only about 60% of production, with planting both species *E. oleracea* and *E. precatoria* (IBGE, 2020; 2020a).

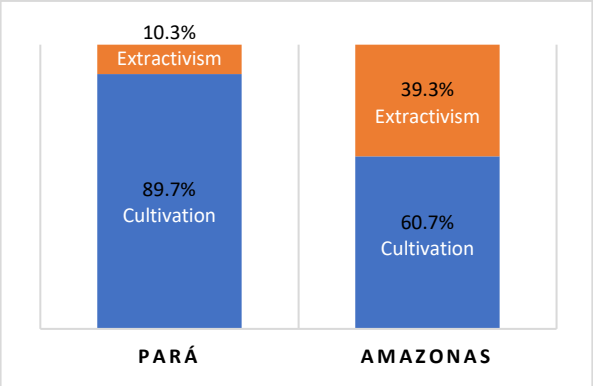

Fig. 6 – Extractive and cultivated açaí effective participation in production in 2019.

The proportion of cultivated açaí fruit in comparison to extractive have been increasing systematically in recent years. According to CONAB (2019a), the percentage of participation between extractive and cultivated açaí in the main producing states in 2017 was 14.2% to 85.8%. As a consequence of increasing production of cultivated açaí, it is the entry into the açaí market of states that did not used to have native açaí areas and did not even have a tradition in the consumption of the fruit, such as Bahia and Espírito Santo states (CONAB, 2019a). That may relativize the meaning of sustainable and social character in açaí production, which is even considered a marketing factor for the fruit, since it relates to the preservation of native açaí areas, the native Amazonian forests and the generation of income for the local traditional families.

Evaluating the production of açaí for the State of Amazonas (Table 1), it is possible to conclude that total açaí production in the state represents 6.9% of total Brazilian production, with extractive production standing for as little as 2.7%, with 43,855 tons, and cultivated production participating with 4.2% corresponding to 67,757 tons. Pará remains by far with the first place with its altogether production reaching 90.8% of total Brazilian production, with 1,471,943 tons.

Table 1 - Total production (ton) in Brazil and the states of Amazonas and Pará in 2019 (IBGE, 2020; 2020a).

	Total	Cultivated	Extractivism
Pará	1,471,943	1,320,150	151,793
Amazonas	111,612	67,757	43,855
Brazil	1,621,034	1,398,328	222,706

Similarly, as can be seen on Table 2 açaí production value in the Amazonas state represents 5.4% of total Brazilian production value, with R$ 195,924.00, from which extractive production stands for 2.1%, and cultivated production participates with 3.3%. Pará state with its altogether production reaches 92.5% of total Brazilian production value, with R$ 3,345,655.00.

Table 2 - Total production value (R$) in Brazil and the states of Amazonas and Pará in 2019(IBGE, 2020; 2020a).

	Total	Cultivated	Extractivism
Pará	3,345,655	2,880,211	465,444
Amazonas	195,924	120,381	75,543
Brazil	3,615,468	3,026,873	588,595

Açaí production in the state of Amazonas supplies the local market and industries, in addition to being exported to almost all Brazilian states, specially to Rio de Janeiro, São Paulo and Brasília, and also to European countries (Conab, 2020a).

Amazonas is one of the states where the lowest price paid to the producer is observed, which is certainly related to issues of cost and infrastructure, such as logistics and the large amount of transhipment operations between production and ports for product outflow (CONAB, 2019b). From the Amazonian cities that most produce açaí, Codajás, Borba, Coari, Itacoatiara, Anori and Manicoré, among others, can be highlighted (IDAM, 2020). They basically depend on the flooding of the rivers for their flow during the harvest period which is, depending on each region, from January until August.

Prices in the state of Amazonas, have been backed by the Minimum Price Guarantee Policy for Socio-biodiversity Products (PGPM-Bio), with occasional light highs. Therefore, the state does not follow the price increase trends observed in other producing regions, since the high cost of transportation by navigation is passed on indirectly to the producer (CONAB, 2019b). Minimum price in 2019 harvest was set to R$ 1.63/Kg, as published by Ordinance MAPA No. 141 of January 08, 2019.

According to the Agricultural and Sustainable Forest Institute(IDAM, 2020), the açaí activity in Amazonas state is practiced by family farmers and rural producers, with the registration of some business cultivation in some cities that has intensified in recent years, usually for self-supplying of pulp agro-industries. The production of açaí fruit is commonly benefited and/or processed in the producing municipalities themselves, in the 21 registered pulp agro-industries or in so called "artisanal beaters", which sell most of the production to Manaus and other regions of the country. The supply of the local population is usually carried out by artisanal 'beaters'. In Adolfo Lisboa market, prices for 50 Kg bags of açaí are sold from R$ 100,00 up to 400,00, depending on each producing region harvest season time, as well as, in terms of quality, the fruits characteristics such as size, freshness, maturity and others.

Prices per litre for the fresh açaí pulps collected on this study for sampling purposes ranged between R$ 8,00 (thin) to R$ 14,00 (thick). Back in 2014, a study held in Manaus(Silva, Chaar, Roberto, & Nascimento, 2014), observed 24 micro and small businesses with relevant and distinct roles in industry sectors, and accounted for 263±141producers and prices practised on fresh açaí pulp sales per litre was R$ 5,00±0.88. Average profits were presumed to be as little as 10% to 15% considering all costs involved in commercialization, not being a market-based trade. As a result, it was pointed that açaí pulp quality was low as there were not legal and sanitary barriers that producers would face to get in and out of market.

V. CONCLUSION

The updated analysis of the economic profile evidenced the transformation in which açaí production and market patterns are changing throughout the last few years in Brazil and its main açaí producer federal states. Total amount produced and production value have been growing steadily with upward trend. Cultivated açaí has been consolidated as the major productive system in Amazonas state. The States of origin of fruits have also been changing more recently, with Amazonas remaining in second position. However, the use of secondary data should be considered as a limiting factor for analysis of this nature and extent.

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