DIAGNOSIS OF THE POTENTIAL GEOGRAPHICAL INDICATION OF CASTOR BEAN PRODUCED IN THE CENTRAL-NORTH REGION OF BAHIA

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Bruno Bahia Ribeiro[1], Joelson Costa Silva[2], Cleiton Braga Saldanha[3], Daliane Teixeira Silva[4] and Marcelo Santana Silva[5].

ABSTRACT

Brazil is the third largest producer of castor beans in the world, with a mild tropical climate that favors the cultivation of this plant of commercial and agricultural value. In this context, Bahia stands out as a national leader, responsible for 80% of Brazilian castor bean production, according to the Brazilian Agricultural Research Corporation (Embrapa). In view of this economic importance, initiatives have been discussed with Bahian stakeholders to establish a request for Geographical Indication (GI) for castor bean produced in the Center-North region of Bahia. This article aims to analyze the potential of castor bean from this region to obtain GI registration, through an exploratory study and application of the GI potential diagnosis methodology of the Brazilian Micro and Small Business Support Service (SEBRAE). Data and information were collected from local cooperatives, evaluating aspects that make the regional castor bean unique. The results of the survey indicated a high potential for GI recognition, which can strengthen the visibility of the region as a castor bean production hub, enhance local identity and boost sustainable development. GI registration would also bring direct benefits to producers, reinforcing the sense of belonging in communities and promoting rural tourism. In this way, the GI for castor beans from Bahia represents a strategy that adds value to the production chain and contributes to the economic and cultural growth of the region, benefiting the image of the product in the market and encouraging responsible agricultural practices.

Keywords: Castor bean. Geographical Indication. Central-North Region of Bahia.

[1] Student of Business Administration
Federal Institute of Bahia (IFBA)
Email: brunobahiacsb@gmail.com
ORCID: https://orcid.org/0009-0001-0740-1670
[2] Student of Business Administration
Federal Institute of Bahia (IFBA)
Email: jcsfariseu@gmail.com
ORCID: https://orcid.org/0009-0004-7737-0007
[3] Master in Intellectual Property and Technology Transfer for Innovation
Federal Institute of Bahia (IFBA)
Email: cleitonsaldanha@gmail.com
ORCID: https://orcid.org/0000-0003-4680-1199
LATTES: http://lattes.cnpq.br/0416866991307033
[4] Master in Intellectual Property and Technology Transfer for Innovation
State University of Santa Cruz (UESC)
Email: daliane.economia@gmail.com
ORCID: https://orcid.org/0000-0002-7162-3147
LATTES: http://lattes.cnpq.br/6079154064796347
[5] Doctor in Energy and Environment
Federal Institute of Bahia (IFBA)
Email: marcelosilva@ifba.edu.br
ORCID: https://orcid.org/0000-0002-6556-9041
LATTES: http://lattes.cnpq.br/4414535367915782

INTRODUCTION

The origin of castor bean (Ricinuscommunis L.) is not a consolidated position in the literature and researchers are divided in pointing its origin to Africa and Asia, mostly. Certainly, it is possible to say that its introduction in Brazil took place through enslaved peoples coming from Africa during Portuguese colonization. As it is a xerophilous and heliophilous plant, it found favorable conditions for survival and proliferation in the tropical country (EMBRAPA, 2022).

According to Embrapa data from 2022, Brazil ranks as the third largest producer of castor beans in the world, with its extremely specialized production in the Northeast region, especially in the semi-arid region. In this context, small family producers play a fundamental role, being the main responsible for the cultivation of castor beans. Bahia, a pioneer in the cultivation of this product, stands out as the largest producer in the country, accounting for about 80% of national production, according to data from Embrapa. The discoveries of castor bean go far beyond the production of biofuel, also covering its use in the cosmetics industry, in oil extraction and in the manufacture of superplastics, reinforcing its economic importance and its potential for innovation in different industrial sectors.

Various products, especially agri-food products, are often identified by the name of their origin, that is, by the geographical name of the country, region or locality where they are produced or manufactured. This practice highlights the strong connection between the product and the territory, conferring added value to its origin.

The Brazilian Patent and Trademark Office (BPTO) defines the Geographical Indication (GI) as an industrial property instrument that aims to identify the geographical origin of a product or service (INPI, 2021). According to Law 9.279 of 1996, GIs in Brazil are divided into two categories: Indication of Origin (IP) and Denomination of Origin (DO). An IP refers to a geographical name, such as that of a country, city, region, or locality, that has become known for the production or extraction of a particular product or service. On the other hand, the DO, in addition to designating the geographical origin, links the qualities or characteristics of the product or service to factors specific to each region, such as its climate, soil, and cultural traditions.

In this context, the central question of this study is: Do the municipalities of Irecê and Capernaum, located in the Microregion of Irecê, in Bahia, have the technical conditions to apply for the Geographical Indication (GI) seal for castor bean production in the region?

In the light of the methodology for identifying potential Geographical Indications (GI) established by SEBRAE, Law 9.279 of May 1996, and the Manual of Geographical Indications of the BPTO, this study aims to carry out a detailed diagnosis of the potential of

castor bean produced in the municipalities of Irecê and Capernaum, in Bahia, to obtain recognition as a Geographical Indication (GI).

The work is structured as follows: initially, the indicators of notoriety and potential of the castor bean crop will be presented, followed by the methodology used, results obtained, information on territoriality, production methods and the production chain. Aspects of governance, identity and sense of belonging, economic performance, and the characteristics that justify the need to protect the IG will also be addressed. Finally, the research data, a vision of the future for the region, an analysis of the results through radar charts with contributions from representatives of the producers, final considerations and references will be discussed.

THE NOTORIETY AND POTENTIAL OF PIONEERING CASTOR BEAN PRODUCTION IN NORTH-CENTRAL BAHIA

Bahia stands out as a pioneer in the production of castor bean in Brazil, consolidating itself as the main producer in the state, with a wide advantage over other producing regions. According to data from Embrapa, the state accounts for approximately 80% of the national production of castor beans. In the micro-region that covers the municipalities of Irecê and Capernaum, castor bean cultivation plays a significant role in local socioeconomic development, with family farming occupying a prominent position in the production processes. Specifically for small properties, it contributes considerably to the development of local communities.

The socioeconomic relevance of castor bean in the indicated municipalities is intensified by the involvement of a large contingent of farmers. In addition, castor bean production plays a strategic role in maintaining the workforce during the off-season of other crops, considering that the region is also an important producer of grains.

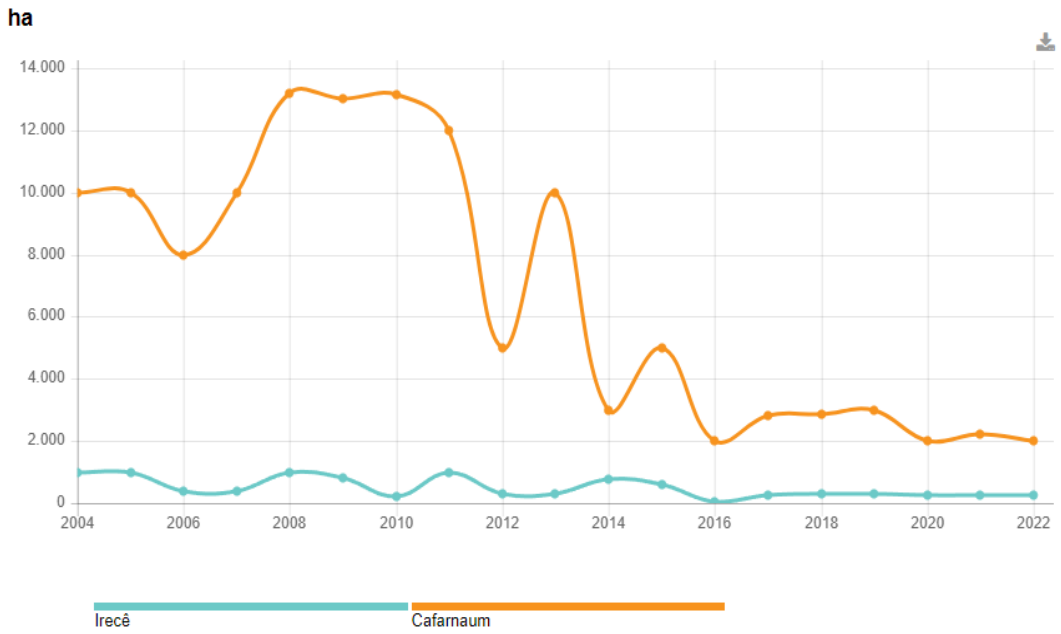
The castor bean crop has shown stability in terms of planted area, productivity, and recent production, as evidenced by Embrapa data (2022). In addition, the National Supply Company (Conab) estimated a 100% increase in productivity for the 2022/2023 harvest, driven by the expansion of cultivated areas. This advance was made possible, in large part, by the partnerships between producers and institutions that allocated resources and technologies for the development of the crop, further strengthening its importance for the regional economy.

When Figure 1 and 2 are presented, which illustrate the amount of castor bean produced in the municipalities of Irecê and Capernaum between 2004 and 2022 and the planted area, it is important to highlight that this crop has been resilient and fundamental for

the region's economy. Through a longitudinal analysis, the data provided by the Brazilian Institute of Geography and Statistics (IBGE) reveal the variations in the production of agricultural development over the years, reflecting not only the climatic and economic conditions of production, but also the local and national efforts to foster agricultural development in the Territory of Irecê. These numbers underline the relevance of castor bean as a key crop for the livelihood of families and the local economy, reinforcing its potential to claim the recognition of a Geographical Indication.

Figure 1 shows the castor bean production data in the region between 2004 and 2022.

Figure 1 - Quantity produced (Unit: t)



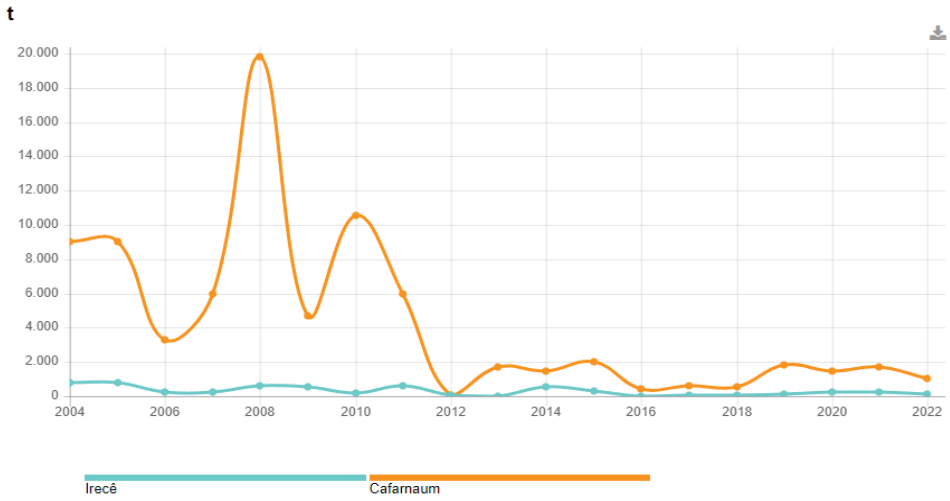
Source: IBGE, 2023

Castor bean has gained notoriety in the Brazilian scenario due to its potential as a raw material for the production of biofuels, especially biodiesel. According to Silva *et al*. (2010), castor bean cultivation stands out for its adaptability to the semi-arid conditions of the Northeast. Castor bean, in addition to being a resistant crop, requires low mechanization and intensively uses local labor, which generates significant employment and income opportunities for small producers.

Figure 2, which shows the castor bean planted area in hectares between the years 2004 and 2022, highlights the municipality of Capernaum, which reached its peak of cultivated area in 2008. Although it has experienced a reduction in the planted area after this period, Capernaum still remains ahead compared to the municipality of Irecê. Even with the oscillations in the extension of plantations over the years, Capernaum preserves its

leadership in terms of cultivated area, reflecting the importance of castor bean for the local economy and its resilience in the face of the challenges of the agricultural sector.

Figure 2 - Planted area (Unit: ha)



Source: IBGE, 2023

The production of castor bean in the micro-region of Irecê stands out not only for its expressive volume, but also for its fundamental role in the socioeconomic development of the region and its contribution to the state and national economy. This recognition is due to the long tradition and quality of production, as well as the active participation of small family producers who drive cultivation. The notoriety of local production, especially in the municipalities of Irecê and Capernaum, is extremely recognized by various sources and sectors. Chart 1 presents news and mentions that reinforce the importance and prestige of castor bean produced in the region, both in the regional and national scenarios.

Chart 1 - Notoriety of castor bean in the Central-North region of Bahia.

TITLE	YEAR/ SOURCE	ACCESS LINK
Agreement to increase castor bean production in Bahia will benefit more than a thousand families in the semi-arid region	2018 g1.globo.com/ba	https://g1.globo.com/ba/bahia/noticia/2018/11/14/convenio-para-aumentar-producao-de-mamona-na-bahia-vai-beneficiar-mais-de-mil-familias-da-regiao-semiarida.ghtml
Irecê has 87% of the area cultivated with castor beans in Bahia and production grows 100%	2023 Jornal da Chapada	https://jornaldachapada.com.br/2023/08/28/chapada-irece-tem-87-da-area-cultivada-com-mamona-na-bahia-e-producao-cresce-100/
Municipalities in the region of Irecê stand out in the production of castor beans in Bahia	2023 Caribbean FM	https://www.caraibasfm.com.br/2023/09/11/municipios-da-regiao-de-irece-se-destacam-na-producao-de-mamona-na-bahia

Irecê region is once again a highlight in castor bean production	2023 Leader News	https://lidernoticias.com/regiao-de-irece-volta-a-ser-destaque-na-producao-de-mamona/

Source: Authors (2024).

According to the articles highlighted in Chart 1, it can be seen that castor beans from the Central-North region of Bahia have gained notoriety at the national and regional levels. They are often highlighted in news reports and studies as a high-quality product, adapted to local climatic and geographical conditions. The importance of castor bean for the municipalities of Irecê and Capernaum is evidenced by strategic partnerships with institutions, as shown by the recent increase in productivity and cultivated area, as a result of investments in technology and agricultural innovation. This scenario highlights the potential of castor bean to obtain the recognition of a GI, adding value to local production and positioning the region as a reference in the castor bean production chain.

The present analysis, supported by solid data and a thorough survey of regional characteristics, reinforces the relevance of this article and the adequacy of the theoretical framework. The GI proposal for castor beans in the region not only aims to raise the prestige of the product, but also to promote a socioeconomic and cultural appreciation of the region. With the granting of the GI, it is expected to expand market opportunities for local producers, strengthen the sense of belonging in the communities and boost rural tourism, creating a strong and lasting identity around castor bean production in the Center-North of Bahia.

METHODOLOGY

The present work is an exploratory case study, through a qualitative-quantitative, bibliographic research, whose objective was to carry out an analysis on the production, commercialization and processing of castor bean produced in the municipalities of Irecê and Capernaum, Bahia, with the application of the methodology of Diagnosis of Potentiality of Sebrae for the identification of potential Brazilian Geographical Indications, which has 31 questions, 2 of which are critical, to evaluate the potential of PI and OD and 29 structural questions, divided into 9 criteria: a) product; b) territoriality; c) production method/production chain; d) governance; e) identity and sense of belonging; f) economic performance; g) need for protection; h) research involved; and i) vision of the future.

In this study, scientific articles, news from portals, theses, dissertations, consultations on official websites, such as the National Institute of Industrial Property (INPI), the Brazilian

Institute of Geography and Statistics (IBGE), the National Supply Company (Conab) and the Brazilian Agricultural Research Corporation (Embrapa) were used as research sources.

The information survey was carried out with two representative entities of the region where the producing municipalities are located, entities that have agricultural producers of different sizes as members. The application of the questions of the SEBRAE methodology took place through Google Forms and waived submission to the Research Ethics Committee, in accordance with article 1, sole paragraph, items II, III, V, IV and VII, of Resolution No. 510/2016, of the National Research Ethics Commission (CONEP) (BRASIL, 2016).

At the end of the study, the Radar Graph was presented, which is configured as the representation that allows the evaluation of the potential of a given region to obtain the registration of Geographical Indication, built from the analysis of criteria that impact the feasibility and potential of a GI, from the perception of representative entities of the producers of the region under study, through applied research between March 17 and 29, 2024.

RESULTS

The results of this study come from the application of Sebrae's Potential Diagnosis methodology, used to evaluate the potential for Geographical Indication (GI) of castor bean produced in the municipalities of Irecê and Capernaum, in Bahia. The data survey, conducted with local representative entities, included critical and structural aspects related to the product, the territorial link and the production chain, seeking to capture the socioeconomic relevance of castor bean cultivation in the region.

The analysis resulted in a Radar Graph that visually represents the level of adequacy of local production to the GI criteria, highlighting the high potential of castor bean in the region to obtain registration. This recognition would not only value the product, but also strengthen the cultural and economic identity of the producing communities, promoting local development and rural tourism. Next, the results will be presented regarding the nine criteria established in the Sebrae methodology.

PRODUCT

The production of castor beans, in fact, is experiencing a moment of reaffirmation of culture. Observing with criteria, the pioneering spirit of Bahia went through the time when seeds came to be used as currency, saw the expectation around their cultivation accentuated with the launch of the National Biodiesel Program, the cooling down with the

delay in harvesting the results of research in the area and regained momentum with new investments and partnerships for the implementation of new technologies. Although official production data for 2023 have not yet been released, CONAB estimated a 100% increase in productivity for the 2022/2023 harvest. This, if materialized, will considerably increase production and bring new perspectives to the grain culture in the state's economic scenario.

According to data from Conab, there was an increase of approximately 3.2 thousand hectares of planted area dedicated to farming (CONAB, 2023). Figures 3 and 4 show the use of hybrid seeds in the cultivation carried out by small and medium-sized producers in the Irecê region.

Figure 3 – Castor bean seed (Central-North Region)

Source: Jornal da Chapada, 2023.

Figure 4 – Castor bean production in the Irecê region

Source: Líder Notícias, 2023.

In addition, castor bean cultivation benefits from favorable conditions for its cultivation, due the easy adaptation to the region's climate, in addition to the low rate of losses due to pests and diseases. This represents a considerable gain for producers, who are mostly have low investment capacity.

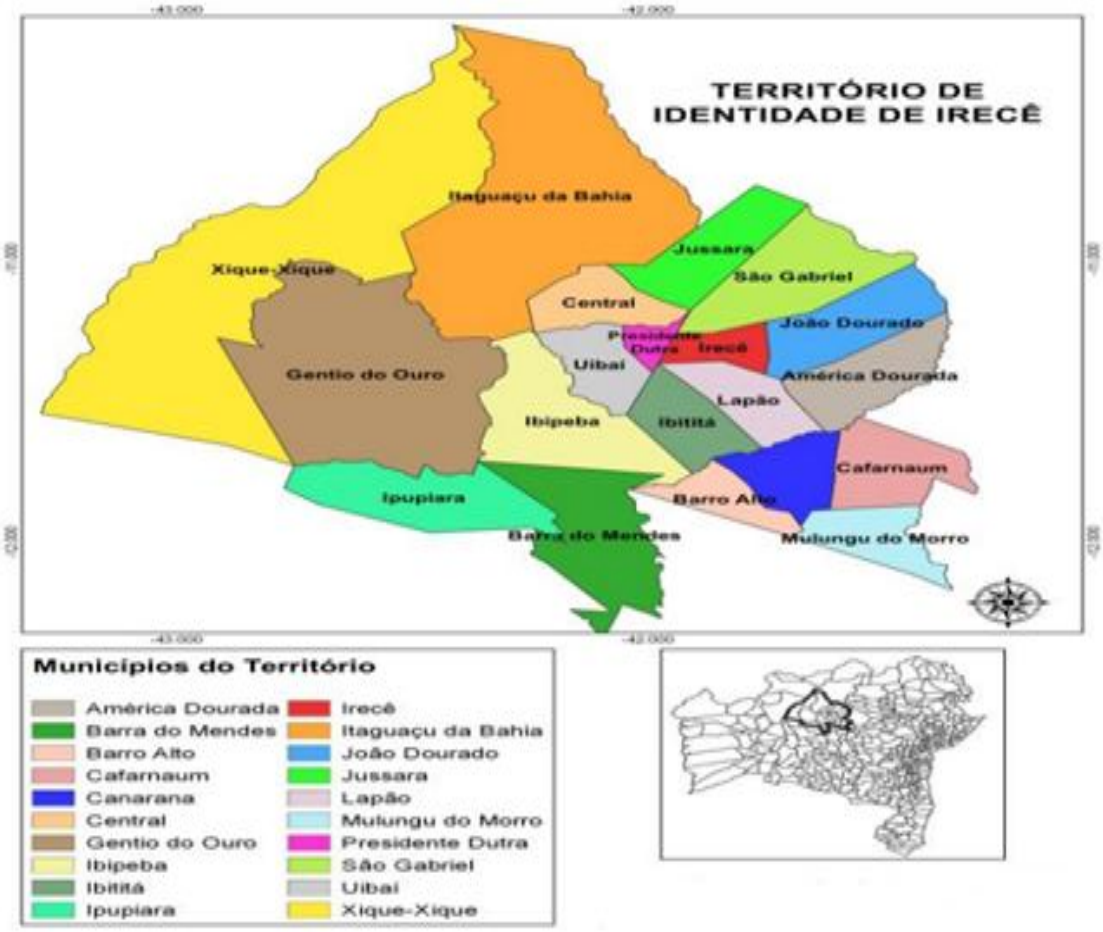
The castor bean plant presents dichotomous growth, with several growth points in the same plant, which is a great competitive advantage for conditions of occurrence of environmental stresses, in particular the water stress, due to lack or excess of water and the thermal caused by the occurrence of super-optimal temperatures (AZEVEDO; BELTRÃO, 2007). Regarding the climatic requirements for the adequate development and production of castor bean, the researchers report that 600 mm to 700 mm are sufficient to obtain yields of around 1,500 kg/ha (BELTRÃO; SILVA, 1999; WEISS, 1983). The greatest water requirement in the soil occurs during the vegetative phase, whose minimum rainfall until the beginning of flowering should be 400 mm to 500 mm (TÁVORA, 1982).

TERRITORIALITY

The municipalities located in the Central-North mesoregion of Bahia with a leading role in the production of castor beans, mostly make up the Microregion of Irecê, which occupies a total area of 17,646 km² and is also composed of the municipalities of Mulungu do Morro, Gentio do Ouro, Barra do Mendes, Uibaí, Lapão, Canarana, Iraquara, João Dourado, São Gabriel, Ibipeba, Central, Ibititá, Souto Soare, América Dourada, Jussara, Presidente Dutra, Barro Alto and Xique-Xique, with a semi-arid climate and average rainfall of 582 mm per year (Prefeitura Municipal de Irecê, 2024).

In the Center-North region, the municipalities of Irecê and Capernaum stand out as centers of castor bean production, with prominence at the national level. According to data from CONAB (2023), in the 2022/2023 harvest there was an increase of 8.5% in production, with an expansion of 18.2% with the recovery of abandoned areas. The production is mostly destined to the production of biofuels.

Figure 5 – Map of the territory of Identidade de Irecê



Source: SEPLAN, 2017.

PRODUCTION METHOD/PRODUCTION CHAIN

The cultivation of castor beans in the municipalities of the Center-North Region is mostly done through family farming, with low agricultural mechanization and rainfed driving. Hybrid seeds of productive varieties and resistant to water stress developed by Embrapa are used. The processes of soil preparation and planting are mechanized, while harvesting is manual, with berry threshing done in a mechanized way.

Among the difficulties encountered, soil compaction is one of the most relevant, as it reduces productive capacity. This is due, among other factors, to the inadequate and intensive use of agricultural implements for long years associated with monoculture crops that do not provide protection to the soils against erosion such as beans and castor beans (EMBRAPA, 2006).

The know-how of the producers, who are mostly from family farming, comes from traditional cultivation practices, combined with the technical support they have been receiving from partners, such as Embrapa and the Bahia Superintendence of Technical Assistance and Rural Extension (BAHIATER), which also involves the supply of seeds. The support of Embrapa Cotton's technical team has been of great importance for producers,

since it has been able to link traditional techniques with the latest in terms of planting technology, seeds and soil management.

GOVERNANCE

The production of castor bean in Bahia has always occupied a prominent position in the country and this has been accentuated since the launch of the National Program for the Production and Use of Biodiesel (PNPB), a Federal Government program launched in December 2004, which sought the implementation of Biodiesel in a sustainable way, aimed at regional socioeconomic development. To this end, for example, it is possible to highlight the creation of the Social Fuel Seal, created by the Ministry of Agrarian Development, as an instrument to encourage the inclusion of family farming in the biodiesel production chain (FERNANDES, *et al*., 2022).

As a result, local producers understood the need for organization through cooperativism to give unity to demands, strengthen the dialogue of producers with the most diverse social and governmental actors, with agroecological practices and professionalization of production units, such as the Cooperative of Castor Bean of Irecê (Copemai) and the Mixed Cooperative of Production, Acquisition and Service of the State of Bahia (Coopersertão). The organization bore fruit and the entities were able to sign agreements with the Government of Bahia to raise a total of R$ 5.7 million, in 2018 and 2020, in actions that were part of the Bahia Produtiva Project (State Agency for Agricultural Defense - ADAB, 2018).

IDENTITY AND SENSE OF BELONGING

The importance of castor bean production in the region of Irecê is unquestionable. The product contributes greatly to the evolution of the local economy, generating development, prosperity, employment and income for the entire local community. Thus generating an increase in the self-esteem of the local population in the face of the work done.

The idea of the producers is to continue investing in the improvement of agricultural practices, in order to obtain greater efficiency in production, generating more and more development in their region. In addition, there is a sense of environmental and social responsibility among producers, which aims to cover rural areas further away from the region, seeking to proliferate the culture of castor bean production throughout the community.

ECONOMIC PERFORMANCE

In terms of economic performance, the growth of the Irecê region deserves to be highlighted, where an advance in castor bean production was signaled by 113%, according to data from CONAB (2023). These data allow the region to reach production records and a production projection of 13.5 million tons of castor beans for the 2022/2023 harvest.

Also according to CONAB (2023), Bahian producers increased the area (in hectares) dedicated to farming from 47.6 thousand to 50.8 thousand. The data released by Conab indicate that the municipality of Irecê holds 87% of the area cultivated with castor beans and the crops have excellent vigor. Irrigated areas have been in a strong expansion trend in the last four harvests and, with the arrival of the dry season, the mapping of the plantation will increase the accuracy of this estimate. At this point, there is room to improve production processes, further increasing the production culture in that region.

NEED FOR PROTECTION

The protection related to the product is also something inherent to the production of castor bean in Brazil, as well as in the largest producing state, Bahia. The climate, production period, soil, are requirements that directly affect castor bean cultivation, so the imminent concern is highlighted in SPA/MAPA Ordinance No. 247/2023, published in the Official Gazette of the Union, where an agroclimatic model is established for a better use of castor bean production.

Through the aforementioned ordinance, different phases and pheneological cycles are verified. The castor bean cycle was divided into 4 phases, namely: Phase I - Germination/Emergence; Phase II - Growth/Development; Phase III - Flowering/Berry Filling and Phase IV - Physiological Maturation/Harvest. The castor bean cultivars were classified into four groups of homogeneous characteristics: Group I (n 130 days); Group II (131 days n 150 days); Group III (151 days n 180), Group IV (n 181 days); where n expresses the number of days from emergence to physiological maturation. III. Available Water Capacity (CAD): It was estimated as a function of the effective depth of the roots and the useful water reserve of the soils. Type 1 (sandy texture), Type 2 (medium texture), Type 3 (clayey texture), with storage capacity of 31.5 mm, 49.5 mm and 67.5 mm, respectively, and an average effective depth of the root system of 45 cm were considered. IV. Water Requirements Satisfaction Index (ISNA): An ISNA of 0.65 was considered in Phase I - germination - establishment of the crop and ISNA 0.30 in Phase III - flowering and berry filling.

RESEARCH INVOLVED

EMBRAPA carried out field studies with the objective of analyzing castor bean cultivation in the region of Irecê – BA to better understand the techniques used by farmers in the management of castor bean crops, since the region has adequate climate and soil characteristics for the cultivation of the seed.

The castor bean plant presents dichotomous growth, with several growth points in the same plant, which is a great competitive advantage for conditions of occurrence of environmental stresses, in particular the water stress, due to lack or excess of water and the thermal caused by the occurrence of super-optimal temperatures (AZEVEDO; BELTRÃO, 2007).

Castor bean produces well in any type of soil, with the exception of those with a very clayey texture. Very fertile soils favor excessive vegetative growth, prolonging the period of maturity and flowering. The most suitable soils are those with a loam and clayey loam texture, deep, well-drained, porous, without compaction (HEMERLY, 1981), medium fertility, pH in the range of 6.0 to 6.8 and without salinity and sodium problems (AZEVEDO et al., 1997)

For the region of Irecê, BA, Embrapa recommends the cultivar BRS 149 Nordestina which has the following characteristics: average height of 1.90 m, green stem with wax, conical raceme, semi-dehiscent berries, black seeds, seed oil content 48.90%, average period of 50 days between seedling emergence and flowering of the first raceme, weight of 100 seeds of 68g and average productivity of 1500 kg/ha of seed, without fertilization, in the semi-arid conditions of the Northeast, in years of normal rainfall (Ministry of Agriculture, Livestock and Supply – Technical Communication: Technical Recommendations for the Cultivation and Planting Time of Castor Bean Cultivar BRS 149 Northeastern in the Region of Irecê - BA).

FUTURE VISION

The claim for the Geographical Indication for the Center-North region of Bahia in the production of castor bean represents an opportunity for productive, technical and social growth for the local community, in addition to promoting the cultural and economic appreciation of the region. Obtaining this certification gives greater visibility and recognition to the quality and authenticity of the product, strengthening the local identity and encouraging sustainable practices. With the Geographical Indication seal, castor bean production is expected to be leveraged, becoming more robust and competitive, which benefits not only producers, but the entire associated value chain.

In addition, the reach of the Geographical Indication offers possibilities for expansion to the domestic and foreign markets, placing Brazil in a prominent position and with the potential to fill supply gaps left by India, currently the largest producer of castor beans in the world. The seal of quality and origin adds value to the product, boosting its acceptance in the international market and increasing Brazilian competitiveness in this sector. The promotion of castor bean culture, through investments in research and development, strengthens the product, while opening up a vast field of opportunities to supply the world market with a validated and valued product.

RADAR CHART

The radar graph was designed and carried out based on the interviews and the data collected, aiming to evaluate in detail the potential of Geographical Indication (GI) for castor bean produced in the Central-North region of Bahia. This visual instrument allowed a comprehensive analysis of the established criteria, facilitating the identification of the strengths and weaknesses of the local culture in relation to obtaining the GI seal.

The chart also allows for the measurement of performance over time, helping to monitor progress towards the standards of excellence for GI certification. It highlights the specificities of castor bean production, differentiating it in the market. The identification of specific weaknesses guides the introduction of technical innovations, aiming to improve productivity and quality.

The score assigned ranges from 1 to 5, where 1 represents the lowest potentiality value and 5 indicates the highest, allowing a clear scale to measure each aspect relevant to GA recognition. In the graph below, it is possible to visualize the score achieved for each of the criteria evaluated, providing an objective view of the strengths and elements that still require improvement to achieve the standard of excellence necessary for certification.

By analyzing the graph of the criteria obtained, it can be concluded that there is an immense potential in the micro-region of Irecê to obtain a Geographical Indication. The data collected indicate not only the high quality and uniqueness of local products, but also the strong cultural identity and the historical link with the territory, elements that are essential for the distinction and appreciation of the product in the market. In addition, obtaining a GI can bring numerous socioeconomic benefits to the region, including strengthening the local economy, creating new jobs, valuing traditional knowledge, and increasing competitiveness in other markets.

Graph 1: Radar Graph of Geographical Indication of Castor Bean in the Central-North Region of Bahia

Source: The Authors (2024)

GI can also contribute to preserving the environment, encouraging sustainable practices and promoting the responsible use of local natural resources, in addition to reinforcing the image of the micro-region of Irecê as a hub for authentic and high-quality products. These factors, added to the positive indicators verified, highlight the feasibility of obtaining GI recognition, adding value to regional production and promoting the socioeconomic development of Irecê and its communities.

DISCUSSION

Castor bean plays an important role in the Brazilian context, especially with regard to sustainable development and energy security. Studies by Souto and Sicsú (2011) demonstrate that its relevance is linked to the production of biodiesel, since it is an oilseed plant that adapts well to different regions of Brazil, particularly in the Northeast. Broadening this discussion, it is seen that castor bean cultivation can act as a vector of territorial valorization. By encouraging local production, castor beans strengthen the regional economy, create jobs and promote the development of sustainable production chains. The presence of an economically viable crop adapted to local climatic conditions, such as castor beans, is a crucial factor in reducing rural exodus and maintaining agricultural traditions, helping to transform historically marginalized regions into productive and sustainable hubs.

Castor bean production in the Center-North region of Bahia, especially in Irecê, shows a resurgence driven by economic and environmental factors. Since the launch of the National Biodiesel Program, the agricultural sector has been strengthened, mainly by policies that encourage the participation of family farming and the adoption of

agroecological practices. The appreciation of castor bean as a raw material for biofuels has generated new market opportunities and aroused the interest of investors and local producers. This reflects a trend of strengthening regional production chains and stimulating local economic development.

The predominance of family farming and rainfed cultivation, with low mechanization, show a production model that, despite its potential, faces limitations. Many farmers in the region rely on subsidies and technical support from organizations such as Embrapa and Bahiater to improve crop yields and address challenges such as soil compaction. This support is crucial, as it enables access to resistant hybrid seeds, which help increase productivity, in addition to assisting in the adoption of more sustainable practices. The performance of cooperatives represents an essential collective strategy to strengthen the organization of producers and maximize market opportunities.

A crucial issue pointed out by this study is the emphasis on the climatic conditions favorable to castor beans, which tolerate well the variations in humidity and temperature typical of the semi-arid region. Proper water management, especially during the vegetative phase, is essential to ensure good productivity. The castor bean crop is resistant to water stress, being able to grow in soils of lower fertility, which is advantageous for the Irecê region. However, rainfed agriculture still exposes farmers to environmental risks, such as severe droughts, which can directly impact productivity.

The introduction of hybrid seeds and the development of agricultural practices with technical support from institutions such as Embrapa represent a significant evolution for productivity. However, low mechanization and intensive use of traditional techniques still limit the increase in production. The adoption of more advanced techniques and modern equipment could optimize harvesting and improve export capacity, especially with the growing interest in castor bean for the production of biofuels. In addition, soil compaction, caused by the inadequate use of agricultural implements, represents a significant challenge and points to the need for policies that encourage soil conservation practices and crop rotation.

Through the data presented, it is verified that the production of castor bean contributes to the sense of identity and belonging of the inhabitants of the Irecê region. Obtaining a Geographical Indication (GI) for castor beans in the region could represent a milestone in the recognition of the local culture and its producers, in addition to adding value to the product. The GI would strengthen the recognition of Irecê as a reference in the sector and expand the potential for commercialization in national and international markets, economically benefiting the entire community. The prospects for castor bean cultivation are

promising, with the potential to expand production to larger and more profitable markets, and the possibility for Brazil to increase its global relevance in the sector, competing with India, the world leader in castor bean production. Investments in infrastructure, mechanization and sustainability are necessary for castor bean production in Bahia to reach its full potential and for the crop to remain sustainable and competitive in the long term.

FINAL CONSIDERATIONS

The Center-North region of Bahia has ideal conditions for the cultivation of castor beans, especially due to the work of local cooperatives, which have helped farmers in the adoption of modern techniques, such as the mapping of plantations. This practice increases the accuracy of production and growth estimates, allowing for more effective planning. The combination of traditional methods and new agricultural techniques promises to bring significant gains to local production, increasing the competitiveness and sustainability of castor bean cultivation in the region.

The importance of this region in castor bean cultivation is reinforced by the strategic role of cooperatives, which not only boost production but also increase the added value of the agricultural chain. By facilitating smallholder access to the biodiesel market, these organizations promote an additional source of income for farmers and strengthen the family economy. This represents a significant step forward for the economic sustainability of the community, connecting local production with expanding industrial demands.

Despite the existing government incentives, the research points out that there is still room for the government to expand its support for family farming, maximizing regional development. Partner entities of technical assistance and rural extension play an essential role in this process and could expand their actions with more comprehensive training and technical support programs. Encouraging the use of more efficient cropping systems and reactivating the flow of production to large processing industries would further benefit producers. With these advances, the castor bean of the region already has the necessary characteristics to achieve a Designation of Origin, which would bring technical, historical and cultural recognition to the pioneering spirit and quality of local production.

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