

Distribution of organic agriculture in Brazil: a comparative analysis across geographic macro-regions

ABSTRACT - The research aimed to map the distribution of organic agricultural production across Brazilian geographic macro-regions. Thus, this is a mixed-method, including descriptive, documentary and applied study, using data from the National Register of Organic Procedures of the Ministry of Agriculture and Livestock (MAPA) from March 2023. Results indicate that primary vegetable production is the predominant organic activity among regions in Brazil, with the exception of the North region, which excels in organic extractive production. Although some crops, such as potatoes, cabbage and lettuce, are common in several regions, each area also offers a specific heterogeneity of products. This emphasizes the diversity of organic agriculture in Brazil and the importance of considering regional particularities when developing policies and strategies to support the sector throughout the country.

Index terms: agricultural sustainability, agricultural variety, environment, organic production.

Distribuição da agricultura orgânica no Brasil: uma análise comparativa entre as macrorregiões geográficas

RESUMO - O objetivo deste artigo foi mapear a distribuição da produção oriunda da agricultura orgânica entre as macrorregiões geográficas brasileiras. Trata-se de uma pesquisa mista, descritiva, documental e aplicada, com dados do Cadastro Nacional de Produtores Orgânicos do Ministério da Agricultura e Pecuária (MAPA) de março de 2023. Resultados indicam que a produção primária vegetal é a atividade orgânica predominante entre todas as regiões do Brasil, com exceção da região Norte, que se destaca pela produção orgânica extrativista. Embora algumas culturas como batata, couve e alface sejam comuns em várias regiões, cada área também apresenta uma diversidade específica de produtos. Isso enfatiza a multiplicidade da agricultura orgânica no Brasil e a importância de considerar particularidades regionais ao desenvolver políticas e estratégias de apoio ao setor em todo o País.

Termos para indexação: sustentabilidade da agricultura, diversidade de sistemas de agricultura, meio ambiente, produção orgânica.

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INTRODUCTION

Organic production, also known as organic farming, is a system of growing food that is based on principles and practices aimed at sustainable production, while respecting the environment, human health and animal welfare. In contrast to conventional agriculture, which often makes intensive use of synthetic pesticides, chemical fertilizers and handling practices that can have negative impacts on the environment, organic production adopts a more natural and holistic approach (Feiden et al., 2002; Moraes & Oliveira, 2017).

Brazil is one of the world leaders in organic food production. This sector has grown at a considerable rate, concerning both, the area cultivated and the variety of organic products available (Moura et al., 2022). Moreover, it was revealed that out of every thousand Brazilians, 360 declare themselves to be organic consumers and points to a 16% growth in the consumption of this type of food in the country between 2021 and 2023 (CNDL, 2023).

Despite the existence of an expanding consumer market, the development of organic agriculture faces technical barriers — e.g., technology, financial investment, and input availability (Scalco & Pinto, 2021; Jones, 2023; Moura et al., 2023) — as well as socioeconomic constraints — e.g., income (Souza et al., 2021). Previous studies suggest additional aggravating factors to these barriers, such as restrictions on budgetary resources for promoting the sector (Hybner & Alves, 2024) and a reduction in the number of establishments engaged in organic activities (Souza et al., 2021). This issue calls for a detailed analysis of the specificities of each region, given the diversity of organic activities practiced at the national level (Ferreira et al., 2024) and the variability of challenges and characteristics across regions (Scalco & Pinto, 2021; Jones, 2023; Auriglietti et al., 2024).

Previous studies have already mapped and investigated variables related to organic

agriculture within a regional scope, such as the number of establishments, education, and level of mechanization (Auriglietti et al., 2024); types of producer associations, gender, and technical guidance (Lourengo et al., 2023); income (Souza et al., 2021); as well as types of institutional compliance (Oliveira et al., 2024). Among studies that analyzed, to some extent, the types of activities carried out, certain limitations are observed regarding the level of detail of activities — e.g., crop or livestock production — and geographic scope — investigations focused on specific regions (Costa Junior et al., 2023).

The present study was designed to contribute to the literature by extending this mapping of organic agriculture activities in Brazil across all macro-regions and by increasing the level of detail regarding the types of activities developed. Expanding this mapping may contribute to a better understanding of the regional characteristics of Brazilian organic production and serve as an informational basis for public policies tailored to these specificities, given that the predominance of certain types of production may generate specific demands related to financing needs and logistical issues, for example.

Having defined the research problem — the gap in literature — and the potential contributions of this investigation, the following research question is proposed: “How is organic agricultural production distributed across the different macro-regions of Brazil?” Hence, the main objective of the research is to map the distribution of organic agricultural production across Brazilian geographic macro-regions.

Initially, this research is justified because it addresses organic agricultural production, which plays a fundamental role in food production in Brazil. Adopting organic practices can contribute to the environmental and economic sustainability of families, as well as promote food security in the country. Furthermore, considering that Brazil is a country of continental dimensions, presenting different climates, soils and cultures,

understanding regional variations in organic farming practices is essential so that to adapt policies and promote best practices in different contexts.

Finally, organic farming promotes sustainable practices — such as reducing the use of agrochemicals and preserving natural resources — and, for this reason, investigating these practices helps to assess their impact on environmental conservation.

BIBLIOGRAPHIC REVIEW

Brazilian organic agriculture

Organic farming can be understood as a system for producing agribusiness products without the use of chemical products (pesticides or herbicides) or fertilizers, and therefore it is an ecologically and socially sustainable form of production (Azam & Shaheen, 2019; Cidón et al., 2021).

It is also an alternative to traditional agriculture (Bosellino et al., 2020). There are four main causes that can help to explain this phenomenon: consumers' growing concern for their health; environmental movements, which are important political apparatus for opening up the market for these products; the influence of religious sects and the evolution of the planted area (Campanhola & Valarini, 2001). In addition, the need to meet a growing demand for food in line with environmental sustainability has generated pressure on the global agricultural production system (Araújo Junior et al., 2015; Borsellino et al., 2020; Cidón et al., 2021).

Institutional recognition of organic farming in Brazil developed largely in the late 1990s, through normative instructions introduced by the Ministry of Agriculture and Livestock. That trend subsequently resulted in the inclusion of organic farming regulations in the Brazilian legal system, represented mainly by Law 10.831/03 as

well as by Decree 6.323/07 (Alves et al., 2012). Nevertheless, there is empirical evidence for the existence of traces of organic agricultural activity in periods prior to its regulation (Aun & Assis, 2021).

Law 10.831/03 relates to organic farming in general. It defines an organic product as “[...] one obtained in an organic agricultural production system or from an extractive process that is sustainable and does not harm the local ecosystem” (Brasil, 2003, art.2º, chapeau, our translation). This same law also requires certification for the marketing of organic products, except when they are marketed directly to consumers, in which case certification is optional (Brasil, 2003). Another relevant piece of legislation concerning organic farming in Brazil is Decree 6.323/07, which regulates Law 10.831/03. It establishes the Brazilian Organic Conformity Assessment System (SisOrg), a department managed by the Ministry of Agriculture and Livestock (MAPA), undertaking the task of monitoring and ensuring compliance with the rules established for organic production (Brasil, 2007).

There are three types of certification in Brazil: certification by audit, social control in direct sales and participatory guarantee systems (SGP). Certification by audit accredited with certifying agencies, where regular inspections are carried out to check on practices and criteria laid down in the legislation if being observed. These products must have the federal seal of SisOrg, a MAPA department. In SGPs, on the other hand, the inspection is carried out by a Participatory Conformity Assessment Organization (OPAC) — a group of people who are also registered in the MAPA. As with certification by audit, products comprising this certification must also have the federal seal of the SisOrg. Finally, social control in direct sales is a form of certification without the formal procedures, in which producers can sell their products without certification, as long as they are included in a Social Control Organization (OCS). However, this type of certification only

allows direct sales to consumers (at fairs, for example) or to the government (public institutions) (Ci Orgânicos, 2017; Ecocert, 2021).

There is a predominance of bibliographic studies (Moura et al., 2022; Vilhena et al., 2023; Ferreira et al., 2024; Santos & Silva, 2024) on agriculture and organic production in Brazil. In general, scientific output has focused on the characteristics of consumers of these products (Vilhena et al., 2023), logistical aspects of the organic products supply chain (Moura et al., 2022; Vilhena et al., 2023), and impacts on the environment and human health (Moura et al., 2022). There is a call for studies that comparatively analyze different Brazilian regions (Vilhena et al., 2023).

Regarding regional particularities, current knowledge indicates a concentration of properties oriented toward organic agriculture in the South and Southeast regions, whereas the Central-West region presents a lower proportion (Souza et al., 2021; Lourenço et al., 2023; Auriglietti et al., 2024). In absolute numbers, the Southeast, Northeast, and South regions stand out, respectively (Weber & Silva, 2021). Between 2006 and 2017, the North, Southeast, and Central-West regions experienced growth in the adoption of organic agriculture (Weber & Silva, 2021). Besides, a predominance of men in the control of these properties (approximately 80%) was observed across all regions (Lourenço et al., 2023).

Moreover, the prevailing income class of establishments engaged in organic agriculture ranges from zero to two minimum wages in all regions (Souza et al., 2021). In absolute terms, Southeast, Northeast, and South regions again stand out, respectively (Weber & Silva, 2021). With respect to the activities performed, plant production accounts for more than half of the country's organic output, with a predominance in the Southeast region. The Northeast region, in turn, is distinguished by the joint production of animal and plant products (Lourenço et al., 2023). Scalco & Pinto (2021) found that

motivations and difficulties faced by organic producers vary according to each region, and part of this variation can be grasped by the production patterns of each locality. In Pará, for example, where extractive activities such as cocoa production are prominent, no problems related to seed acquisition were reported, in contrast to a barrier encountered by producers in the South and Southeast regions (Scalco & Pinto, 2021). Regarding the determinants of organic agriculture, technical guidance for farmers shows a positive relationship mainly through the presence of units engaged in organic production, revealing potential to generate spillover effects in neighboring regions (Auriglietti et al., 2024).

Based on the current literature, it is expected that Brazilian organic production occurs asymmetrically across different regions of the country and is concentrated in primary vegetable production, with the exception of the North region, where extractive activities predominate.

METHODOLOGY

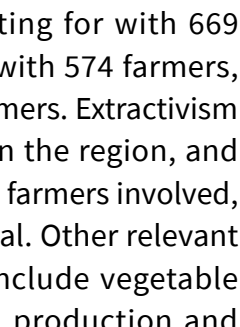
This research can be classified as descriptive, mixed and pure (Collis & Hussey, 2014). The method of operationalizing data collection was carried out through a documentary analysis of the information available in the National Register of Organic Producers of MAPA regarding the scope and activities carried out by registered organic producers published in March 2023. The spreadsheet obtained from the platform showed 24.795 records, out of which 23.636 were used due to the fact that they presented complete data regarding the activities performed.

The data of interest was organized in a spreadsheet according to region using Microsoft Excel 2019 software. The data was processed using descriptive statistics techniques and the “word cloud” tool. The word cloud consists of a graphic resource, in the form of a cloud, which represents the most frequent words in a given

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Table 3 shows that primary vegetable production is the most common activity in the region, including 2,889 organic farmers, which represents 45.6% of the total. Bahia leads the way in this activity, accounting for with 669 farmers, followed by Ceará, with 574 farmers, and Pernambuco with 458 farmers. Extractivism is also a significant activity in the region, and Maranhão stands out with 777 farmers involved, representing 13.3% of the total. Other relevant activities in the Northeast include vegetable production, primary animal production and the production of organic vegetable products.

east region.

Number of organic farmers							
MA	PB	RN	PI	SE	AL	Total	
11	418	370	145	171	73	2,889	45,6%
777	0	5	0	0	0	842	13,3%
11	150	0	27	85	0	729	11,5%
0	9	0	286	15	1	716	11,3%
0	0	0	0	0	0	291	4,6%
0	78	55	0	0	0	256	4,0%
0	0	151	0	16	18	185	2,9%
0	0	0	0	0	0	109	1,7%
0	2	53	0	0	1	71	1,1%
0	12	0	0	0	0	43	0,7%
0	0	0	0	0	0	39	0,6%
0	0	0	0	27	0	35	0,6%
0	0	0	0	0	0	35	0,6%
0	0	0	0	0	0	32	0,5%
0	12	0	0	0	0	23	0,4%
0	0	0	0	0	3	21	0,3%
0	0	0	0	0	0	17	0,3%
799	681	634	458	314	96	6,333	100%

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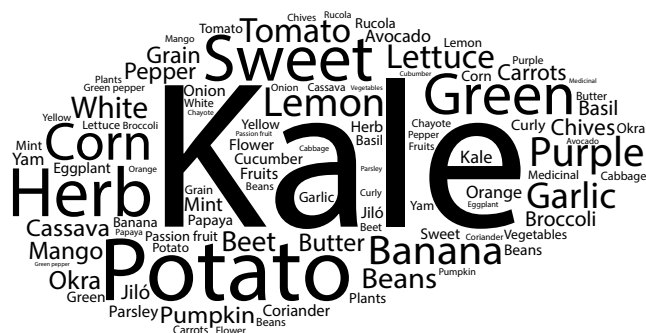


Figure 5. Most popular productions - Central region.

products are related to the cultivation of kales, sweet potatoes and green herbs, which are characteristic of the region. In addition, adjectives such as “purple” are prominent, indicating that organic products with this characteristic are prominent in this region. As in other regions, there is a certain congruence with the national scenario, given the prominence of the words “kale” and “potato”. Table 5 provides information on the activities carried out by organic farmers in the North, according to the National Map.

Table 5 shows that extractivism is the most common activity in the region, with 2,605 organic farmers involved, representing 68.2% of the total. Pará stands out, with 2,287 farmers involved in this activity. Primary vegetable

production also has a significant presence in the region, with 642 organic farmers engaged in this activity. Amazonas is the state with the largest number of farmers involved in primary vegetable production, with 455 registered. Other activities carried out by organic farmers in the North include vegetable production, organic vegetable processing, primary animal production and processing. Figure 6 illustrates the most popular products in the north region.

The word cloud representing the North suggests that the region's most popular products are açaí, cocoa, bananas and guarana. This is quite a different scenario compared to the other regions, which is to be expected, given the importance of extractivism for the region's activities.



Figure 6. Most popular productions - North region.

Table 5. Activities performed by organic farmers in the North region.

Activities	Number of organic farmers								
	PA	AM	AP	RO	AC	RR	TO	Total	
Extractivism	2,287	127	140	3	48	0	0	2,605	68,23%
Primary Vegetable Production	158	455	0	16	8	0	5	642	16,82%
Vegetable Production	218	40	0	0	5	0	0	263	6,89%
Others	0	0	8	63	10	25	0	106	2,78%
Organic Vegetable Processing	101	0	0	0	0	0	0	101	2,65%
Processing Products of Vegetable Origin	0	46	0	1	2	0	0	49	1,28%
Primary Animal Production	0	20	0	3	3	0	0	26	0,68%
Processing	5	8	0	0	0	0	0	13	0,34%
Sustainable Organic Extractivism	7	2	0	0	3	0	0	12	0,31%
Vegetable Organic Product	0	1	0	0	0	0	0	1	0,03%
Total	2,776	699	148	86	79	25	5	3,818	100%

DISCUSSION

Results obtained can be compared with the existing literature regarding the geographic concentration of organic farmers and the predominant activities. With respect to the first element, previous studies have shown a concentration of organically producing farms in the Southeast region (Souza et al., 2021; Lourenço et al., 2023; Auriglietti et al., 2024) as well as in the South region (Auriglietti et al., 2024; Finatto et al., 2024; Oliveira et al., 2024). The Central-West region presents the lowest proportion of organic agriculture at the national level. These findings indicate a somewhat different pattern for organic agriculture, as the Southeast region ranked as the second-to-last region in terms of the number of farms, behind the North, Northeast, and South regions, respectively, a pattern analogous to that reported by Finatto et al. (2024).

From a macro-regional perspective, spatial concentration described by Auriglietti et al. (2024) is not necessarily related to the number of organic farmers in a given state. For example, the states of Acre and Roraima ranked fourth and fifth, respectively, within the North region in terms of the number of organic farmers, despite standing out as micro-regions of concentration in the aforementioned study.

In the South region, the state of Paraná was not the main representative. In the Northeast region, the state of Bahia exhibited the highest number of organic farmers, whereas, according to Auriglietti et al. (2024), Bahia showed a small number of organic farms relative to the total for the region. Although the territorial extent of the federative units is a variable that may help explain the greater dispersion of farms in geographically larger states, this pattern suggests that the agglomeration of organic production units should not be presumed as a function of the growth in the number of organic establishments within a region. Therefore, an analysis of the spatial location of these farms should be considered in order to obtain effects

such as spillovers, for example (Auriglietti et al., 2024).

With regard to predominant activities, primary crop production is the most frequent category at the national level, accounting for approximately 54% of total activities, a pattern consistent with that reported by Lourenço et al. (2023), who used data from the 2017 Agricultural Census. This indicates that over a six-year-period, the configuration of organic activities in Brazil has been maintained. A clear predominance of primary crop production was observed across the macro-regions, with the exception of the North region, where extractivism accounts for nearly 70% of total production (Scalco & Pinto, 2021).

Regarding the products produced at the national level, a prevalence of items such as kale, potatoes, beans, lettuce, bananas, and corn was identified. The bibliometric study by Pinto & Rocha (2023) found that a portion of the scientific literature on organic production has focused on specific products, with particular emphasis on palm oil, corn, soybeans, beans, and rice. Therefore, a certain thematic mismatch can be observed between the focus of scientific research on the topic and the most predominant activities, which also points to opportunities for future research, given the relevance of products such as kale, potatoes, lettuce, and bananas in national organic production. Table 6 summarizes the main findings regarding the distribution of organic agriculture in Brazil across the different macro-regions.

Table 6 suggests that the segmentation of the main products by macro-region allows the identification of certain location-specific characteristics, both in terms of products, since each region encompasses a distinct set of products, and in terms of production concentration. The South region appears to exhibit greater diversity, whereas production in the Northeast region seems to be more concentrated in banana, beans, and corn.

Table 6. Distribution of activities carried out by Brazilian organic agriculture across macro-regions.

Region	Main categories	Main products
South	Primary Vegetable Production and Vegetable Production	Kale, sweet potato, beans, corn, tomato, lemon, garlic, and lettuce
Northeast	Primary Vegetable Production and Extractivism	Banana, beans and corn
North	Extractivism and Primary Vegetable Production	Açaí, cocoa, banana, and kale
Southeast	Primary Vegetable Production and Vegetable Production	Lettuce, kale, banana, lemon, and sweet potato
Central-West	Primary Vegetable Production	Kale, sweet potato, corn, and green herbs
Brazil	Primary Vegetable Production and Extractivism	Kale, potatoes, beans, lettuce, banana, and corn

CONCLUSION

The aim of this article was to map the distribution of Brazilian organic agricultural production across geographic macro-regions. To achieve this, descriptive statistics and word cloud tools were used on data from the National Register of Organic Producers, published by the Ministry of Agriculture and Livestock (MAPA).

The results revealed that activities classified as primary vegetable production dominate organic farming in Brazil, which is reflected in all regions, except the North. The North region stands out due to the fact that it concentrates a significant part of extractive organic production. Furthermore, although the different regions showed a predominance of some common products, such as potatoes, kales and lettuce, each region also showed a more specific variety of organic products. This suggests that, despite the apparent similarities, each region presents its own particularities and unique characteristics in relation to organic production.

This information indicates the diversity of organic production in Brazil. Thus, the importance of considering regional nuances when developing policies and strategies to promote and support organic agriculture throughout the country. Considering budgetary resource constraints and the need for targeted policy reorientation, knowledge of the specific characteristics of each locality can support the design of more effective public policies.

Concerning future research, we suggest reproducing models on the determinants of organic practice from a regional perspective, due to the fact that, given their particular characteristics, it may be possible to obtain useful information to guide public policies and strategies that meet the needs of each region of the country. This allow as well the identification of possible obstacles that may be restricting the development of these activities. Moreover, it is suggested that future research shall investigate which logistical or market-related dynamics could be affected by a prevailing type of production in each region.

The results found can contribute to the current literature on organic farming by providing information that allow for the construction of a more unique and heterogeneous profile of organic practices in Brazil, since recognizing the particularities of each region. It is possible that the difficulties faced and the opportunities identified are different, thus requiring a different approach when compared to conclusions and studies based on aggregated national data.

A limitation of this research is the exploratory-descriptive nature of the analysis, which does not allow for prescriptive conclusions to be drawn regarding the research problem. Furthermore, although the word cloud analysis revealed production patterns across the Brazilian macro-regions, it does not capture potential intra-regional asymmetries within each macro-region, thereby limiting the reliability of the identified patterns for analyses and policies directed at specific localities, for example.

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