Chapter 12

20 years of transgenics in Brazil: reflections for Lula government 3

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Sônia Soares
E-mail: sonia.soares@ufrn.br

ABSTRACT
About 90% of the soy and corn planted area in Brazil is occupied by transgenic crops. The release of these crops was marked by legal disputes, conflicts and uncertainties. The study aims to present for analysis the approvals made by the National Technical Biosafety Commission for the commercialization of transgenic corn and soy seeds in Brazil until December 2022, and to elaborate some reflections that can be considered by the incoming government, in light of the application of the principle of precaution and the duties of the State to guarantee sovereignty and food security. A descriptive study, with a quantitative approach, was carried out using bibliographical and documentary research procedures, based on secondary data sources, obtained from publicly accessible portals. The results show that: the release of transgenics in Brazil continues to be questioned in court; only two companies hold the patent for 38 of the 74 authorized soy and corn events; the crops, mostly, have the characteristics of tolerance to herbicides and resistance to insects; there was no respect for the precautionary principle; sovereignty and food security are threatened, either by the monopoly of seeds or by conflicts between the food security law and releases based on substantial equivalence. For the Lula 3 government to defend the right to adequate food, it is urgent to initiate an agroecological transition

Keywords: Transgenic foods, Precautionary principle, Food security.

1 INTRODUCTION

In March 2003, President Lula signed the first Provisional Measure (MP 113) releasing the commercialization in Brazil of soybean production of that year's crop, the result of the cultivation of genetically modified seeds smuggled from Argentina. In September of the same year, the Vice President would sign MP 131, referring to the planting and commercialization of soybean production for the 2004 harvest. The following year, Lula signed MP 223 to release the planting of genetically modified soybeans from the 2004–2005 crop (Fernandes, 2005). The request for commercial cultivation of this soybean had been made in 1998, but by court decision the authorization given was suspended, due to the non-presentation of studies and environmental impact reports (EIA/RIMA), but the seeds continued to arrive in Brazil and were used (Menasche, 2000).

In a presidential campaign, however, the then candidate Lula had committed to support a moratorium on the release of commercial cultivation and commercialization of GMOs in Brazil, indefinitely, recognizing, in his government program, the Zero Hunger Project, that the transgenics could promote genetic pollution and greater dependence of the producers of this technology, in addition to not being a solution to the problem of hunger, associated with the use of herbicides (Fernandes, 2005). The

fact is that, in less than two decades, after the provisional measures, which paved the way for the legalization of transgenics, Brazil became part of the "top five" in an area planted with transgenic crops, surpassed only by the USA, and followed by Argentina, Canada and India. In terms of planted area, Brazil went from 5 million hectares planted in 2004 to 53 million, with transgenics occupying almost 95% of the area planted with soybeans in 2019, 88% with corn and 85% with cotton, in addition to sugarcane, bean and eucalyptus plantations (Colli, 2021, p. 99).[1]

In fact, it was expected that Brazil would officially grow transgenics as early as 2000 (James, 1999). The first approval for commercial use of a genetically modified food was in the USA, in 1994, it was the flavrSavr™ tomato of Calgene, of delayed ripening, which was a failure of sales. In the same year, Monsanto filed a marketing application for its genetically modified soybean to tolerate glyphosate (RR soybeans®), a herbicide whose patent was due to expire in 2000; it was the first broad-growing GMO in the world (Robin, 2008, p. 156). Since then, no new technology adopted by the agricultural industry had a standard as high as gm crops, since between 1998 and 1999 there was a 44% increase in hectares of transgenic crops worldwide; in 1996, there were 1.7 million hectares, passing 39.9 million hectares in 1999 (James, 1999). Related to this, we have the formation of oligopolies in the agricultural market, which includes not only transgenic seeds, but also conventional seeds, fertilizers and pesticides, in an increasingly less transparent environment of financialization (ETC Group, 2022).

According to former presidents of the National Technical Commission of Biosafety (CTNBIO), the body responsible for the creation of risk assessment and management standards, for authorizations of transgenic crops in Brazil, "the debates on the use of GM vegetables were very intense. Not without reason. Brazil was the first country in the tropical world to adopt large-scale planting of genetically modified vegetables [...]. We could not transfer the reality of temperate countries to our conditions" (Barroso, Finardi & Felipe, 2021, p. 165).

The debates, however, were not enough, with criticism stemming from the lack of transparency in CTNBio's actions, the low popular participation in the release processes, as well as the disrespect of the precautionary principle, which has constitutional support (Andrioli, 2008; Mariconda, 2014; Zanoni & Ferment, 2011; Fonseca & Guivan, 2019). The majority of the Brazilian population does not have enough knowledge about what are transgenic foods, having as main concerns the information about the presence of transgenics in food and the lack of information about the effects of consumption,on their health, in the

[1] The terms "transgenic" and "genetically modified", in the context of this study, can be considered synonyms, since every transgenic organism is genetically modified, through the transfer of genetic material between distinct species, but the reverse is not true. The Brazilian biosafety law (both ancient and current) defines genetically modified organism (GMO) as that organism whose genetic material (DNA/RNA) has been modified by any genetic engineering technique. In fact, as Berlin (2011, p. 157) notes, the term GMO has little meaning, since we are constantly changing genetics as living beings, so much so that Cohen and Boyer's patent obtained in the first transgenic manipulation, in 1973, was called "functional chimera", synonymous with "genetic chimera", but this would not be a marketing name. The soybean in question is a GMO in that its genetic material has been modified to tolerate the herbicide glyphosate by transferring genetic material from another species(s), in this case: cauliflower mosaic virus, bacteria of the genus *Agrobacterium* and petunia. The trade name of glyphosate is *Round up*, and RR soybeans® mean "ready for *Round up*".

long term, generating mistrust (Furnival & Pinheiro, 2008, 2009; Castro, Young & Lima, 2014). Moreover, the diffusion of transgenic plants in the world has brought a fundamental question to the debate on the safety of transgenic foods, as Fonte (2004) points out: who will control this new agri-food system? What degree of monopoly will be accepted or acceptable? What are the social and environmental consequences of a possible concentration of power in industry?

Faced with this scenario dominated by legal disputes, controversies, controversies and uncertainties, 20 years after the first Provisional Measures that released transgenic soybeans in the country, and considering the third term of President Lula, the study aims to critically analyze the approvals made by CTNBio for the commercialization of transgenic corn and soybean seeds in Brazil until December 2022, and to elaborate some reflections that can be considered by the government that begins, in the light of the application of the precautionary principle and the duties of the State to guarantee sovereignty and food security. It is expected to contribute to the resumption of the debate on the release of transgenics in the country, in the context of the defense of the human right to adequate food.

2 THEORETICAL REFERENCE

The first genetically modified organisms (GMOs) were developed in the 1970s. At the Asilomar Conference in California in 1975, molecular biologists gathered there, due to the risks related to the confined use of GMOs in the laboratory, decided to establish a moratorium – which lasted only one year – for three experiments, recommending both caution, given the unpredictability of its effects, as well as postponement, until its dangers were better assessed, guidelines for biosafety of research with confined GMOs (Cascais, 2007; Pelaez, 2010). It was absent from the debates at the time, the agricultural use and the manufacture of genetically modified plants to be released into the environment (Apoteker, 2011).

The commercial use of GMOs has reached the market, not in the form of foods, but of proteins used in vaccines and medicines, such as insulin, and has not generated disputes or controversies. For Ferment (2011), this can be explained by two reasons: this use represented an important technical step for the scientific community in meeting social needs, and because users of these new technologies could be monitored, allowing the detection of side effects of technology on human health and the intervention of public authorities if necessary. Other important differences: what is consumed, for example, in the case of insulin, is the product of expression of the transgene (the recombinant protein), since the GMOs themselves, proteins and viruses that produce proteins of therapeutic interest, are discarded after the isolation and purification of their synthesis products; in addition, these are GMOs confined in laboratories. With transgenic plants, the process and risks are different, since, released into the environment, these living beings can transfer genetic material to other organisms (Ferment, 2011). For this reason, said then Greenpeace activist Arnaud Apoteker (2011): "the consequences of genetically modified crops on the environment, the way of life and the choice of the agricultural model, require undoubtedly greater public debate than the use of GMOs in confined environment" (p. 85). The debates on the subject, involving the

most diverse actors, are almost always permeated by controversies and polarizations (Lacey, 2006; Camara, 2013; Mariconda, 2014, Barroso et al, 2021)

In the seed business, Monsanto was a pioneer. The first field tests took place in 1986 in France and the USA with herbicide resistant tobacco culture (ISAAA, 1996). That same year, the White House Office of Scientific and Technological Policy (OSTP) issued a directive creating a Coordinated Framework for Biotechnology Regulation, establishing that biotechnology products would be regulated under existing federal laws, not including new regulations (Robin, 2008). It was on the basis of the principle of substantial equivalence that no specific regulation was made for transgenics in the USA, nor was the need for labelling, different from what occurred in Europe, where there was a moratorium on the cultivation of transgenics, and the regulation opted for the precautionary principle, on a case-by-case basis, in addition to establishing the indication on the label to guarantee the consumer's right to information on transgenic foods (Saija, 2017; Errigo, 2020; Ferment, 2008). The European Union, in disciplining GMOs, has adopted the precautionary principle, either in Directive 18 (2001) on the deliberate release of GMOs into the environment, or in Regulation No 178 (2002), which lays down the general principles and standards of food law – which includes traceability and labelling rules for identifying GMO foods – and establishes the European Food Safety Authority, responsible for the risk assessment of GMOs on health and the environment (Saija, 2017).

Another characteristic of the process in the USA was the continuous simplification, as a way to encourage biotechnology in the county, which did not happen without controversy (Lacey, 2006; Pizella & Souza, 2016; Fernandes, 2015). Also in Brazil, the idea of flexibility in regulation was present, when a group of experts was formed in 1994 to formulate the first biosafety standards; the group did not consider it necessary to have a law, nor for biotechnology to bring any new risk; only biotechnology products should be evaluated, but by existing regulatory bodies (Pelaez, 2010). In fact, studies that seek to compare the regulation of GMOs in Brazil with the European and North American process indicate that our system is closer to the liberal North American model (Pizella & Souza, 2016; Moriconi, Tonietti, Moreno & Matté, 2014). This is due to the choice between applying the principle of substantial equivalence (PSE) or the precautionary principle (PP).

The PSE was introduced by the Organization for Economic Cooperation and Development (OECD) in 1993 and then adopted by the United Nations Food and Agriculture Organization (FAO) and the World Health Organization (WHO) in 1996. The concept of substantial equivalence was proposed in the context of the determination of food safety and food components derived from organisms developed by the application of modern biotechnology, which would be substantially equivalent to their conventional analogues. The idea was to consider that existing organisms used as food would serve as a basis for comparison when assessing the safety of human consumption of a food or food component that had been modified or new; and since they are substantially equivalent, the new foods would be considered in the

same way as their conventional counterpart; if it is not substantially equivalent, then the differences identified should be the focus of further evaluations (OECD, 1993, pp. 14-15).

Several objections can be made to the PES, from epistemic questions, which question its scientificity, given the inaccuracy, since the degree of variation tolerated has never been defined, to its character as a regulatory principle, since it does not provide for toxicity assessment, besides presenting a basic contradiction, because, for example, whether transgenic maize is substantially equivalent to non-transgenic corn and, so it does not need to be labeled, why then was patented as new invention? (Millestone, Brunner & Meyer, 1999; Ferment, 2008, 2011; Lacey, 2010; Fernandes, 2015; Zaterka, 2019).

On the other hand, the PP has been following the advance of biotechnology since its inception, in the World Charter of Nature of the European Community (1982), at the Stockholm Environment Conferences (1972) and Rio de Janeiro (1992), as well as in the Cartagena Protocol (2000), to which Brazil is a signatory (Wedy, 2009; Platiau & Varella, 2004). In the Rio Declaration (1992), it was stated in its principle 15 that "In order to protect the environment, states should apply broadly the precautionary criterion according to their capacities". According to Rios (2004), when inserted in the Rio Declaration, "the precautionary principle was elevated to the rule category of international law" (p. 4). One of the results of Rio-92 was Agenda 21, in which chapter 35, which deals with science for sustainable development, reaffirms that "in the face of threats of irreversible environmental damage, the lack of scientific knowledge should not be an excuse to postpone the adoption of measures that justify themselves" (35.3). The intended approach at that time was to adopt the precaution as a "basis for policies relating to complex systems which are not yet fully understood and whose consequences of disturbances cannot yet be foreseen" (35.3). It was also in Rio-92 that the Convention on Biological Diversity (CBD) was signed, which includes the Cartagena Protocol on Biosafety, the first document that scopes the GMOs, as read in Article 4: "all modified living organisms that may have adverse effects on the conservation and sustainable use of biological diversity, taking into account the risks to human health." Thus, caution is not restricted to environmental damage, as was initially thought of. The Protocol is explicitly aimed at GMOs, although using another nomenclature, and establishes guidelines for regulating the cross-border movement of any living organism that has a combination of unpublished genetic material obtained through the use of modern biotechnology[2].

In the original text of the bill of the first biosecurity law that came to the Senate in 1992, there was explicitly the requirement of EIA/RIMA for activities related to GMOs, in order to conform to the Constitution, but there was amendment, to leave it up to CTNBio to choose whether or not the requirement was appropriate. Although this discretion of the Commission was the subject of Decree, because it was vetoed of the bill, this was the core of all the controversy in the release of transgenics in Brazil, mainly because the Resolution of the National Council of the Environment (CONAMA) No. 237 (1997),

[2] According to Berlin (2011), the term GMO was an imposition of Monsanto "so that these revolutionary techniques could be described as the continuation, by more reliable, more precise, more predictable and safer methods, of what humanity had done since the beginning of the domestication of plants and animals" (p. 158).

recognized the introduction of exotic and/or genetically modified species as subject to environmental licensing, as effective or potentially polluting or causing environmental degradation, and therefore the requirement of the EIA/RIMA.

For former presidents of CTNBio (2021), it was the delay in deciding whether or not to need the EIA/RIMA, which led farmers in Rio Grande do Sul to plant Monsanto soybeans with seeds brought from Argentina. It should be noted that in Argentina, the introduction of transgenic seeds in 1996 occurred when Monsanto renounced the patenting of the seed of its RR soybean®, selling only glyphosate, although its practice of prosecuting farmers for patent infringement is known (Andrioli, 2008).

In addition to the conflict between environmental legislation and biosafety law, the releases of transgenics should also be analyzed in the context of another important legal framework. The Organic Law on Food Security (LOSAN) – Law No. 11,346 (2006), regulated by Decree No. 7,272 (2010) – which created the National Food and Nutrition Security System (SISAN), with a view to ensuring the human right to adequate food (BRASIL, 2006). In a study on Brazilian scientific production, in the field of public health, on GMOs, with regard to (in)food safety, it was concluded that in fact it is not addressed to safety, but to the insecurity of genetically modified foods (Camara, Marinho, Guilam & Nodari, 2009).

Transgenic foods are therefore at the point of union between an intricate relationship that unites science, law, precaution, sovereignty and food security, in a context that does not escape the political debate (Zanoni & Ferment, 2011; Guivan, 2001).

3 METHODOLOGY

A descriptive study was carried out, with a quantitative approach, using the procedures of bibliographic and documentary research (Sá-Silva, Almeida & Guindani, 2009). Initially, a narrative literature review was made on the state of the art of the release and regulation of transgenics in Brazil, Europe and the United States. This type of review, more simplified, can be useful in describing the state of the art of a specific subject, for a more free approach from a theoretical or contextual point of view (Grant & Booth, 2009; Souza, Firmino, Marques-Vieira, Severino & Pestana, 2018), being, therefore, the selection of studies and the interpretation of information, subject to the subjectivity of the author. Reading forms were elaborated from the bibliographic research, including legal documents, to organize chronologically remarkable facts in the historical and political process of the release of transgenic seeds in the USA and Europe, to relate to the Brazilian case, object of the study.

The documentary corpus of the research was constituted, from secondary data sources, by digital files of electronic documents representing official records for communication purposes, available for download in public access portals. For data collection, the summary table of transgenic plants approved for commercialization in Brazil was located, through consultation with CTNBio's official website (http://ctnbio.mctic.gov.br/inicio), tab "CTNBio services", "commercial release", "plants" folder", subfolder "plant table - commercial use"; for data processing, this PDF file was downloaded, which was

downloaded as 'original table'. Only the data on soybean and corn releases were selected and copied from the original table, because they are the plants predominantly used in human food and represent the highest percentage of planted area (Finardi & Sbambato, 2021). To make up the research database, new individual spreadsheets were constructed, one of soybean and another of corn, with the following analytical categories selected for the study: GMO, patent holder, characteristic provided by genetic manipulation, year of application for authorization of the cultivation and year of approval of the commercial crop. The year of the request was considered in the analysis of the frequency distribution of authorized plants, according to their characteristics and their holders, while the year of approval of the application was used for the historical analysis of the releases throughout the studied period.

The survey was conducted from June 2021 to December 2022; the last visit to the CTNBio page to verify the update of the data from the original table was made on December 10, 2022, observing that the date of update of the file with the original spreadsheet was 15/02/2022. To complement or clarify data from the original table, the technical opinions were consulted directly, obtained on the same CTNBio page, tab "CTNBio services", "commercial release", "plants" folder, "soybean" sub paste and "corn" sub paste.

Spreadsheets, tables, and charts were built using Microsoft® Excel for® Microsoft 365 MSO (Version 2203 Build 16.0.15028.20218) 64-bit. The data were processed to present the results using descriptive statistical measures. The reflections on the results of the survey were made based on the legal-normative framework of biosafety and food security currently in force in Brazil.

4 RESULTS AND DISCUSSION

In July 1998, under Fernando Henrique Cardoso (FHC), Monsanto sent a request to CTNBio to release the cultivation, on a commercial scale, of genetically modified soybeans to tolerate the herbicide glyphosate, Roundup Ready® soybean (RR soybean®). In the application, the company requested deregulation of the biosafety aspects of the product, claiming, among other things that: soybeans were already approved in other countries, its planting was already disseminated in Argentina and the USA, the glyphosate resistance gene inserted in the plant was innocuous and glyphosate was biodegradable and non-cumulative in the soil; another important claim made by Monsanto was the previous decision of CTNBio that had released the import of soybeans RR®, stating in its opinion that it was equivalent to non-transgenic soybeans (Pelaez, 2010). In fact, in September 1997, CTNBio had granted Ceval Alimentos (later acquired by Bunge) authorization to market oil made from transgenic soybeans imported from the United States (Menasche, 2000). The approval of Monsanto's application was granted by CTNBio, by express decision in Communiqué No. 54 (1998), without the requirement to carry out the EIA/RIMA.

From there, a series of legal disputes against Monsanto's soy authorization began. The Biosafety Law in force did not explicitly include the defense of the precautionary principle, but Article 225, § 1, IV, of the Federal Constitution (1988) which requires, in the form of the law, the prior study of environmental impact, "for the installation of work or activity potentially causing significant degradation of the

environment", finds support in that principle. In addition, the articles of law dealing with the creation and competences of CTNBio had been vetoed; only with its regulations, given by Decree No. 1,752 (1995), the Commission was created and its powers were established, among which, the requirement of the EIA/RIMA in the processes of release of GMOs, "as an additional document, if it deems necessary" (Art. 2, XIV), that is, in addition to CTNBio being able to decide whether or not it was the case to require the EIA/RIMA, this competence was given by Decree, and not by Law, as required by paragraph IV of §1 of Article 225 of the Constitution (Guimarães, 2021).

Based on the lack of the EIA/RIMA (not required by CTNBio) and the lack of definition of biosafety criteria for the authorization and marketing of GMOs, including labeling, the entities IDEC and Greenpeace (Brazilian Institute of The Environment and Renewable Natural Resources (IBAMA), subsequently joined the action) obtained favorable decisions in court, which they established, both the labeling of imported transgenic soybean oil, as well as the Union's prohibition of authorizing the commercial planting of transgenic soybeans, until CTNBio had standards regulating the control, supervision and release of transgenics in the country, with the realization of the EIA, in addition to the segregation of transgenic crops. The continuation of the lawsuit led, in June 2000, to the final decision of the judge who declared unconstitutional Art. 2, XIV, of Decree No. 1,752 (1995) and extended the prohibition of the cultivation and marketing of said soybeans to all GMOs. In this action, the Union was at Monsanto's side, which led IBAMA to withdraw, given the conflict with other government sectors.

In the midst of legal disputes over the release of transgenic soybeans, Law No. 10,165 (2000) amended Law No. 6938 (1981), which instituted the National Environment Policy, to include the introduction of exotic or genetically modified species and the use of biological diversity by biotechnology in the list of potentially polluting activities and users of environmental resources. This intensified the conflict between the Biosafety Law (which did not address the requirement of the EIA/RIMA) and the Environmental Legislation. In an attempt to resolve the issue, a Provisional Measure amended the Biosafety Law to include an article establishing CTNBio's competence to identify the activities resulting from the use of GMOs and potentially causing derivatives of significant degradation of the environment and human health. Article 1 - D, XIV established, among others, CTNBio's competence to "issue a conclusive prior technical opinion, on a case-by-case basis, on activities, consumption or any release in the environment of GMOs, including its classification as to the degree of risk and level of biosafety required [...]".

The conflict of powers between environmental legislation and biosafety legislation was only resolved in court, at second instance, in February 2002, when the court ruled that the provisions of Law No. 8,974 (1995) should prevail. Thus, after the judicial suspension of the first request authorized by CTNBio, in 1998, it was only in the Lula government, and through MP, that soybean crops were released for commercialization in 2003 and 2004. However, as soon as the new Biosafety Law was approved, in 2005, the Attorney General proposed a direct action of unconstitutionality (ADI 3526) against CTNBio's

competencies for the evaluation of biosafety in the environmental area[3]. This ADI is still in the Supreme Court, having last move in September 2021, after request for views of Minister Gilmar Mendes (https://portal.stf.jus.br/processos/detalhe.asp?incidente=2305630). IDEC and Greenpeace continue to participate in this action as interested parties, as well as the entity Terra de Direitos.

4.1 RELEASE OF TRANSGENIC SOYBEAN AND CORN PLANTS BY CTNBIO: 20 YEARS OF EXPANSION AFTER THE ACCOMPLISHED FACT

While the dispute within the courts is still ongoing, CTNBio continues to release GMO crops. The results show that 18[4] transgenic soybean and 56 transgenic corn events were authorized for commercial cultivation in Brazil during the study period. The characteristics obtained by genetic manipulation of these soybean and corn events reproduce the world standard of what is considered the first wave of transgenic plants (Fernandes, 2015), with predominance, in soybean, herbicide tolerance, in isolation or combined with other characteristics, and in corn, a combination of herbicide tolerance and insect resistance (Table 1).

Table 1: Distribution of the number of transgenic soybean and corn plants, by characteristic, released for commercial cultivation by CTNBio, in the period 1998-2022, Brazil.

Characteristic	Soy	Corn
Insect resistant	1	10
Herbicide tolerant	10	10
Herbicide tolerant and insect resistant	4	33
Tolerant to herbicides and others*	2	0
Other(s)**	1	3
Total	18	56

Own elaboration

Legend: *Others: drought tolerance and modified fatty acid profile; **Other corn: Restoration of fertility for seed production; increased amyasis thermostability; drought stress; in soybean: nematode resistance and selectivity to HPPD-inhibiting herbicides.

For Marinho and Gomez (2004) the way Brazilian government agencies act in the release of transgenics "constituted an important conflict-generating focus" (p. 96). An example of this, regarding the requirement of the EIA/RIMA, never requested by CTNBio, the first President of the Commission stated that this question did not make sense, in the case of transgenic plants, because "How to study the environmental impact of a tree or shrub?" (Colli, 2021, p. 93). If for the longest-running member of CTNBio, until the approval of the new law in 2005, "It was seven years in which little was invested in biotechnology in Brazil, hindering the generation of know-how and critical mass in the biotechnology

[3] In the drafting of the new biosafety law, there was a fundamental change in the original proposal, which conferred an advisory and non-deliberative role on CTNBio regarding the issuance of assent to the research and marketing activities of GMOs. The law passed, however, granted broad powers to the Commission in relation to the other bodies involved in the Ministries of Health, Agriculture and the Environment, including the requirements of EIA/RIMA (Pelaez, 2010).

[4] The term event comes from the expression "transformation event", since the transgenic procedure promotes a cell transformation, transferring exogenous genetic material (transgene) to several receptor cells that will incorporate this material in different locations of its genome. Therefore, each transformed cell has its own particular transgene integration pattern. The plant derived from one of these cells is considered an "event" (Galeano, 2017).

sector in our country" (Nepomuceno, 2021, p. 11), for Fernandes (2015), the first decade of validity of the new law was marked by the absence of scientific rigor in the approval processes of transgenics in Brazil. This lack of scientific rigor generated legal disputes, based on the disrespect of the Constitution for the non-requirement of EIA/RIMA.

As of 2005, within the legal framework of the new Biosafety Law, the first authorizations granted by the Commission were corn in 2007, referring to requests made in 1998, 1999 and 2000, by Bayer (Liberty link/T25 – tolerant to ammonium glufosinate), Monsanto (MON810 – resistant to insects) and Syngenta (Bt11 – resistant to insects), respectively.

The case of corn is emblematic, especially due to the problem of coexistence and consequent contamination, considering the deficiencies in the regulatory process, which resulted, once again, in judicial suspension of liberty link, until coexistence and monitoring plans were presented. Subsequently, with the establishment of monitoring and coexistence standards by CTNBio in August 2007, the injunction suspending the authorization of transgenic maize was revoked and this event and mon810 were authorized for commercial purposes in March 2008 (Ferment, Zanoni, Brack, Kageyama & Nodari, 2009). Thus, the judicial questions that have marked our history about transgenic release processes in the country are repeated.

4.2 RELEASE OF TRANSGENIC SOYBEAN AND CORN PLANTS BY CTNBIO: THE FIRST 20 YEARS AND THREATS TO FOOD SOVEREIGNTY AND SECURITY

Transgenics can be considered a step forward in the same model of industrialization of agriculture implemented by the Green Revolution, which was based on scientific reductionism and strategies for nature control, presenting itself with promises never fulfilled, such as the end of hunger and the reduction of pesticide consumption (Shiva, 1997; Ferment, 2011; Lacey, 2006; Carneiro et al, 2015). The advance of capital over seeds, making this one of its goods, sheltered by property rights, is a worldwide phenomenon, which had in Brazil a privileged locus to develop, facilitated by the historical concentration of land and the option of economic policy to maintain an export model of natural wealth, sustained by deregulation (Lima, 2021; Carneiro et al, 2015).

In a study that analyzed the impact of the adoption of transgenic crops on the demand of pesticides, it was observed that the total use of pesticides in Brazil increased 1.6 times between the years 2000 and 2012, with emphasis on use in soybean crops, which increased more than 3 times; moreover, in the period from 2000 to 2012, the use of pesticides per capita increased by 7%, while productivity increased only 3.5%. (Almeida, Friedrich, Tygel, Melgarejo & Carneiro, 2017). It follows that transgenic crops contributed to the increase in the use of pesticides, and glyphosate-based herbicides account for more than half of all pesticide consumption in Brazil (Ministry of Health, 2016, p. 13). The growth of the area of production of transgenics is accompanied by a much greater growth in the use of pesticides, not only in Brazil (Fernandes, 2019; Carneiro et al, 2015), as well as in the USA (Benbrook, 2009).

The increase in pesticide tolerant crops should be a concern for food safety and sustainability, given the emergence of superpests, soil contamination, water table and damage to workers' health (Benbrook, 2009, Carneiro, Augusto, Rigotto, Friedrich & Burigo, 2015). The dangers of glyphosate, a herbicide used since the earliest transgenic crops, are widely known and have been classified as probably carcinogenic to humans by the International Agency for Research on Cancer (IARC, WHO, 2015). As for Bt crops, its risks have also been widely disseminated, including in Europe, having been one of the reasons for the moratorium in France (Ferment, 2008). In 2011, the presence of bt toxin from mon 810 transgenic maize was found in the blood of pregnant women and their fetuses (Aris & Leblanc, 2011). In the USA, StarLink corn contaminated the food chain, with the suspicion that the properties of the transgenic protein could trigger allergic reactions (Almeida Júnior & Mattos, 2005). The largest study ever conducted with rats fed glyphosate tolerant transgenic corn (Monsanto NK 603, also approved in Brazil), coordinated by french scientist Gilles-Eric Séralini, showed worrying results, among them, higher and frequent mortality, in addition to breast tumors and spinal and kidney problems in females and chronic deficiencies in the liver and kidneys of males (Séralini, Clair, Mesnage, Gress, Defarge, Malatesta, Hennequin, and Vendômois, 2012). All these events, approved in Brazil, are being cultivated and consumed by the Brazilian population.

The results point to the conflict between the releases of soybean and corn, the object of the study, and the legal frameworks of food security established in Brazil. Table 2 shows that only two companies – Monsanto and Syngenta – hold 38 of the 74 authorized soybean and corn events in Brazil, therefore, more than half.

Table 2: Distribution of the number of soybean and corn transgenic crops authorized by CTNBio, per holder, in the period 1998-2022, Brazil.

	Soy	**Corn**	**Total**
Monsanto	06	16	22
Monsanto & Dow	00	01	01
Syngenta	01	15	16
Dow	04	08	12
Dow & DuPont	00	03	03
Dupont	01	10	11
Cortega	00	01	01
Bayer	03	01	04
Basf	01	00	01
Basf & Embrapa	01	00	01
TMG	01	00	01
Helix Seeds	00	01	01
Total	18	56	74

Own elaboration.

For epidemiologist Jaime Breilh (2015), the monopoly of agribusiness is among the obstacles of the 21st century to build healthy societies, by the model of agriculture that "destroys the food and cultural sources of cultural sovereignty" (p. 41). The concentration of few companies in the world market for

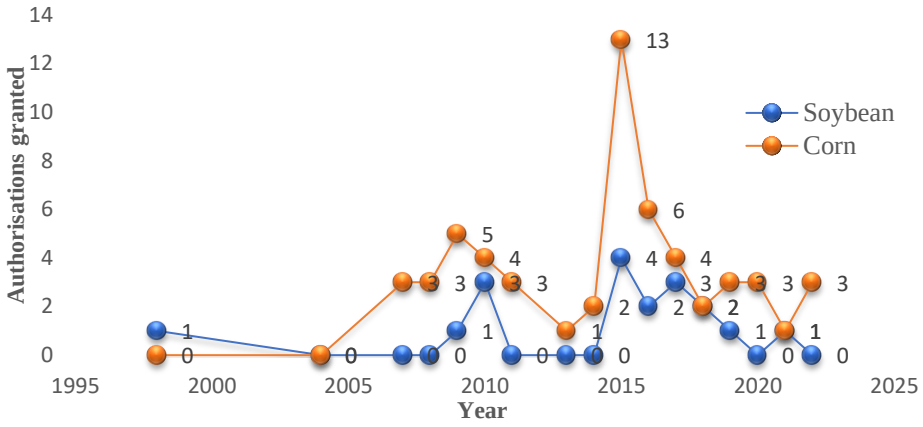
transgenic seeds is a reality that generates great concern in discussing food sovereignty, given the power of capital over seeds (Berlan, 2011; Lima, 2021), which can be considered a heritage of humanity, of the cultivating peoples (Fernandes, 2007). A powerful weapon for coping with this power is the organization of society, as seen in Syngenta's attempts to patent seeds with Terminator technology and a wide-coverage patent on various vital genetic sequences of rice, which were barred, thanks to the action of the ETC Group (Ribeiro, 2011). For Fonseca and Guivant (2019), however, with the approval of the new Biosecurity Law in 2005, there was a political weakening movement of the movement opposed to the process of transgenization of agriculture, while the transgenic production area and the commercial approval of new varieties of GMOs grew. The author may be right, because, in the case of the labeling of transgenic foods, passes in the Senate a bill already approved in the House that will make it much more difficult to detect the presence of transgenic DNA from ingredients derived from soybean or transgenic corn, present in the vast majority of processed foods, such as soy lecithin, and corn glucose (Cortese, 2018; Cortese, Martinelli, Fabri, Melgarejo, Nodari & Cavalli, 2017).

In any case, it is up to the State to provide the population with adequate food, respect their access to them, as well as protect the population from those who prevent such access, such as corporations producing transgenic seeds. In a fairly simple reasoning, given the unlikely coexistence and impossibility of segregation, even in the entire production chain, if all crops are transgenic, neither the farmer nor the consumer will have the freedom of choice, either to plant or to eat.

The most contradictory in this process, is that the SISAN was established by LOSAN, in 2006, food was inserted as a fundamental social right in 2010, year in which the National Food Security Policy (PNSAN) was also approved, in 2102, the National Policy of Agroecology and Organic Production (PNAPO) was approved and in 2015, the National Pact for Healthy Eating was approved.

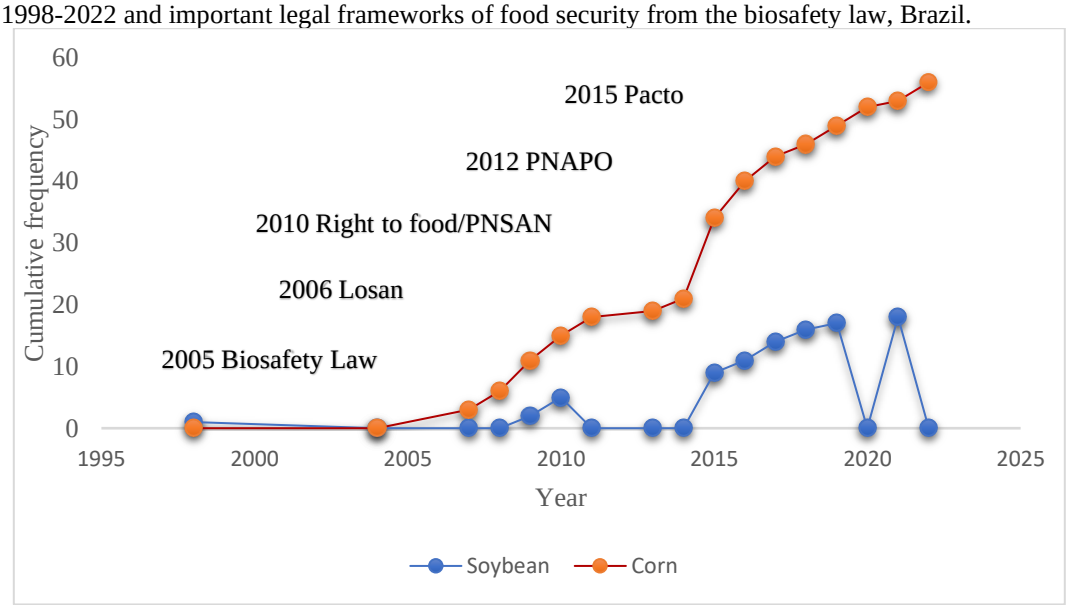
Figure 1 represents the distribution of releases, per year, during the study period, and Figure 2 lists the accumulated frequency of these releases in the timeline with the approval of important legal frameworks for the defense of sovereignty and food security, as opposed to transgenics.

Figure 1: Authorizations granted by CTNBio for crops of transgenic plants of corn and soybean, per year, in the period 1998-2022, Brazil.



Own elaboration.

Figure 2: Cumulative frequency of authorizations granted by CTNBio for crops of transgenic corn and soybean plants, per year, in the period 1998-2022 and important legal frameworks of food security from the biosafety law, Brazil.



Own elaboration

Legend: Losan: Organic Law on Food Security; PNSAN: National Food Security Policy; PNAPO: National Policy of Agroecology and Organic Production; Pacto: National Pact for Healthy Eating.

Art. 3 of LOSAN (2006) states that food security is based on "health-promoting food practices that respect cultural diversity and are environmentally, culturally, economically and socially sustainable", something that the transgenization of agriculture does not favor (Pessanha, 2004; Winckler & Munarini, 2019). In addition, Article 5 of the same law recognizes that "The achievement of the human right to adequate food and food and nutritional security requires respect for sovereignty, which gives countries the primacy of their decisions on food production and consumption."

The PNSAN, instituted by Decree No. 7,272 (2010) is very clear in establishing, among its guidelines and objectives listed in Art. 2, II, the "promotion of the supply and structuring of sustainable and decentralized systems, of agroecological basis". Decree No. 7,974 (2012) instituted the PNAPO, with the objective, provided in article 1, of "integrating, articulating and adapting policies, programs and actions inducing agroecological transition and organic and agroecological production". The transition, according

to PNAPO, would be a "gradual" process of changing agroecosystem practices and management, which would lead to agriculture systems incorporating eco-based principles and technologies.

What was verified in the real world was an increase in the releases of transgenic crops, from the approval of PNAPO, which peaked in 2015, when the highest number of releases of the two crops studied was recorded, 13 types of corn and 4 types of soybean. This represents, considering the accumulated releases until 2015, therefore, 10 years of the Biosafety Law, 38.2% of corn and 44.4% in the case of soybean. In relation to the entire study period, corn and soybean releases in 2015 represent, respectively, 23.2% and 22.2% of the total releases, i.e., 18 years after the Biosafety Law, one-fifth of all authorized soybean and corn crops occurred in 2015, the year in which the Pact for Healthy Eating was established, Decree No. 8,553 (2015). One of the axes of this Pact, listed in Art. 3, II, is "to reduce the use of pesticides and induce models of agroecological food production", something that has not happened in Brazil to date, as the results of this study reveal.

It is not possible to produce food in an agroecological way at the same time that transgenic plants are produced that will enter the production chain to generate products and by-products of the food industry; this coexistence is not physically possible and the result is that we have on the market several products derived from transgenics that are not even labeled (Cortese, 2018), and the Food Guide itself for the Brazilian population makes no reference to this category of products (Ministry of Health, 2014).

Therefore, any ruler who proposes to guarantee the food security of the people, towards the realization of the right to food, through access to healthy food, urgently needs to break the progress of transgenics in Brazil.

5 FINAL CONSIDERATIONS

The legalization of the authorization of transgenic crops in Brazil continues to be questioned in court, considering that the Brazilian Constitution and the international instruments of which the country is a signatory offer legal support for the protection of the environment and the guarantee of food security, through precautionary measures regarding transgenic plants, which have never been adopted. Even so, two decades after the first authorization under the new biosecurity law, the country occupies the position of the second largest producer of transgenics in the world.

Given the advance of transgenics in Brazil, it is essential to question how a nation can be sovereign in the context of the monopoly of the seeds that feed its people. The president who took office on January 1, 2023, elected in a context of profound threat to democracy, now has before him the opportunity to correct the directions of seed production in the country, in the face of the tragedy that began to be announced in the late 1990s. It is a question of choosing between respecting democracy and citizen science, investing in agroecology, or being incoherent, once again, with his discourse to combat hunger and defense human dignity.

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