

CONFRONTATION PROPOSALS TO FACE NEGATIVE EXTERNALITIES FROM PESTICIDES IN BRAZIL

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ABSTRACT

This article aims to demonstrate the need for the Brazilian state to act on the internalization of the negative externalities of pesticides in agriculture. Thus, the research problem is: why does the internalization of negative pesticide externalities be important for an agricultural policy that respects fundamental rights? As a methodological strategy, initially, it identifies some Brazilian and international policies that supported the green revolution. It was the green revolution that disseminated agribusiness and intensive pesticide use. The second step investigates the negative pesticide externalities in agriculture, food, and the environment. Finally, the article shows some policies that could be adopted by Brazil to internalize the negatives pesticides effects. Pesticides violate human rights, so the democratic rule of law must act to reduce or end them. It proposes some actions to face the negative externalities of pesticides. It concludes that, as the pesticides have been supported by State, their discouragement must be the object of effective public policies

Keywords: pesticides; food; externalities; environment.

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PROPOSTAS DE ENFRENTAMENTO ÀS EXTERNALIDADES NEGATIVAS DECORRENTES DO USO DE AGROTÓXICOS NO BRASIL

RESUMO

O objetivo deste artigo é demonstrar a necessidade de uma atuação efetiva do Estado brasileiro na internalização das externalidades negativas decorrentes do uso de agrotóxicos na agricultura. Assim, o problema da pesquisa é: por que são importantes medidas de internalização das externalidades negativas decorrentes do uso de agrotóxicos para o desenvolvimento de uma política agrícola que respeite direitos fundamentais? Como estratégia metodológica, inicialmente serão identificadas as medidas adotadas pelo governo brasileiro e organismos internacionais que difundiram a revolução verde e o avanço do agronegócio no país, valendo-se da modernização agrícola e do uso intensivo de agrotóxicos. Após, serão investigadas as externalidades negativas decorrentes do emprego de agrotóxicos na agricultura, bem como a necessidade de se promover a internalização desses efeitos negativos, desonerando a população desse custo e convergindo ações para impedir a violação dos direitos humanos. Como resultado, propõe-se medidas para a internalização das externalidades negativas geradas pelos agrotóxicos. Concluiu-se que, assim como a expansão do agrotóxico foi amplamente fomentado pelo Estado, seu desestímulo deve ser objeto de políticas públicas efetivas.

Palavras-chave: *agrotóxicos; alimentação; externalidades; meio ambiente.*

INTRODUCTION

This article relies on the idea that the advance of agribusiness in Brazil took place in association with the adoption of practices widespread by the green revolution, through the Brazilian government's commitment to strengthen agriculture based on a productive system supported by the intensive use of modern techniques of cultivation and application of chemical inputs, aimed at increasing modernization and productivity in the field while disregarding the negative effects such production model relegates to society.

The use of pesticides in the countryside, facilitated by the advance of agribusiness, has caused damage and imposed burdens on the whole society. It is precisely to this process of onlending the costs generated by a given activity to a third party not involved in the production process that economic studies call a negative externality.

The agribusiness production process presupposes economic and social exploitation that unequally distributes profits and waste. The profits from the agricultural production are converted into the form of benefits for the central countries, while their waste, the negative externalities, manifests as losses for the Brazilian population.

Given this setting of violations, there is the need to incorporate environmental and social externalities into production costs to create the circumstances so that polluting is no longer more advantageous for the producer than the adoption of the necessary prevention measures.

With that in mind, we seek here to understand how determinant the government's incentive was for the advancement of agribusiness in Brazil, from the adoption of the green revolution model, and how the increase in the use of pesticides in the countryside as a result of this process has led to damage to the environment and the food to which people have access while bearing the costs of this means of production. Thus, the issue that arises is why are measures to internalize negative externalities resulting from the use of pesticides important for the development of an agricultural policy that respects fundamental rights?

This work generally aims at showcasing the need for effective action by the Brazilian State in the internalization of negative externalities resulting from the use of pesticides in agriculture. Specific objectives can be outlined as follows: presenting the role of the Brazilian State in the development of an agricultural policy led by the use of pesticides; identifying

the negative externalities generated by the use of pesticides in agriculture; demonstrating the violations of human rights to an ecologically balanced environment and adequate nutrition promoted by the conventional agricultural model; presenting mechanisms for the internalization of negative externalities resulting from the use of pesticides in agriculture, and proposing measures whose implementation by the public authorities is essential in this context.

Methodologically, there is the pinpointing of the measures adopted by the Brazilian government and international organizations that served to spread the green revolution and encourage the advancement of agribusiness in the country using the modernization of cultivation techniques and the intensive use of pesticides. This first part should allow for the argument that the intensive use of pesticides is not a natural need in agriculture, but the result of an agricultural policy promoted by the Brazilian State, which has compromised fundamental rights. Then, the negative externalities resulting from the use of pesticides in agriculture will be investigated, as well as the imperative to promote the internalization of those negative effects. Measures to internalize the externalities generated by pesticides are proposed, aiming at an agroecological transition.

As a result of the research, measures are proposed to affect the internalization of negative externalities resulting from the use of pesticides, such as the review of the current tax exemption policy for pesticides and the rural credit and insurance policy; monitoring and production of information on the damage caused by pesticides; more effective action by the bodies of Justice and the Judiciary; greater rigor and restriction of pesticides in circulation in Brazil.

In conclusion, there is the argument that, just as the massive use of pesticides reflects an agrarian policy that has compromised fundamental rights, the transition to an agroecological paradigm must also have effective legal mechanisms for the internalization of negative externalities.

1 GREEN REVOLUTION AND POLICIES TO SUPPORT PESTICIDES

Since the mid-twentieth century, the agricultural development in Brazil has been guided, with the encouragement of the State, by the chemification and mechanization of crops, with agricultural production

becoming increasingly dependent on the agrochemical industry (PORTO-GONÇALVES, 2017). It can be argued that the market has been imposing its logic of maximizing profit on agriculture by increasing productivity, which is also formalized by the agricultural policy implemented by Brazilian governments and led by the green revolution.

The policies and measures adopted by Brazilian governments are part of a larger context of the transformation of agricultural production, not only in Brazil but throughout the world, which took place during the green revolution. According to Shiva (2015, p. 17), this “was the name given to the scientifically based transformation in Third World agriculture”.

The green revolution relied on the neo-Malthusian idea that mankind was unable to produce the food needed for the present and future population and, therefore, a change in the agricultural model should take place to allow the intensification of production (SHIVA, 2015).

Despite justifying itself in the need to solve the issue of hunger in the world, the green revolution ignored the debate on the real reasons for hunger and attributed a strictly technical character. The problem of hunger around the world would be solved with the employing of modern systems in agriculture and, thus, the belief was reinforced that there is a technical solution for everything, as long as it follows the hegemonic framework standardized by dominant countries (PORTO-GONÇALVES, 2017).

The agroindustrial model conceived by the green revolution was planned to also incorporate the solution for another issue, that is, the massive stock of nitrogen leftover accumulated across North America as a remnant of the bombs manufactured during World War II. The use of nitrogen as an inorganic fertilizer made allowed for the replacement of the crop rotation technique for nitrogen fixation in the soil and was the starting point for the dissemination of large monoculture crops. This inorganic fertilizer remnant was distributed across the third world, aimed toward a new form of agriculture (McMICHAEL, 2016).

The poisons that have been applied in pests control in crops are also surpluses from the war industry, initially created as chemical weapons. European and North American industries have improved the applicability of these chemical weapons in agriculture while commercially developing them as pesticides and dumping their toxic residues in several countries through the green revolution (BULL; HATHAWAY, 1986).

Another process that marked the green revolution was the development of high-yield plant varieties through the genetic improvement of

seeds. However, this high yield depends on the association of cultivation and the mechanization of production, and the use of chemical inputs, which resulted in chemically dependent crops and an increase in the volume of pesticides sprayed in countries that adopted this production model (SHIVA, 2015; CARNEIRO *et al.*, 2015).

To disseminate this new means of agricultural production, it was then necessary to steer the agricultural policies of the dominated countries to favor the adoption of the practices idealized by the green revolution. Some international organizations played a key role to this end.

1.1 International organizations in the context of the green revolution

The agricultural transformation process promoted by the green revolution was fostered by international organizations such as the Food and Agriculture Organization of the United Nations (FAO), the International Monetary Fund (IMF), and the World Bank (WB), with intensive use of pesticides, chemical fertilizers, and manipulated seeds as a premise for its development (LONDON, 2011).

In the late 1960s, the World Bank intensified its activities focused on agriculture and rural development. Through articulation with the Ford and Rockefeller North American foundations, it acted in the creation of an international network of agricultural research centers, to promote the green revolution in third world countries. It was from this initiative that, in 1971, the *Consultative Group on International Agricultural Research* was created, enabling the activities of the World Bank to finance the improvement of technologies aimed at the green revolution, as well as contributing with financial resources for the development of the proposed agricultural model in third world countries (PEREIRA, 2016).

One of the ways the World Bank intervened in Brazil was through a project approved in 1973, which provided a loan of US\$ 54 million to finance the modernization and expansion of agroindustries in the center-south region of Brazil, following the paradigms of the green revolution. A second project, approved in 1976, earmarked another US\$ 84 million for the expansion of agribusiness, including targeting technical assistance. In 1983, an additional US\$ 400 million were made available to continue the promotion of the green revolution within the country (WORLD BANK, 1973; 1976; 1983).

It was also the work of the World Bank that enabled the incorporation

of small farmers into the production of *commodities*³ and their integration into the agroindustrial means of production. Developed in the 1970s, the World Bank Project to Combat Rural Poverty “advocated help to 700 million small landowners (but not the landless) with credit – it integrated small landowners to the green revolution technologies increasingly applied in the development of new agroexports” (McMICHAEL, 2016, p. 105).

Initially encouraged by international institutions, and soon supported by national credit instruments, the advance of agribusiness in Brazil fostered an agricultural production dependent on modified seeds, chemical inputs, and the foreign market itself, as it grows *commodities*, not food.

It can thus be seen that the green revolution, supported by strong national and international credit lines, favored the advance of agribusiness: a model of intensive agricultural production, cultivating monocultures (currently transgenic) destined for export, with highly mechanized crops supported by the application of modern chemical inputs (pesticides and fertilizers). Therefore, the green revolution promoted the integration of third-world producing regions into capital routes through the expansion of agribusiness with the support of international organizations and the encouragement of local governments (McMICHAEL, 2016).

1.2 National incentive for the use of pesticides

Above all, the green revolution was a political choice and, despite not being the only option available for progress in the countryside, it converged the interests of landowner capitalists and the great world powers while greatly facilitating its advance in several countries, overlapping other possible ways.

In Brazil, the military regime fostered the legal and political conditions that ensured the advance of the green revolution in the country, inserted in government programs as measures to modernize agricultural production, from the maintenance of monocultures, introduction of the use of agricultural machinery and encouragement to the use of chemical inputs in crops.

Government programs provided farmers with the technological packages that outlined this new model of agricultural production. To receive state aid and incentives, the farmer should fit into the official program, which required the use of pesticides, fertilizers, and certified seeds, known

³ Standardized and storable primary products, with markets organized worldwide (DELGADO, 2012).

as modern inputs (MACHADO; MACHADO FILHO, 2014).

Bull and Hathaway (1986) reinforce that the application of chemical inputs by farmers was not only included among the production costs financed by rural credit but a condition for their concession. The authors point out that, in the 1970s, the total amount granted through the National Rural Credit System (SNCR) for the purchase of pesticides was enough to cover almost all sales of such inputs in the country, financing 85% of the market in 1973.

In this context, the Agricultural Credit Guarantee Program (Programa de Garantia da Atividade Agropecuária, or PROAGRO) and the granting of rural credit by financial institutions, in compliance with Circular No. 241/1974 of the Central Bank of Brazil, established that the borrower (the rural producer to whom credits are granted) should fulfill an obligation to use modern inputs to receive financial benefits (BCB, 1974).

And, even today, the enforcement of PROAGRO imposes a similar obligation on the beneficiary, as highlighted through Resolution No. 4,418/2015 of the Central Bank of Brazil, clarifying that the bases of agricultural policy developed during the military period still guide agricultural development in the country (BCB, 2015).

Since then, the assistance offered by the Brazilian government in the form of technological packages has been imposed on farmers. The governments of the military regime turned their planning to the agricultural sector, promoting the development of agribusiness in the country guided by the precepts of the green revolution while incorporating large and small producers. From then on, the intensive use of pesticides became the basis for sustaining this new model of agricultural production.

Post-military dictatorship governments in Brazil perpetuated this policy of encouraging the use of pesticides. Signed between the Minister of State for Finance and the Secretaries of Finance, Finance or Taxation of the Brazilian States and the Federal District, ICMS Agreement No. 100/1997 reduced by 60% the basis for calculating the Tax on Circulation of Goods and Services (Imposto sobre Circulação de Mercadorias e Serviços, or ICMS) on interstate departures of agricultural inputs, including the most diverse range of biocides and pesticides. Since then, this agreement has been renewed, with the benefit initially extended until December 31, 2025 (CONFAZ, 1997).

Decree No. 5,195/2004, in turn, reduced to zero any contribution rates

towards PIS/PASEP⁴ and COFINS⁵ levied on imports and gross revenue from the sale of manure, fertilizers, and pesticides within the domestic market. Revoked by Decree No. 5,630/2005, tax exemptions were maintained by the new standard (BRASIL, 2004, 2005). Once again, the commercialization and consequent use of chemical inputs were favored by the State.

Also, Decree No. 6,006/2006 exempted several pesticides from the incidence of tax on industrialized products (IPI). Repealed by Decree No. 7.660/2011, and later replaced by Decree No. 8,950/2016, the pesticides' benefit of exemption from IPI was maintained and currently remains in force, reducing the cost of the inputs and making their use more advantageous (BRASIL, 2006; 2011; 2016).

Many rules facilitating the use of pesticides in agriculture reinforce the understanding of Porto-Gonçalves (2017), for whom the dependence of the rural producer on the technical-scientific agricultural component (machines, seeds, and pesticides) confers increasing power to high-tech industries. Thus, these industries go on to command not only the rules of the market but the internal norms that regulate the agriculture of the dominated countries.

It is clear, therefore, that the green revolution spearheaded the development of agriculture in Brazil and directed the action of the State toward the advancement of agribusiness. Since the military regime, governments have been striving to facilitate and promote the development of this agricultural model that, supported by the massive use of chemical inputs, has turned Brazil into the world's largest consumer of pesticides since 2008 (CARNEIRO *et al.*, 2015).

In this sense, we should make the point that there is a close link between development policies and the guarantee of human rights in society (FLORES, 2009). When the government directs its action in the sense of exclusively favoring economic development, as in the case of Brazilian agriculture, society is faced with the unfair and unequal way in which economic activities are organized, reflecting the inhuman consequences of the

⁴ The Social Integration Program (Programa de Integração Social, or PIS) and the Public Servant Asset Development Program (Programa de Formação do Patrimônio do Servidor Público, PASEP) were created, respectively, by Complementary Laws No. 7/1970 and No. 8/1970, later covered in art. 239 of the Federal Constitution of 1988, and are intended to finance the unemployment insurance program and the allowance due to public and private employees.

⁵ The Social Security Financing Contribution (Contribuição para Financiamento da Seguridade Social, or COFINS) was created by Complementary Law No. 70/1991 to fund social security, as provided for in art. 195, I of the Federal Constitution of 1988.

predominance of economic interests within the social structure framework. (FLORES, 2009).

Supported by the unrestricted use of natural resources, based on the massive use of pesticides, agribusiness in Brazil leads to social and environmental damages borne by society, proving itself an economic activity yielding high profits while ignoring its negative externalities.

2. NEGATIVE EXTERNALITIES IN AGRICULTURE: THE USE OF PESTICIDES AND THE OFFENSE TO HUMAN RIGHTS

Hegemonic in Brazil and the world, the agricultural production model known as agribusiness has its development and expansion made possible through the destruction of sociobiodiversity and the damage it causes has been supported by the whole society over the years. Loss of biodiversity; genetic erosion; destruction of the environment with deforestation and extensive use of natural resources; contamination of soil and water; rural exodus; exploitation in social work relationships; problems in the organization of production systems; elimination of rural people's culture and associated agricultural practices; threat to food security, sovereignty, and human rights are some of the effects of the expansion of agribusiness that result in negative consequences for the entire population (CARNEIRO *et al.*, 2015; SHIVA, 2015).

Economic studies attribute the name of negative externality to the phenomenon of passing on the costs generated by a certain activity to a third party not involved in the process⁶ (MAY, 2010). In the context of agribusiness, negative externalities emerge with the massive use of pesticides, which generates negative effects borne by Brazilian society, and not by rural producers or chemical inputs companies.

The use of the term “externality” is credited to economist Arthur Cecil Pigou, who conceived the concept to designate an action that, unintentionally, has an effect (either positive or negative) on a third party that does not contribute to the practice of the action. According to its definition, externality appears whenever the production of an establishment, company or even individual affects the production process of another establishment or other people's lives (MOURA, 2011).

⁶ There are also positive externalities, which are positive external effects that a production system transfers to third parties that are not part of it. An example would be an apiary near an orchard, which benefits the owner of the orchard with improved production due to the pollination activity of neighboring bees (NUSDEO, 2015).

In the field of economic analysis, negative externalities are identified as market failures, imperfections, and inoperability that arise when the market is incapable of dealing with the complexity of real economic life (NUSDEO, 2015). As explained by Derani (2006), they are external diseconomies no longer accounted for by the entrepreneur and, thus, end up perceived by others as discharges of the production process.

In this sense, Silva (2015) points out that negative externalities arise when companies fail to account for part of their costs, externalizing them, making third parties responsible for such negative consequences. The author reinforces that this externalization of costs happens “often, although not always, with full legal support” (p. 286).

The free market economy favors the performance of economic agents in the sense of externalizing their costs in search of increasing profit. Thus, they profit from the transfer of damages and the negative results, excluded from the economic calculation, are absorbed by society in time and space.

According to Nusdeo (2015), negative externalities do not characterize an illicit act practiced by costs generators. In fact, “the external effect is verified when the legal framework is unable to identify and allocate such costs properly” (p. 126) and these end up falling upon third parties that are not part of the marketing operations, resulting in the label ‘social costs’.

To Flores (2009), once market forces internalize that everything is appropriable and can be subjected to the rule of greatest benefit at the least cost, the process of capital accumulation will always be above people’s needs and rights. In the context of neoliberal globalization, the influence and power of the market control the application and enunciation of human rights, now deemed social costs, externalities that business activity must nullify in the name of competitiveness. Its effectiveness is not perceived as a duty for the benefit of society, but as a high economic cost that must be cut off to increase the efficiency of accumulation processes.

Agricultural production, which is an economic activity, follows this process and ends up externalizing the environmental, health, and social costs generated by the indiscriminate use of pesticides, absorbed by the public health and social security system and, ultimately, by society itself, in a typical case of a negative externality that violates human rights (CARNEIRO *et al.*, 2015).

As it spread the homogenization of agricultural practices, the green revolution did not rationalize that its technological package ends up inflicting a high cost on the whole of society. Contamination of workers and

consumers (by residues in food); contamination of water resources, flora, and fauna; and the consequent impoverishment of biological diversity are some of the damages caused to the environment and health of the population by the use of pesticides. This entire cycle of poisoning is not taken into account in the agricultural production process (CARNEIRO *et al.*, 2015).

It is worth noting that developmental policies for agriculture implemented in Brazil have favored economic development to the detriment of socio-environmental development. By privileging financial interests, the government compromises the country's right to development, as it only takes place with respect for human rights (FLORES, 2009).

When the understanding of development is restricted to the increase in GDP and wealth, it is made clear that this is a limited understanding, since economic growth alone is not enough to end inequalities. Furthermore, a project of growth through disrespect for human rights cannot be conceptually or politically called development (SANTOS, 2011).

With this, we can see how the advancement of agribusiness in Brazil sought only economic development. The negative externalities generated by this model of agricultural production are negative effects supported by society and that violate human rights to an ecologically balanced environment and adequate nutrition.

2.1 The human right to adequate nutrition

The human right to food was initially formulated as the daily access to food and capable of warding off hunger. However, given the changes that capital brought into agriculture with the transformation of food into a simple commodity, the standardization of food production and consumption, as well as the negative consequences for the environment, the claim for the right to food gained new outlines and began to incorporate the need for quality food; no chemical or biological contamination; according to the customs of each people; with nutritional variety; capable of promoting the health of the population (VALENTE, 2002).

Since the green revolution and the expansion of agribusiness, while grain production has increased three times, the use of chemical inputs has increased 14 times (PORTO-GONÇALVES, 2017). It is clear, therefore, how the increase in production is sustained by the chemification of agriculture, responsible for the poisoning of nature and human beings.

Since 2008, Brazil has been the international leader in the consumption

of pesticides. While the world pesticide market has grown by 93% in the last ten years, the Brazilian market has grown by 190%. Data from the 2011 harvest show that 853 million liters of pesticides were sprayed on 71 million hectares of crops planted in the country, representing an average exposure of 4.5 liters of pesticides per inhabitant (CARNEIRO *et al.*, 2015).

Through the 2017 Report of the Special Rapporteur on the right to food, the UN exposed the main issues related to the use of pesticides, demonstrating how their use represents a threat to human rights. A worrying fact presented in the report concerns the number of deaths from contamination due to direct contact with pesticides: 200,000 deaths per year, of which 99% occur in developing countries, where regulations on the subject are weaker and less enforced (ELVER, 2017).

Contamination of food with pesticide residues is also a worrying factor concerning the health of the population. The Program for the Analysis of Pesticides Residues in Food (Programa de Análise de Resíduos de Agrotóxicos, or PARA), of the National Health Surveillance Agency (Agência Nacional de Vigilância Sanitária, or ANVISA), analyzed samples of food consumed daily by Brazilians in the 26 states of the country and the Federal District, finding that 51% of the samples contained residues of pesticides (ANVISA, 2018).

In 23% of the foods analyzed by PARA it was possible to identify the presence of residues of products not authorized for the crops and/or above the Maximum Residue Limit (MRL), that is, in an amount above the allowed, according to the nomenclature used by ANVISA. Also, residues were found within the MRL in 28% of the samples, which still represents a risk to the health of the population, as the long-term effects of pesticide ingestion are not known (ANVISA, 2018).

It is worth remembering that there are two types of contamination by pesticides: acute, which affects those who have direct contact with the substance, and whose effects manifest in 24 hours, causing nausea, vomiting, convulsions and can lead to death; and chronic, which results from continuous exposure to small doses of the substance and affects those who ingest it in contaminated food (CARNEIRO *et al.*, 2015).

The effects of chronic contamination can appear weeks, months, years, or even decades after the period of use and are often associated with neurological, hormonal problems, the appearance of cancers, etc. (SOARES;

PORTO, 2007). And the reflections of this contamination are present in the bill paid by society, where each dollar spent on the consumption of pesticides corresponds to a future expense of US\$ 1.28 in social expenses by the government (MACHADO; MACHADO FILHO, 2011).

The negative externalities resulting from the use of pesticides are yet another factor in violation of the human right to adequate nutrition, which is not achieved through food production in the context of agribusiness. Encouraging the standardization of cultures and eating habits; the devaluation of the cultivation and consumption of native species; food poisoning are practices that reveal how the current agricultural model has negatively interfered with the fulfilling of this right.

The guarantee of the human right to adequate food permeates the entire agricultural production chain. The food must be safe, that is, not chemically or biologically contaminated; it must also be of nutritional, biological, sanitary, and technological quality (VALENTE, 2002). Also, the agricultural production process must be aligned with the preservation of the environment, avoiding chemical contamination of the soil, water, flora, and fauna.

2.2 The human right to an ecologically balanced environment

The understanding of the human right to the environment, as well as the human right to food, has undergone transformations over time. It initially emerged as an object of discussion and claim in the 1960s, when a serious environmental crisis was first perceived as a result of the dominant patterns of production and consumption and the ecological irrationality that ground the limits of economic growth (LEFF, 2015).

While previously focused on the damage caused by industrialization, the protection of the environment currently reaches different proportions in the fight against globalized agriculture and the widespread dominance of poison in the countryside. Logging; destruction of biodiversity; commitment of water resources; contamination of flora and fauna are the issues that begin to ask for an expansion in the scope of the human right to the environment.

The presence of pesticides in the environment undergoes several variants, but they are certainly found in the air, due to the volatilization of some compounds; on the ground, simply because of application, spillage,

or improper disposal; in watercourses, being carried by rainwater, and may even reach groundwater through soil percolation (CARNEIRO *et al.*, 2015).

In this sense, Machado and Machado Filho (2014) warn that less than 0.1% of pesticides currently applied achieve their objective of combating parasites. The remainder, 99.9% of pesticides used in agriculture migrate to the environment, contaminating the soil, air, water and, ultimately, affecting public health and animal and plant health.

Another aspect that must be observed is the contamination of watercourses and groundwater by pesticides, besides the reduced availability of these resources, aggravated by the consumption of large transgenic agribusiness monocultures in irrigation (SOARES, 2010). The fact is that the world is currently experiencing an unprecedented water crisis and the contamination of water by pesticide residues intensifies this problem in Brazil.

Water pollution also has harmful consequences for aquatic fauna. According to Porto-Gonçalves (2017), the contamination of water resources by agricultural residues has caused a decrease in species and the number of fish. In addition to the threat to biodiversity, the author reinforces that this also affects riverine populations dependent on the fishing resource to survive.

Soares and Porto (2007, p. 134) understand that the “degradation of groundwater and surface water quality has been identified as the main concern concerning the impact of agriculture on the environment”. It’s another burden that the use of pesticides in agriculture imposes on the Brazilian population, demonstrating that the productive method established by the green revolution is inadequate at guaranteeing minimum environmental quality (ABRAMOVAY, 2008).

Furthermore, the resistance pests developed towards chemical inputs, aggravated by the extinction of their natural predators due to the use of pesticides, is another factor of ecological imbalance burdening the society as a whole. This cost is initially borne by the farmer, who ends up having to apply more and more pesticides to the crop, but it passes on to the consumer in a second moment, with the increase in the cost of the final product, in addition to affecting the entire population with environmental losses and the damage to human health caused by the increased spraying of pesticides (BULL; HATHAWAY, 1986).

In addition, McMichael (2016, p. 170) warns that “the ‘external’ costs of agribusiness multiply with global warming and ecosystem degradation

[...] and combine to undermine the conditions for accumulation of long-term capital”. The nature factor integrates the market dynamics, producing an increase or decrease in wealth for society, but is not monetarily quantified (DERANI, 2006).

It remains clear that starting from the green revolution, the population has been taking on the real cost of the use of chemical inputs in agriculture. Despite being daily poisoned with pesticide residues, society sustains the damage caused to its own health, while its rights to adequate nutrition and an ecologically balanced environment are violated. There is, therefore, the need to promote the internalization of the negative externalities generated by the use of pesticides in agriculture.

3 MECHANISMS FOR INTERNALIZATION OF NEGATIVE EXTERNALITIES ARISING FROM THE USE OF PESTICIDES: THE SEARCH FOR THE SAFEGUARDING OF HUMAN RIGHTS

When analyzing the damage caused by the use of pesticides, Carson (2010) concludes that, when the true costs to the population’s health and the environment are accounted for, it is evident how their adoption is indeed costly for society.

Regarding the negative effects of agribusiness, according to Soares and Porto (2007, p. 132), “if, on the one hand, the marginal cost of using pesticides by the farmer includes items such as the price of the input, the cost of the sprayer’s work, and the material used in the application, on the other hand, it does not cover the damage to fauna and flora, the quality of water and soil, as well as human health”. The internalization of these negative externalities can be effected, initially, by adding the costs resulting from their application to the price of pesticides themselves.

For the cost of applying chemical inputs to be real, it is then necessary to account for the damage and losses caused to the environment and the health of the population. The process of internalizing negative externalities is necessary to balance the social costs generated by the use of pesticides and contribute to the realization of human rights to adequate nutrition and an ecologically balanced environment, working to ensure an agricultural production that respects human rights.

Concerning this internalization of costs, the importance of the topic provoked its discussion at the United Nations Conference on Environment

and Development, posing as one of the provisions of the Rio Declaration on Environment and Development:

Provision 16: Local authorities must promote the internalization of environmental costs and the use of economic instruments, taking into account that the polluter must bear the costs of pollution (UN, 1992).

In this sense, it is worth mentioning an initiative promoted in the European Union through Directive 2004/35/EC of the European Parliament and of the Council, which established “an environmental responsibility framework based on the polluter-pays principle to prevent and repair environmental damages” which includes damage caused to species and natural habitats, water, soil arising from any polluting activity (EUROPEAN UNION, 2004).

The directive lists potentially polluting activities, among which are those related to the production and use of pesticides, defines damage prevention actions to be implemented by polluters, as well as the appropriate measures to repair damage to the environment (EUROPEAN UNION, 2004).

It also consolidates the operators’ (polluters) obligation to bear the costs of actions to prevent and repair damage to the environment and establishes that the member states of the European Union must adopt measures for the implementation of instruments and markets for financial guarantees to cover the responsibilities inherent to polluting activities, exempting the State from the socio-environmental costs resulting from pollution in an effective process of internalization of negative externalities resulting from the use of such inputs (EUROPEAN UNION, 2004).

Also, the performance of justice agencies can be an important instrument for holding polluters accountable for the damage caused by pesticides. In the United States, more than 95,000 lawsuits are pending against Monsanto concerning the harmful effects of the herbicide glyphosate (POL; HUPFFER; FIGUEIREDO, 2021).

In 2014, a landmark decision by a California jury in the United States sentenced Monsanto to pay \$289 million to Dewayne Johnson for cancer caused by the use of the herbicide glyphosate (SUPREME COURT OF CALIFORNIA, 2018). This example of the company’s judicial accountability reflects how the government, through the Judiciary, can promote the internalization of negative externalities and exonerate the population from the social costs resulting from the use of pesticides.

Thus, the Brazilian State must act more effectively in internalizing the

negative externalities generated by agricultural production. In this sense, we can consider some legal provisions that implement greater responsibility in the use of pesticides a great advance. Law No. 7,802/89 establishes that the sale of pesticides shall take place through its own proper prescription by a legally qualified professional, which must contain recommendations for the safe use of the product, a measure aimed at avoiding contamination, both for the applicator and the environment (BRASIL, 1989).

The same rule establishes the administrative, civil, and criminal liability of those involved in the chain of commercialization and use of pesticides, concerning the disrespect for the issuance of prescriptions and use of products in violation of their recommendations. In addition, this triple liability also extends to users who do not dispose of empty pesticide containers in an environmentally appropriate manner, in line with the reverse logistics system⁷ imposed by Law No. 12,305/10 (BRASIL, 1989; 2010).

However, several other public instruments can be used to internalize the negative externalities resulting from the use of pesticides. Among them, the following stand out:

- a) Review of the current tax exemption policy for pesticides: when addressing the internalization of the negative effects generated in a production process, Moura (2011) gives an example of how this is already happening in some European countries, through state action, with the introduction of fees and taxes on the normal price of potentially polluting products, discouraging their consumption. The scenario in Brazil, in opposition to the internalization process presented by Moura (2011), is the wide concession of tax exemption for the production and commercialization of pesticides. As previously discussed, the Brazilian government facilitates the use of pesticides by reducing the ICMS tax base in the sale of these products; exempting the payment of PIS/PASEP and COFINS on the importation and commercialization of pesticides into and within the domestic market; as well as exempts the collection of IPI in the production of those inputs. Tax exemption ends up representing a reinforcement in the system that transfers the negative effects generated by the chemification of agriculture to society. A regulation aimed at discouraging the use of pesticides must be based on the taxation of the marketing operations of potentially polluting products, which presup-

⁷ The concept of reverse logistics is laid out by art. 3, XII of Law No. 12,305/10: “instrument of economic and social development characterized by a set of actions, procedures and means aimed at enabling the collection and return of solid waste to the business sector, for reuse, in its cycle or in other production cycles, or other environmentally appropriate final destination” (BRASIL, 2010).

poses the action of the State in the review of the current tax exemption policy.

- b) Review of the current rural credit and insurance policy: as already demonstrated, the credit policy has been the main means of promoting conventional agriculture, and the adoption of the technological package is placed as a condition for accessing credit and carrying out agricultural insurance. PROAGRO's financial benefits and the granting of rural credit by financial institutions make credit conditional on the obligation to use chemical inputs. The notion of insurance and credit risk does not internalize the environmental and health damage generated by pesticides. There is currently no concern on the part of financial institutions regarding the damage to health and the environment caused by pesticides. The single concern has been the development of controlled agriculture, with the use of certified seeds, fertilizers, and pesticides, which reduces the economic risks of crop loss (FARIAS, 2016). Farmers who seek to develop crops on agroecological bases still find few lines of credit and enormous difficulties in accessing them. Sometimes, when they obtain credit, they are left without agricultural insurance for not using the technological package, taking on the risks of their production personally (LONDRES, 2006; SOUZA, 2021). Brazil lacks a national policy aimed at the agroecological transition, which discourages conventional production while promoting ecological production. This presupposes a redirection in the current credit and insurance systems, with more advantageous and accessible lines for organic and agroecological production and greater demands for the conventional farmer, internalizing the environmental and human health costs resulting from this activity. In this sense, some countries have been standing out in implementing measures to support the agroecological transition. Through Bio Suisse, a certification body implemented a subsidy program for rural producers in Switzerland, helping them with the costs of unconventional agricultural production with resources from a fund to support the cultivation and multiplication of organic seeds (RENAUD; BUEREN, 2016).
- c) Monitoring and production of information on the damage generated by pesticides: given all the damage caused by pesticides to the environment and health of the population, effective and continuous monitoring of water, soil, and food is necessary; monitoring of environmental and workers' health. The production of information that allows for the identifi-

cation of the use and its damages is fundamental for the accountability of the people responsible, either directly or indirectly, for the pollution caused by the use of pesticides. This monitoring, albeit partially, was carried out by the Program for the Analysis of Pesticides Residues in Food (Programa de Análise de Resíduos de Agrotóxicos em Alimentos, or PARA) of the National Health Surveillance Agency (ANVISA) in the analysis of food samples collected across 26 Brazilian states and the Federal District. However, PARA presented its last results in 2018 and is currently discontinued, signaling a setback in the monitoring of food contamination, yet another government measure that impairs the control of the damage caused by the use of pesticides within the country. Another important source of information that requires improvement is the monitoring of diseases and injuries to human health associated with contamination by pesticides, which began in 2007, with the structuring within the scope of the Ministry of Health of Environmental Health Surveillance and in Health of Populations Exposed to Pesticides. Published in 2018, the National Health Surveillance Report for Populations Exposed to Pesticides points out that the highest number of reports of pesticide poisonings were recorded in Brazil in 2014: 6.26 cases for every 100 thousand inhabitants. The general data, collected from 2007 to 2015, indicate 84,206 cases. However, the Report highlights that underreporting is still significant, a fact that prevents the real dimensioning of the issue across the country and makes the costs of these services invisible to the Unified Health System – SUS (BRASIL, 2018). The report itself shines a light upon State failures in the adoption of surveillance and health care measures, highlighting the need to improve services for “identification, diagnosis, treatment, rehabilitation, and notification of cases of pesticide poisoning” (BRASIL, 2018, p. 12). The reliable production of information allows for the verification of the dimensions of the damage generated by pesticides, making it possible to better identify the nature of the pollution and those responsible for it, facilitating the development of public policies for the internalization of negative externalities, which also includes greater ease of judicial accountability.

d) More effective action by the Justice and Judiciary bodies: the bodies of the Justice system (Public Ministry, Police, environmental inspection bodies), as well as the Judiciary itself, still shy from acting upon the internalization of negative externalities generated by pesticides, despite

the robust environmental legislation in place. The concepts of pollution (art. 3, III), polluter (art. 3, IV), and objective accountability (art. 14, §1) present in the National Environmental Policy law (Law No. 6.938/81) already provide the necessary legal support for the accountability of those who generate damages caused by pesticides (BRASIL, 1981). However, what is observed is that the judicial cases are still minimal. Until 2018, as demonstrated by Ribeiro (2018), no case involving environmental damage by pesticides had reached the STJ or the STF, with few cases ongoing in the first and second spheres of ordinary justice. Perhaps, the strengthening of monitoring systems exposed in the previous topic contributes to polluters' greater accountability by making the damage generated more evident. The role of the Labor Court has also been problematic. As Coelho (2020) points out, it is possible to find a greater number of cases involving the search for compensation concerning the damages caused by pesticides in labor courts than in ordinary courts. However, labor justice has not, as a rule, contributed to the internalization of damages. The labor court ignores the damage caused by pesticides as pollution inherent to the work environment (art. 14, § 1, of Law No. 6.938/81 cc art. 200, VII, CF/88). In an analysis of the jurisprudence of the TRT 18th Region, Coelho (2020) showed that this argument is hardly presented in petitions or taken into account in decisions. The Labor Court has also not recognized rural activities carried out in a fumigated environment or that are directly associated with the application of pesticides as risky activities (art. 927, Sole Paragraph, of the Brazilian Civil Code). As a result, the worker must prove that the damage they grieved was their employer's (the polluter) doing, which rarely occurs given the complexity of the contamination or the difficulty that these workers face to provide evidence since many are in a situation of significant social precariousness. The internalization of negative externalities generated by pesticides necessarily involves a more effective action by the justice system as a whole (environmental police, Public Ministry, Environmental Agencies), as well as by the Judiciary. They must actively act in the identification of damages, in the individualization of responsibility, and in the determination of the reparation for the pollution generated, measures that will contribute for the polluters to gradually bear the costs of their activities.

- e) Greater rigor and restriction of pesticides in circulation in Brazil: it should be noted that, besides all the negative effects resulting from the

use of pesticides already mentioned in this article, Brazil is the largest consumer of pesticides whose use has been banned in other countries due to their toxicity and the damage caused by these products (CARNEIRO *et al.*, 2015). Despite there being actual proof of the harmful effects of those pesticides, leading to their ban in other countries, the Brazilian government is still reluctant to limit the use of chemical inputs in agriculture. What can be seen, in fact, is that the number of pesticides registered in Brazil has been growing every year, reaching the mark of 493 pesticides released for use in the country in 2020, the highest since 2005, according to data from the Ministry of Agriculture, Livestock and Supply (BRASIL, 2021). The pressure exerted by the agribusiness sector to lighten the technical criteria and procedures for the release of pesticides is intended to increase supply, including products banned in other countries, and thus lower prices. A policy of internalizing externalities must go in the opposite direction. There must be increasing rigor in the approval of new products and revalidation of old ones, striving for less damage, greater environmental and food safety, and lesser consequences for human health. Raising the cost, allowing only the circulation of less harmful products, is a public policy of enormous importance for the internalization of negative externalities resulting from the use of pesticides. Costs and profits are, as a rule, decisive factors for farmers to decide to use pesticides (BULL; HATHAWAY, 1986). Thus, only in the face of actions that allow for the internalization of such social costs, by “causing the costs and benefits to fall on the very units responsible for their generation”. society will no longer be responsible for the negative effects of the use of pesticides and will advance in guaranteeing the fulfillment of human rights (NUSDEO, 2015, p. 130).

CONCLUSION

The advance of agribusiness in Brazil reinforces an idea of economic development that does not take into account the perverse consequences of this activity for the environment and society. In addition to the elimination of culture in the countryside and the subjugation of producers to a hegemonic model of production, nature and the health of the population are also suffering the consequences of this process.

The modernization of agriculture experienced by Brazil in recent decades, which culminated in the advancement of agribusiness, is

profoundly influenced by the agricultural policy implemented by Brazilian governments from the military regime. The Brazilian State took on the role of directing the agricultural modernization project and the agricultural policy developed during the military regime, even after redemocratization, and continues to lead the government's actions in the countryside.

The agricultural policy of the military and post-redemocratization governments laid the foundations for the modernization of agriculture through the adoption of the technological packages of the green revolution, allied to the state stimulus to the use of pesticides and chemical inputs. The role of the State in the modernization of agriculture has been decisive, based on incentives and requirements regarding the use of pesticides and other modern inputs in agriculture. We must also emphasize that there was and still is a deliberate policy of the Brazilian State for a chemically-dependent agriculture that uses increasingly more pesticides. This trend must be changed, starting with the development of an agricultural policy that internalizes the damage generated by the use of pesticides, while promoting a sustainable agrarian model.

The development of agribusiness based on the use of pesticides has continuously caused damage and spread burdens to the whole society, which characterizes a process of negative externality: the transfer of costs generated by a given activity to a third party not involved in the production process (MOURA, 2011). Agribusiness is an activity based on profit, regulated by private interest, and strives through the socialization of losses, and not by relieving the population of bearing the costs of the widespread use of agricultural poisons in their production.

Therefore, as a response to the proposed issue, it was found that it is essential that the government implement measures to internalize the negative externalities resulting from the use of pesticides for the development of an agricultural policy, as the adoption of a chemically-dependent agrarian model was a choice of the Brazilian State. Its harmful consequences are blatant. In this process, the Brazilian State is not a passive agent, but a fundamental subject for a transformation of the national agrarian paradigm.

Thus, some measures are envisaged that, if adopted, could contribute to the effective internalization of negative externalities resulting from the use of pesticides. It is, therefore, necessary to review the current tax exemption policy for pesticides, with the adjustment of the ICMS tax base in the commercialization of these products, the revoking of the exemption from IPI collection in the production of pesticides, as well as the elimination of

the exemption from the payment of PIS/PASEP and COFINS in importing and commercialization of such inputs within the domestic market. The taxation of marketing operations of potentially polluting products serves as a disincentive to their production and use.

The rural credit and insurance policy also must be reviewed by the government. The adoption of a technological package based on the use of pesticides in agriculture is currently a condition for accessing credit and taking out agricultural insurance, a factor that promotes traditional agriculture to the detriment of sustainable forms of agricultural cultivation. Therefore, it is necessary to redirect the current systems of rural credit and insurance, with more advantageous and accessible lines for organic and agroecological production and greater requirements for the conventional farmer, so that this is an instrument to promote the agroecological transition, and not encourage the use of pesticides.

Furthermore, to verify the dimensions of the damage generated by pesticides, there is the need to expand and carry out effective and continuous monitoring of water, soil, and food; as well as environmental and workers' health. The reactivation of the Program for the Analysis of Pesticides Residues in Food (PARA), of the National Health Surveillance Agency (ANVISA), which last results were presented in 2018, is essential to assess the contamination of food by pesticides, and the improvement of the system of Environmental Health Surveillance and Health Surveillance of Populations Exposed to Pesticides is urgent for the verification and monitoring of diseases and human health issues associated with contamination by pesticides.

The bodies of Justice and the Judiciary must also improve their actions toward the damages generated by the use of pesticides in agriculture, actively proceeding in the identification of the damages, individualization of responsibilities, and determination of the means to repair the pollution generated to ensure polluters bear the costs of their activities.

Finally, there must be greater rigor and restriction of pesticides in circulation in Brazil. Public authorities must act more carefully in approving new products and revalidating old ones, banning the use of pesticides due to their toxicity and the damage caused, which is already being done in other countries.

Exonerating the population from the damages resulting from the use of pesticides, and relying upon those costs to those responsible for their origin within the production process, is an incentive for abandoning this

practice and migrating to sustainable cultivation methods. In this perspective, the State must stop being a promoter of the use of pesticides and develop effective public policies that allow the development of an agriculture that respects the environment, health, and adequate nutrition.

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