PESTICIDES AND THEIR PROBLEM IN AGRICULTURAL PRODUCTION

PESTICIDES AND THEIR PROBLEMS IN AGRICULTURAL PRODUCTION

Elixandre Antonio Api[1]

SUMMARY
Currently, Brazil is the largest consumer of pesticides in the world. Pesticides began to be used in large quantities after the so-called Green Revolution, with the intention of increasing productivity and alleviating the population's hunger. Some industries dominate the production and sale of pesticides. Discussions are being held in Brazilian legislation regarding the use of pesticides and the production of similar products. Pesticides are responsible for several environmental problems such as contamination of soil, water, air and insect deaths, in addition to being the triggering factor for several diseases in humans, due to exposure during application and also associated with the consumption of pesticides. foods.
Key words: Pesticides. Foods. Environment. Health.

ABSTRACT
Currently, Brazil is the largest consumer of pesticides in the world. Pesticides began to be used in large quantities after the so-called Green Revolution, with the intention of increasing productivity and alleviating the hunger of the population. Some industries dominate the production and sale of pesticides. Discussions are taking place in Brazilian legislation regarding the use of pesticides and the production of similar products. Pesticides are responsible for several environmental problems such as contamination of the soil, water, air and insect mortality, in addition to being the triggering factor of several diseases in humans, due to exposure during application and also associated with the consumption of pesticides foods.
Keywords: Pesticides. Foods. Environment. Healt.

1. INTRODUCTION

Pesticides are chemical products used in agriculture to generate greater productivity, combat pests and organisms that could compromise agricultural production. However, the use of these inputs is not only responsible for environmental contamination, but is also the cause of many health problems, as when inappropriately applied they harm the environment and the health of both rural workers and consumers.

The mass use of pesticides in Brazilian agriculture began in the 1960s, with the implementation of the national agricultural pesticides program (PNDA), which gained momentum in the 1970s. The program linked the use of these substances to the granting of agricultural credits, the state being one of the main encouragers of this practice. Agriculture in Brazil

[1]INTEGRALIZE CORPORATION

It advances every year and currently the country is one of the main agricultural producers in the world, but this production is linked to the increasing use of pesticides. Currently, Brazilian legislation addresses and discusses the topic trying to reconcile the differences between ruralists and environmentalists, since they have different views. Given this, it is important to reflect on: how important is the use of pesticides for agriculture? What are the interests in releasing an increasing number of pesticides? What are the impacts of these agricultural pesticides on the environment and the health of the population?

Therefore, it is necessary to understand the importance of using pesticides for agricultural development and reflect on the impacts on the environment and the health of both rural workers and consumers.

Bearing in mind that the increase in the use of pesticides in Brazil for agricultural production has caused a lot of concern due to environmental problems, which can lead to soil destruction, river contamination, air pollution, destruction of the food chain, serious health problems human health and other consequences that are still being studied. Therefore, this study will serve to deepen knowledge related to this issue.

The methodology used is bibliographical research using data from the internet, academic articles, research from public bodies. This work is divided into three moments. The first involves a study of what pesticides are and their importance for agricultural production. The second refers to current legislation in Brazil, the use of pesticides and the interests in liberalizing or not using them. And in the third, the environmental and human health impacts caused by pesticides are addressed.

2 PESTICIDES AND AGRICULTURAL PRODUCTION

Pesticides are products used in agriculture to control insects, diseases or weeds that cause damage to crops. The term pesticide began to be adopted in Brazil from federal law number 7,802 of 1989, regulated by decree number 4,074 of 2002, and brings the following concept:

> Products and agents of physical, chemical or biological processes, intended for use in the production sectors, in the storage and processing of agricultural products, in pastures, in the protection of forests, native or planted, and other ecosystems and urban, water and industrial plants, whose purpose is to alter the composition of flora or fauna, in order to preserve them from the harmful action of living beings considered harmful, as well as substances and products used as defoliants, desiccants, growth stimulators and inhibitors (BRASIL, 2002).

According to the Food and Agriculture Organization (FAO), the United Nations (UN) Program responsible for the areas of agriculture and food, pesticides are defined as:

> [...] any substance, or mixture of substances, used to prevent, destroy or control any pest – including human and animal disease vectors, unwanted species of plants or animals, causing damage during (or interfering with) production, processing, storage, transport or distribution of food, agricultural products, wood and derivatives, or which – or which must be administered to control insects, arachnids and other pests that affect the bodies of farmed animals. (FAO, 2003).

Mendonça (2014) points to the origin of the word pesticide, considered more broadly, in its essential action. "The term agro comes from the Latin agru and means field or farmland, and toxic comes from the Greek tóxikos which means having the property of poisoning". (p.14). Thus, pesticides are considered substances used in the agricultural sector with the aim of poisoning.

According to Carneiro (2015), pesticides are classified according to the chemical group to which they belong, as well as the damage related to the environment and human health. Insecticides are used to combat insects, fungicides are used to combat fungi, herbicides are used to combat weeds, defoliants are used to combat unwanted leaves and fumigants are used to combat bacteria in the soil.

Currently, Brazil is one of the largest food producers in the world and also one of the countries that consumes the most pesticides in the production methods of various agricultural crops, developing technologies that meet export demands (CARVALHO et. al., 2017).

Many foods that are part of the Brazilian diet have a high concentration of pesticides. A study by the National Health Surveillance Agency (ANVISA), in its 2011 report, on foods that have the highest concentration of pesticides, used 2,488 samples. Of these, it was found that pepper is the product with the highest concentration of pesticides, as can be seen in the Figure below.

Figure 01- Food samples with pesticide residues.

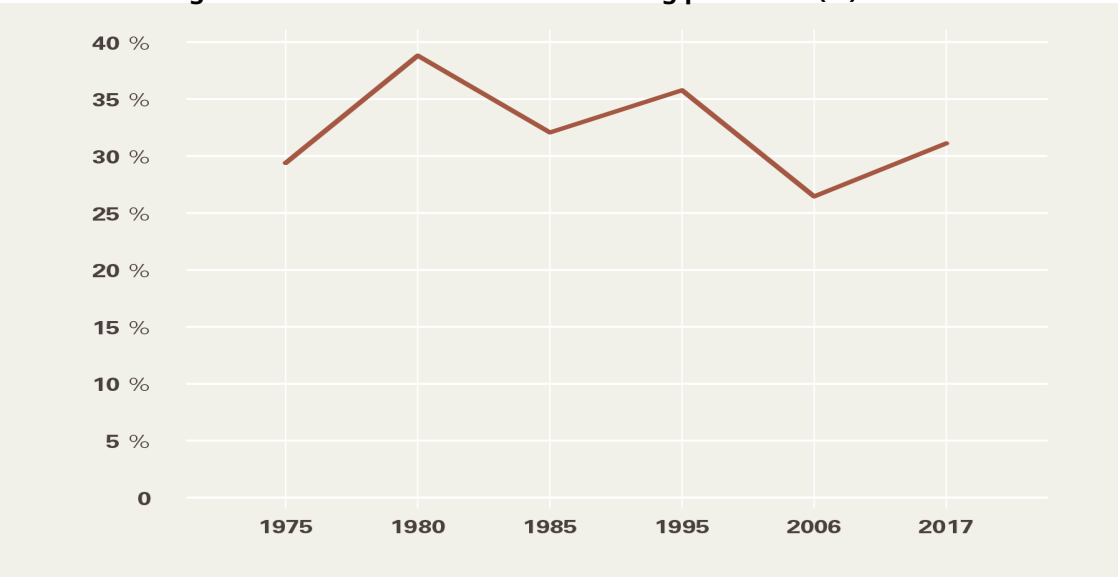
Source: ANVISA, 2011.

Brazil is considered one of the greatest powers in the agricultural sector in the world and is also at the top when it comes to the sale of pesticides. According to data from the Brazilian Institute of the Environment and Renewable Natural Resources (IBAMA) (2017), the commercialization of agricultural pesticides in Brazil generates around U$$ 10 billion per year, and in 2017 around 450 were used in Brazil. thousand tons of agrochemicals, approximately 50% more than in 2010.

The use of pesticides in Brazil is mainly related to climatic factors, as the country has a tropical climate in most of its territory. Another relevant factor linked to the use of pesticides is the issue of technological developments occurring in the field, as the instruments currently used in the agricultural sector have favored increased productivity and to achieve this, greater control of possible damage to crops is necessary.

Agriculture needs to be constantly modernized, but with attention to the appropriate use of natural resources. The agricultural model adopted in the 60s and 70s featured facilities granted by the Federal Government, such as rural credit for the acquisition of external technologies, such as pesticides and fertilizers. (BALSAN, 2006). Since then, an increasing increase has been noticed in the number of establishments that admitted using pesticides, increasing by 20.4% in the last 11 years, as can be seen in the 2017 agricultural census, released by IBGE.

Figure 02- Chart of Establishments using pesticides (%)



Source: AGRICULTURAL CENSUS, 2017.

In relation to establishments that declare that they use pesticides, 73% had less than 20 hectares of cropland. And of the 32 billion expenses with pesticides, only 7.4% are establishments of this size.

The term defensive is often used, as it gives the impression that it is defending the plantation, making this term less aggressive than the word pesticide. Carneiro (2015) highlights that designating pesticides as pesticides is a way of mitigating and even hiding the harmful nature of these products. He suggests the term as crop protection and hides the effects that these products can cause to both human health and the environment.

2.1 PESTICIDES AND THEIR HISTORY IN BRAZIL

Agriculture has been practiced by humanity for more than 10,000 years, but the use of pesticides began after the First World War, where they were used as chemical weapons and with the Second World War their use intensified. After the war, it began to be used on plantations as an agricultural pesticide (SALLES, 2014).

It is noteworthy that the organic compound DDT was the first pesticide synthesized in 1874 by Otmar Ziegler, but it was only in 1939 that scientist Paulo Muller discovered its insecticidal properties. For his discovery and subsequent application of DDT to combat insects, Muller received the Nobel Prize in chemistry in 1948. After the war, the winning countries continued to expand their

business, taking advantage of the industries and knowledge developed during the conflict period, with an emphasis on the chemical industry.

It was a period of great food shortages and hunger in Europe. It was then that the Green Revolution emerged, with the intention of promoting agriculture, generating more food to feed people around the world. “In the 1960s and 1970s the Green Revolution emerged, a model based on the use of genetically improved seeds and the use of fertilizers and pesticides, among others, with the aim of increasing agricultural productivity and solving the problems of hunger in developing countries” . (SALLES, 2014, p. 5).

The Green Revolution arrived in Brazil in the mid-1960s and was implemented through the imposition of the pesticide industries and the Brazilian government: bank financing for the purchase of seeds only occurred if the farmer also purchased fertilizer and pesticides.

> In 1965, the National Rural Credit System was created, linking the granting of agricultural credit to the mandatory purchase of chemical agricultural inputs by farmers. In the early 1970s, Banco do Brasil made it mandatory to direct 15% of the value of loans towards the acquisition of pesticides. With the establishment of the National Agricultural Pesticides Program in 1975, the pesticide industry was established in the country, integrated by the main companies manufacturing these products worldwide. (ARAÚJO, 2016, p. 04).

Thus, it can be said that it was from the 1970s onwards that the use of pesticides occurred on a large scale in Brazil, especially in the southern region, in soybean, wheat and rice monocultures. Furthermore, the use of pesticides was encouraged without due concern for educating farmers about the risk to their health, the environment and the consumer. Thus, creating a false concept among farmers that the products applied were practically harmless to both the environment and human health. (MATA; FERREIRA, 2013).

Since then, consumption has only increased and today Brazil is one of the largest consumers of these substances in the world. Araújo (2016) points out that in 2008, Brazil surpassed the United States and became the world's largest pesticide market. In 2009, the country reached the mark of over one billion liters of pesticides applied, which is equivalent to an average consumption of 5.2 kg of pesticides per inhabitant.

Brazil is the country that uses the most pesticides, but in terms of its production, it is far from being the leader. According to Borges (2018), a quarter of the current market is in the hands of the German industry Bayer, which recently also purchased the American Monsanto. Being responsible for the production of the well-known ROUNDOP, a very popular pesticide used in agriculture. O

ROUNDOP is used to kill weeds, using glyphosate as its active ingredient, the substance most consumed in Brazilian plantations.

There is an exaggerated increase in the use of these chemicals on plantations. In this sense, it is also important to check the legislation and regulations that have been regulated over time regarding the use of pesticides.

Until law number 7,802 of 1989, issues related to pesticides were regulated in Brazil only by ministerial orders, mainly from the ministries of agriculture and health. Salles (2014) highlights that this law represented a great achievement for society, as it requires prior registration of pesticides so that they can be produced, imported, exported and sold. It prohibits the registration of products that cause cancer, malformations, among others.

With the law, health and environmental bodies moved closer to agriculture in granting registration and became responsible for human and environmental toxicology assessments, respectively. This law represented a great contribution towards ensuring products used in health and plant protection. The handling of pesticides needs to be cautious, complying with technical determinations provided for in law number 7,802, of 1989 and with classification of use because they present a high level of toxicity.

Toxicity refers to the ability of a substance to cause adverse health effects. It is essential to know the degree of risk that a certain pesticide poses. Levigard; Rosenberg (2004, p.26) adds that toxicity "is based on the lethal dose 50 (DL 50), which is a statistical value that determines the amount of venom in mg/kg of body weight necessary to kill 50% of the population sample in study for acute poisoning. The values are determined in guinea pigs and extrapolated to humans based on weight."

It is guaranteed by law that the labels of all pesticide products must have a colored band indicating their toxicological class, as can be seen in Figure 03, which shows the toxicological class, the color of the band on the product label and the lethal dose.

Figure 03- Toxicological class, band color on the product label and lethal dose 50 (LD50).

Classe toxicológica		Cor de faixa	Dose letal 50 (DL50)
Classe I	Extremamente tóxicos	FAIXA VERMELHA	< 5mg/kg 1 pitada ou algumas gotas
Classe II	Altamente tóxicos	FAIXA AMARELA	5 – 50mg/kg 1 colher de chá
Classe III	Medianamente tóxicos	FAIXA AZUL	50 -500 mg/kg 1 colher de chá cheia/2 sopa
Classe IV	Pouco tóxicos	FAIXA VERDE	

Source: SILVA et al. 2015.

Bill 6,299 of 2002 is defended by the agribusiness sector in the chamber of deputies as a modernization of the standards established to date. The production of pesticides in Brazil may undergo changes in approval criteria, risk analysis and even the name that will be given to the products. The proposal is under discussion in the Chamber of Deputies, was approved by committee and is defended by businesspeople and the ruralist caucus and criticized by environmentalists and medical entities. Bill 6,299 of 2002 is defended by the agribusiness sector in the chamber of deputies as a modernization of previously established standards.

Salles (2014) highlights that the bill provides for the use of the terms agricultural pesticides and phytosanitary products instead of pesticides; that analyzes for new products and authorization of registrations are coordinated by the ministry of agriculture; creation of a registration and temporary authorization so that they can be registered in other OECD (Organization for Economic Cooperation and Development) member countries; that the analysis for granting registration is presented by the company requesting the release of the product, allowing the use of products with acceptable risk and only barring the use of products with unacceptable risk; that the States and the Federal District cannot restrict the distribution, commercialization and use of products authorized by the Union and, finally, facilitate bureaucracy for the release of pesticides that are identical and similar to others already registered.

The justification presented by the project that defends similar or generic pesticides is that they will have a lower cost for farmers and also the increase in competition between manufacturing industries, even allowing national companies in the sector to benefit.

Environmentalists, in turn, question the increasing increase in use, increasingly leading to environmental and human health problems.

It is noteworthy that Brazilian legislation is drawn up and approved by politicians elected by the population and that often, due to political and financial interests, they defend and approve laws that increasingly facilitate and encourage the use of pesticides on plantations.

2.2 PESTICIDES: IMPACTS ON THE ENVIRONMENT AND HEALTH

There is no doubt that the use of pesticides has greatly influenced the increase in productivity with less use of labor, which contributes to the growth of agribusiness in the country, however, their use has been the subject of many debates and questions because it is directly related to environmental issues.

With the growth and strengthening of agribusiness, pesticides are characterized as a basic input because they use large areas of land to implement monocultures. According to studies, the cultivation of a single product is one of the factors in the destruction of local biodiversity and imbalance in the natural environment, making the environment conducive to the emergence of high populations of insects and diseases, requiring the use of chemical products to combat them. .

Pesticides used in agriculture can follow different paths in the environment. Regardless of the method of application, there is a high chance that it will reach the soil and water. According to Bohner, Araújo, Nishijima (2013), less than 10% of pesticides applied by spraying reach their target and even those that are applied directly to plants have the soil as their final destination, as rain or irrigation washes the leaves and ends up arriving to the ground.

For Melo; Monteiro; Paz (2018) pesticides make it difficult for microorganisms that live in the soil to fix nitrogen, making it poorer in nutrients. Over time, the soil retains a large amount of contaminating substances, thus becoming more fragile, with less fertility, even triggering the death of microorganisms, causing acidity and the consequent increase in soil degradation, decreased fertility and greater pest infestation, generating a vicious cycle that consists of the increasingly intense use of pesticides, as the increase in pests consequently requires an increase in the amount of pesticides.

The waters, in Bohner's understanding; Araújo; Nishijima, (2013) are also frequently polluted by pesticides, since rivers, lakes and others can come into contact with the product through runoff from places where the use of pesticides is applied. Agricultural practices and

The natural vulnerability of the aquifer can represent a high level of negative impacts, thus making the water unfit for consumption.

> Pesticides in water do not only affect species that live in this environment. Humans, for example, can suffer from pesticide contamination when they eat fish that lives in an area contaminated by this type of product. Some species do not die from contact with pesticides, but end up accumulating them in their bodies. This accumulation causes the product to be passed through the food chain, thus harming other species. (MELO; MONTEIRO; PAZ, 2018, p. 14).

It is important to remember that there are several types of pesticides and their impacts on water depend on the type of substance that was used and also the stability of the affected environment. In some cases, pesticides can cause the death of both aquatic plant species and the animals that live there.

The air is also exposed to pesticides, which can remain in suspension. "[...] these products in the atmosphere can trigger the poisoning of people and other living organisms that breathe contaminated air". (MELO; MONTEIRO; PAZ, 2018, p. 14).

Another aspect of the damage caused by the use of pesticides is the risk of extinction of some animals such as birds, bees, butterflies and other insects that are responsible for pollination and ecological balance. With regard to human health, among many concerns regarding the damage caused by pesticides, one can highlight the lack of care and the use of Personal Protective Equipment (PPE) that must be used for handling, in this case farmers, the vast majority of them without much information about the real effects of these products.

Santos (2018) points out that among the many symptoms that can arise due to handling pesticides, headaches, fainting, seizures, nausea, shortness of breath and vomiting can be highlighted, as can be seen in the following table.

Figure 04- Main effects of exposure to pesticides

Classificação quanto a praga que controla	Classificação quanto ao grupo químico	Sintomas de intoxicação aguda	Sintomas de intoxicação crônica
Inseticidas	Organofosforados e Carbomatos	Fraqueza; Cólicas abdominais; Vômitos; Espasmos musculares; Convulsões	Efeitos neurotóxicos retardados; Alterações cromossômicas; Dermatites de contato
	Organoclorados	Náuseas; Vômitos; Contrações musculares involuntárias	Lesões hepáticas; Arritmias cardíacas; Lesões renais; Neuropatias periféricas
	Piretróides sintéticos	Irritações das conjuntivas; Espirros; Excitação; Convulsões	Alergias; Asma brônquica; Irritações nas mucosas; Hipersensibilidade
Fungicidas	Ditiocarbamatos	Tonturas; Vômitos; Tremores musculares; Dor de cabeça	Alergias respiratórias; Dermatites; Doença de Parkinson; Cânceres
	Fentalamidas	–	Teratogêneses
Herbicidas	Dinitrofenóis e Pentaclorofenol	Dificuldade respiratória; Hipertermia; Convulsões	Cânceres (PCP - formação de dioxinas); Cloro acnes
	Fenoxiacético	Perda do apetite; Enjoo; Vômitos; Fasciculação muscular	Indução da formação de enzimas hepáticas; Cânceres; Teratogênese
	Dipiridilos	Sangramento nasal; Fraqueza; Desmaios; Conjuntivites	Lesões hepáticas; Dermatites de contato; Fibrose pulmonar

Source: ASSIS, 2019.

Despite having grown in recent years, Brazilian research on the impact of the use of pesticides on human health is still insufficient to understand the extent of the chemical load of occupational exposure and the extent of the damage to health resulting from the intensive use of pesticides (ARAÚJO; OLIVEIRA, 2017). Exposure to substances present in pesticides has major consequences for human health and is related to the type of substance and the time of contact with it.

Santos (2018) cites research that indicates that more than 200,000 deaths per year in the world occur due to problems generated by the use of pesticides, most of which occur in developing countries.

> Chronic exposure to pesticides (exposure to low doses for long periods) can trigger the development of diseases in both workers and the population exposed to these compounds, whether in the environment or through food. In general, the risks to human health arising from exposure to pesticides are the development of cancer, malformations and damage to the nervous system and the functioning of the endocrine system. (RANGEL; ROSA; SARCINELLI, 2011, p.19).

In addition to these, many other diseases may be related to substances present in pesticides that are in foods that are part of the population's daily diet. Thus, the

Conventional models of development and agriculture are focused on growing production and productivity in the economy, without showing concern about the effects that this model could have from the point of view of the sustainable development of society as a whole.

According to Altieri (2004), the conventional agricultural model does not prioritize the production of basic foods such as beans, rice, cassava, corn and others that are essential for food security. The author also highlights that the practices developed so far tend to harm productivity. future in favor of high productivity in the present.

The future of ecological productivity is affected in many ways as agricultural resources such as soil, water and genetic diversity are overexploited and degraded, changes in the global ecological processes on which agriculture depends and the social conditions that lead to the conservation of resources are weakened and unstructured. As a result, there is a concern to make agricultural production environmentally, socially and economically viable and compatible. (ALTIERI, 2004).

In this way, agroecology presents itself as a new approach that integrates agronomic, ecological and socioeconomic principles, recognizing the knowledge, knowledge and experiences of traditional peoples, as well as everyone involved in rural development processes. Agroecology aims to develop agro ecosystems with a minimum dependence on agrochemical inputs (ALTIERI, 2004).

It stands out, therefore, that agroecology is the alternative suggested for producing food more safely, but this requires a form of cultivation that differs from conventional cultivation, which results in lower profitability and profitability for the producer, as well as for the final consumer. This product becomes more financially costly, making it difficult to purchase.

FINAL CONSIDERATIONS

Based on the studies carried out, it can be seen that pesticides emerged during the War period, where they were used as a chemical weapon. From then on, they began to be used in agriculture as a way to combat pests and weeds.

In Brazil, the use of pesticides began in 1960 and its use was linked to the release of government subsidies for financing agriculture. From then on, the use of

pesticides grew more and more, with the aim of producing more food with less labor and without taking risks with insects and herbs that harm crops.

It was observed that Brazilian legislation needs to advance and reach a point where it is possible to establish the use of pesticides, their production and also thinking about mitigating their effects on the food produced.

There are many negative effects caused by the use of pesticides on the environment, such as contamination of soil, water and air, causing the death of plants and animals that live in them and leaving their use inappropriate.

In humans, studies increasingly reveal the close connection between a series of diseases and exposure to pesticides and the consumption of contaminated food. The topic is broad and needs to be constantly deepened, as new studies and research continue to be developed to investigate and prove the negative effects of the use of pesticides.

REFERENCES

ALTIERI, MA**Agroecology**: the productive dynamics of sustainable agriculture. 5. ed. Porto Alegre: UFRGS, 2004.

ARAÚJO, E.**Impact of Pesticides on food, health and the environment**. Furnas, 2016. Available in: http://www.mobilizados.org.br/wp-content/uploads/2016/08/Cartilha-Agrotoxicos-final.pdf. Accessed on: 10 June. 2021.

ASSIS, NI de.**The use of pesticides and their consequences for workers' health.** Monograph (Postgraduate in Occupational Safety Engineering) – Centro Universitário de Lavras.Lavras,2019.Available at: http://200.216.214.230/bitstream/123456789/425/1/ TCC%20Nayara%20Izabella.pdf. Accessed on 12 June. 2021.

BALSAN, R.**Impacts resulting from the modernization of Brazilian agriculture.**CAMPO-TERRITORY: magazine of agrarian geography, v. 1, no. 2, p. 123-151, Aug. 2006. Available at: file:/// C:/Users/ /Downloads/11787-Texto%20do%20article-55073-1-10-20120316%20(1).pdf Accessed on: May 6, 2021.

BRAZIL.**Law no. 7,802, of July 12, 1989 (Federal Law on Pesticides).**Brasília, Official Gazette of the Union, 12 July. 1989. Available at: http://www.planalto.gov.br/ccivil_03/LEIS/L7802.htm. Accessed on: 12 April. 2020.

BRAZIL.**Decree no. 4,074, of January 4, 2002.**Regulates Law no. 7,802/89 (federal pesticide law). Brasília, Official Gazette of the Union, 8 Jan. 2002. Available at: http:// www.planalto.gov.br/ccivil_03/LEIS/L7802.htm. Accessed on: 12 June. 2021.

BRAZIL. **Census agriculture**. IBGE, 2017. Available in: https://www.ibge.gov.br/estatisticas/economicas/agricultura-e-pecuaria/21814-2017-censoagropecuario.html?=&t=o-que-e. Accessed on: 12 April. 2021.

BOHNER TOL; ARAÚJO, LEB; NISHIJIMA,**T. The environmental impact of the use of pesticides on the environment and the health of rural workers.**Electronic Magazine of the UFSM Law Course, v. 8, 2013.

CARVALHO, MMX; NODARI, ES; NODARI, RO "Pesticides" or "pesticides"? The history of the use and perception of pesticides in the state of Santa Catarina, Brazil, 1950-2002.**History, Science, Health**-Manguinhos, v. 24, no. 1, p. 75-91, 2017. Available at: http://dx.doi.org/ 10.1590/s0104- 59702017000100002. Accessed on: 22 April. 2021.

FOOD AGRICULTURAL ORGANIZATION (USA).**Agricultural Base date.**2003. Available at: http:// www.fao.org/brasil/fao-no-brasil/brasil-em-resumo/pt/. Accessed on: 27 June. 2021.

LEVIGARD, Y.; ROZEMBERG, B. The interpretation of health professionals regarding complaints of "nerves" in rural areas: an approach to the problem of pesticide poisoning. **Public Health Cad.**[Internet]. 2004. Available at: Available at: http://www.scielo.br/pdf/csp/v20n6/08.pdf. Accessed on: 18 April. 2020.

MATA, JS; FERREIRA, RL Pesticides in Brazil – Use and Impacts on the Environment and Public Health.**Ecodebate,**02 Aug. 2013.Available at: https://www.ecodebate.com.br/2013/08/02/agrotoxico-no-brasil-uso-e-impactos-ao-meio-ambientee-a-saude-publica-por-joao-siqueira-da- mata-e-rafael-lopes-ferreira/. Accessed on: May 12, 2021.

MELO, P.; MONTEIRO, TM; PEACE, A.**Pesticides and GMOs.**innovation and sustainability bulletin,**BISUS,**2018– v. two. Available in: https://www.pucsp.br/sites/default/files/download/bisus2018-vol2-agrotoxico-e-transgenicos.pdf. Accessed on: 10 April. 2020.

MENDONÇA; SGS**Analysis of the perception of the environmental impact of pesticides on the environment and health by farmers in the city of Paty do Alferes – RJ.**Federal University of Rio de Janeiro Pólo Universitário de Três Rios, 2018. Available at: https:// itr.ufrrj.br/determinacaoverde/wp-content/uploads/2018/07/monografia-samiramendonca.pdf accessed on: 08 Jul. 2021.

RANGEL, CF; ROSA, ACS; SARCINELLI, PN Use of pesticides and their implications for occupational exposure and environmental contamination.**Colet Health Cad.**., 2011, Rio de Janeiro, 19 (4): 435-42. Available in: http://www.cadernos.iesc.ufrj.br/cadernos/images/csc/2011_4/artigos/csc_v19n4_435-442.pdf. Accessed on: 15 April. 2020.

SALES, W. **The regulation of pesticides.** 2014. Available in: https://carollinasalle.jusbrasil.com.br/artigos/121549719/da-regulamentacao-dos-agrotoxicos. Accessed on: May 12, 2021.

SANTOS, VS **Pesticides and our health.**2018. Available at: https://mundoeducacao.uol.com.br/saude-bem-estar/os-agrotoxicos-nossasaude.htm . Accessed on: 08 Jul. 2021.