The Brazilian Agribusiness and the Consequences of the Intensive Use of Agrochemicals

Samuel Carvalho De Benedicto
Doctor in Administration from the Federal University of Lavras (UFLA), Brazil
Researcher of the Master's degree in Sustainability Pontifical Catholic University of Campinas / SP-Brazil
samuel.benedicto@puc-campinas.edu.br

Jefferson Pereira da Silva Castro
Master in Sustainability
Pontifical Catholic University of Campinas / SP-Brazil
castro.jep@gmail.com

Cibele Roberta Sugahara (Corresponding author)
Doctor in information science from the University of São Paulo (USP), Brazil
Researcher of the Master's degree in Sustainability Pontifical Catholic University of Campinas / SP-Brazil
cibelesu@puc-campinas.edu.br

Cândido Ferreira Silva Filho
Doctor in Social Sciences from the Pontifical Catholic University of São Paulo (PUC-SP), Brazil.
Researcher of the Master's degree in Sustainability Pontifical Catholic University of Campinas / SP-Brazil
candidofilho@puc-campinas.edu.br

Abstract

To meet the continued growth of the population and to extinguish the hunger that still affects 800 million of those living in underdeveloped countries, the increase in the supply of food is becoming more urgent. However, it is also essential to reduce the use of pesticides, in order to offer a better quality food, with less negative impacts on the environment and on the human health, through polycultures grown in smaller areas of plantations. This work, based on a bibliographical research, aims to present some of the risks and consequences arising from the use of agrochemicals in Brazil. On one hand, they enable the cultivation of monocultures, and on the other, they affect the health of farm workers, consumers and the environment. Therefore, this study aims to contribute to the discussion about the risks of pesticides. And as a result, arguments corroborating the idea that the great challenge is to rethink industrial agriculture and begin a transition of food systems, based on a sustainable, biodiversity-based and socially fair agricultural model.

Key Words: Pesticides. Intensive farming. Sustainability. Family farming. Food offer.

1. Introduction

The Food and Agriculture Organization (FAO) researchers projected that in the coming years, the food production should rise by around 60% to ensure a balanced food security, as the world population is expected to reach nine billion people. Increased food supply may occur with planting, but also with reduced waste. Food loss is extremely high, occurring during the harvesting, storage, transportation, spillage and degradation in the industrial process, during market exposure, and in household consumption. The loss of food represents a waste of resources used in production, such as land, water, energy and inputs. Foods produced and not consumed, also represent unnecessary CO2 emissions and loss of the economic value used in the cultivation (Gustavsson, Cederberg, & Sonesson, 2011).

Agriculture is a practice that has been developed by humanity for thousands of years, but the intensive use of agrochemicals to control diseases of crops and pests has existed for just over fifty years. And it was originated in the post-war era, when the chemical industry producing poisons, which were used as weapons, turned to agriculture with the aim of raising this new market for its products (Boff, 2012).

During the early years of the 21st century, monocultures increased significantly throughout the world. Of the world's 1.5 billion hectares of farmland, 91 percent are dedicated to extensive monocultures of corn, soybeans, rice, wheat and others. With the expansion of the industrial agriculture, the crop diversity per unit of cropland declined, and the agricultural land use intensified with a tendency to be concentrated in the hands of some producers and, in particular, large enterprises (Altieri, 2009).

The technologies that traditionally favored the transition to the monoculture are: mechanization, genetic improvement of modern varieties and the development of agrochemicals for soil fertilization and pest and weed control. In addition, the trade and the government policies in recent decades have promoted the acceptance and use of these technologies. So today, biotechnology has become the driving force behind the intensification of industrial agriculture (Altieri, 2009).

In Brazil, Silva et al. (2005) highlight the creation in 1965 of the National Rural Credit System as a fundamental factor for the growth of consumption of agrochemicals in Brazil. This system entailed the obtaining of agricultural credit to the compulsory purchase of chemical inputs by farmers. Another initiative that contributed to the expansion of the consumption of these products was the creation, in 1975, of the National Program of Agricultural Defenses, under the II National Development Plan (PND). This Program provided financial resources for the creation of national enterprises and the establishment in the country of subsidiaries of transnational agricultural inputs companies. Another factor that also contributed to the dissemination of these products in Brazil was the Law 7.802, approved in 1989, facilitating the registration of hundreds of toxic substances, many of which are already prohibited in developed countries, as will be discussed later.

With all the encouragement given, the use of pesticides has risen dramatically in recent years, as highlighted by Londres (2011) and Porto and Milanez (2009). Considering the dollar price of agrochemicals, the quantity of these products applied per hectare more than doubled between 1995 and 2005; and between 2001 and 2008 the sale jumped from just over $ 2 billion to over $ 7 billion, when Brazil came to occupy

the position of the world's largest consumer of agrochemicals. On the other hand, between 1996 and 2010, the balances from agricultural activities jumped from 7.9 to 63 billion dollars and reached 72.5 billion in 2016 (IPEA, 2017).

And as a consequence of the intensive use, it is estimated that they cause around 7 million poisonings annually worldwide, with low- and middle-income countries accounting for at least half of these intoxications and 75% of deaths from pesticides. These measurable data are only part of the problem, since the chronic diseases associated with agrochemicals are difficult to estimate (Londres, 2011).

This study has as main objective to contribute with the discussion about the intensive use of pesticides in the crops and to present data that corroborate with the idea that it is important the increase of the small plantations of polycultures. The main justification for this work is the need to increase the production of foods grown with less pesticides, seeking a more sustainable agricultural system.

This study is divided into seven sections, including this introduction. In the second one, it is discussed and presented data on the distribution of land in Brazil. After that, some data from a study by the European Parliamentary Research Service, (2016), which is the research department of the European Parliament, discusses the benefits of organic food and the risks of the consumption of food produced with agrochemicals. The fourth section discusses the sale and regulation of pesticides, as well as the residues of these substances in foods commercialized in Brazil. In the fifth section, therefore, based on the last Agricultural Census, some characteristics of Brazilian rural workers are presented. In the sixth part of this study, it is shown that the agribusiness model practiced in Brazil makes the transition to a production with less application of agrochemicals impossible. In the last section, there is the understanding of the production structure of family agriculture. Finally, at the conclusion of the study, some of the main social risks identified in the plantations are pointed out.

2. Disadvantages of monocultures associated with the use of agrochemicals

The structure of the modern agriculture and current policies clearly influenced the context of the agricultural production and technology, which in turn led to the expansion of monocultures and associated environmental problems, including the reduction of the biodiversity in adjacent fields and ecosystems (Altieri, 2009).

Today, the global agriculture is indeed in a delicate situation because the global economy imposes conflicting demands on farmlands, which is around 1.5 billion hectares. So these lands are not only intended to produce enough food for a growing population, but also to produce biofuels. This model is unleashing an unprecedented crisis in the world food system, threatening the food security of millions of people. This is a direct result of the model of industrial agriculture, which is not only dangerously dependent on hydrocarbons, but has also become the largest human force to modify the biosphere (Altieri, 2009).

In Brazil, according to the latest agricultural census, 80.0 million hectares of family agriculture were used, 45.0% were for pasture, while the area with forests or agroforestry systems occupied 28.0% and, finally, the crops occupied 22.0%. Non-family agriculture also followed this order, but the share of pastures and forests was slightly higher (49.0% and 28.0%, respectively), while the area for crops was lower (17.0%). It is worth noting the participation of the area of the forests destined to the permanent preservation or legal

reserve of 10,0% in average in the familiar establishments, and of other 13,0% of areas used with forests and/ or natural forests. Even farming a smaller area with crops and pastures (17.7 and 36.4 million hectares, respectively), family agriculture is responsible for guaranteeing a large part of the country's food security, as an important supplier of food for the domestic market (IBGE, 2009).

The humanity is rapidly becoming aware of the fact that the industrial model of agriculture is not enough to provide the necessary food or preserve the nature. The expansion of agricultural land to biofuels or transgenic crops, which already covers more than 120 million hectares, will exacerbate the ecological impacts of monocultures that threaten the biodiversity and degrade the nature. In addition, industrial agriculture now contributes with more than a third of the global emissions of greenhouse gases, especially methane and nitrous oxides (Altieri, 2009).

As Oliveira and Paula (2016) mention, agribusiness can be understood as a model of hegemonic agricultural production, focused on monoculture, predominance of use of chemical inputs, latifundia, technological equipment, genetically modified seeds and seedlings, de-characterization of local biodiversity and uniform plantations.

These elements are together with the expansion of the agroindustrial model fomented from the 1960s in Brazil, and consolidate the basis of the large-scale agribusiness model in the international financial capitalism scenario of the 21st century. In this sense, there is a clear attempt to use the agrarian space to increase the accumulation and homogenization in an association between the large industrial capital and the large landed property, under the patronage of state policies (Delgado, 2013).

When comparing the agribusiness investment in genetically modified organisms with that in conventional agriculture, it is possible to say that the same logic exists in the manufacture of insecticidal plants and herbicide-associated plants, and since its beginning, a little more than a decade ago, it has increased the consumption of agrochemicals. The chemical components, and, in particular, the different varieties used in food crops, provoke the vulnerability and risks to the applicators and manipulators of these products and the people living in regions controlled by agribusiness (Oliveira & Paula, 2016) .

In addition, Porto and Milanez (2009) emphasize that the decision regarding the choice, quantity and quality of pesticides is not always taken considering the damages of their chemical components to health, society and ecosystems, but rather from a vision limited to get a short-term return. According to Orsi et al. (2012), the overuse of agrochemicals can damage the environment by contaminating groundwater that moves through the atmosphere, applied to eliminate the natural enemies of crops such as pests and insects, but also these agrochemicals eliminate bees and other pollinators generally.

In addition, there are still problems commonly generated by technical drift, as known in the technical jargon of agronomy. Technical drift is the name given to the dispersion of pesticides in the environment through wind or water and occurs in at least 30% of the products applied. It is the poison that does not reach the crop that must be treated and leaves the air to contaminate the environment, which can occur according to all applicable standards (Londres, 2011).

One of the forms of application is through aerial spraying which, although prohibited in Europe, is permitted in Brazil, but must follow the Normative Instruction n. 02 of the Ministry of Agriculture, Livestock and Supply (MAPA), from 2008, which establishes the limit of five hundred meters for aerial

spraying. This distance must be maintained from any inhabited area, away from residences, streams, water supply and animal breeding sites. But usually this normative instruction is not obeyed (Souza & Folgado, 2016).

Another relevant factor to be observed is the constant need to increase the application of chemical substances in crops, as shown by data from the US Department of Environment. Vaz (2006) points out that in the 1970s, US farmers used 25,000 tons of agrochemicals and lost 7% of the crop before the harvest. In the late 1990s, they used 12 times more pesticides and lost twice as much. This was due to the fact that agricultural pests have the capacity to develop resistance to the applied pesticides: over time agrochemicals are losing effectiveness and causing farmers to increase the applied doses or to use new products; thus forming a vicious circle.

In the period between 2004 and 2008, there was a growth of 4.6% in the cultivated area. On the other hand, the quantities of agrochemicals sold in the same period rose approximately 44.6% in Brazil (IBGE, 2009), corroborating with Vaz's (2006) statement that the need for increased use of these substances is constant .

According to Altieri (2009), the great challenge is to transform industrial agriculture and begin a transition of food systems. To do so, an alternative paradigm of agricultural development is needed, which provides for socially fair and sustainable forms of agriculture; redrawing the entire food system toward more equitable and viable forms for farmers and consumers, which requires radical changes in the political and economic forces that determine what, how, where and for whom it is produced. Thus, only by challenging the control exercised by multinational corporations over the food system and the agricultural export model favored by neoliberal governments it will be possible to halt the spiral of poverty, hunger, rural migration and environmental degradation.

Therefore, multifunctional agriculture can only arise if the rural landscape is characterized by hundreds of small biodiversity farms, which are capable of producing between two and ten times more per unit of agricultural land than large farms. In addition, small and medium-sized farmers reduce erosion and conserve biodiversity more. With the added advantage that communities surrounded by small farms present fewer social problems such as: alcoholism, drug addiction, domestic violence, etc. In addition, cities surrounded by vast tracts of sugar cane are warmer than cities surrounded by medium and diversified farms (Altieri, 2009).

From the ecological point of view, the consequences of the specialization of the monoculture are varied. The most notable includes the high vulnerability of ecologically and genetically homogeneous systems, climate change and the invasion of pests and diseases.

In the following section, the data from the European Parliamentary Research Service Report - European Parliament, showing the disadvantages of pesticide dependent plantations are presented.

3. Agrochemicals in Europe

Studies that discuss the effects of organic foods on population health are scarce. A recent study on the subject was published in 2016 by the European Parliament, which presents the benefits of food grown without pesticides compared to those grown with the use of pesticides. The purpose of this study is to

provide information to guide policy actions by providing information on how organic farming and food can contribute to improving human health.

The report is important as the basis for negotiations on a new regulation under discussion in the European Union (EU) on the labeling of organic products. To this end, a more rigorous policy regarding pesticide residues in organic products is under discussion.

The study points out that there is not only a conventional agri-food system or just an organic agri-food system, but a variety of different forms with some overlap. Some attention is drawn to the fact that in the study the term "conventional agriculture" refers to the predominant type of intensive agriculture in the EU, i.e. intensive agriculture with high inputs of synthetic pesticides and mineral fertilizers and a high use of antibiotics, in the conventional production of animals. "Organic farming" refers to the agriculture which complies with EU regulations or similar standards for organic production, including the use of organic fertilizers, such as manure and other non-chemicals, as well as measures for the prevention and pest control.

Among the results of the study, what stands out is the indication that organic foods reduce the risk of allergy in children and decreases the incidence of obesity among adults. In addition, it has been found that a prolonged use of phosphorus mineral fertilizers contributes to the increase of cadmium concentrations in agricultural soils. This is highly relevant to the human health, since the diet is the dominant route of human exposure to cadmium in nonsmokers. And the current exposure of the population to the chemical component is near, and in some cases above the tolerable limits.

Brantsaeter et al. (2016) point out a study that analyzes the relationship between the incidence of allergies and food with pesticides, with a sample of more than 28,000 pregnant women with children born between 2002 and 2008. The study sought to identify the frequency of consumption of organic foods, while those reporting frequent consumption of organic vegetables (but not other food groups) showed a 21% reduction in the risk of preeclampsia, which is a disorder occurring during the third trimester of the pregnancy and is characterized by high blood pressure and a large amount of protein in the urine. Some cases can be serious, threatening both the mother and the fetus and leading to a premature birth. Despite a small number of cases, this study also provided some evidence of a link between organic food consumption and lower risk of hypospadias, but no cryptorchidism (both congenital defects in male genitalia).

Another point of discussion was to investigate the association between the organic food consumption and cancer risk in a research group comprising 623,080 middle-aged women from the UK during a follow-up period of 9.3 years. The overall risk of cancer was not associated with the consumption of organic foods, but a significant (-21%) reduction in the risk of non-Hodgkin's lymphoma was observed. The conclusion was that there is a potential link between preferences for organic foods and non-Hodgkin's lymphoma, which could be interpreted in light of the results of a recent meta-analysis based on 44 original studies reporting that occupational exposure to pesticides, including phenoxy herbicides and insecticides carbamate, organophosphates and lindane, were positively associated with the risk of non-Hodgkin's lymphoma. B-cell lymphoma of the subtype was also positively associated with the exposure to the glyphosate and phenoxy herbicide (European, 2016).

Another study carried out in Italy, according to De Lorezo et al. (2010), had a sample of 50 men (100 healthy male subjects + 50 patients with chronic male kidney disease (CKD)). In the study, Mediterranean

diets, consisting of organic or conventional foods, were each successively administered for fourteen days, and a statistically significant improvement in the fat mass and homocysteine was observed in all subjects, and in the body weight and the body mass index only in patients with CKD.

The Italian work is consistent with the results observed in the German National Nutrition Survey II, Eisinger-Watzl et al. (2015), in which a study of national food consumption among 13,074 adults was carried out. German consumers of organic foods exhibited healthier characteristics compared to those who did not consume this kind of food.

The conclusion they had regarding the benefits that can be gained by an organic food diet was that there is a shortage of studies that investigate the potential beneficial effects of the consumption of these foods compared to the conventional ones in health, through a direct estimate of consumption. However, few researches such as those cited above have shown that foods grown with pesticides are harmful to the human health (European, 2016).

4. Regulation and residues of pesticides in Brazil

According to the European Parliamentary Research Service (2016), currently, 389 substances are authorized as pesticides in the EU. Of these, 35 are also approved for use in organic agriculture. However, most of the substances used for pest control approved for organic farming have comparatively low toxicological concern for consumers because they are not associated with any identified toxicity (eg peppermint oil, quartz sand and some microorganisms), being part of a normal diet or they are human nutrients such as: iron, potassium bicarbonate, rapeseed oil, in other cases, are approved to be used in insect traps and therefore are not applied to soil or plants (pyrethroids synthetic lambda-cyhalothrin and deltamethrin, pheromones).

In Brazil, all the agrochemicals mentioned in the report, released by the European Parliament, as being harmful to human health, with the exception of lindane alone, are allowed. Therefore, all others such as: phenoxy herbicides, carbamate insecticides and organophosphates, are released for use. The organophosphate insecticide is the second most commonly used chemical pesticide in Brazil, so in 2013 the consumption alone was 79,293 tons of this product. The insecticide carbamate is in sixth place in the list of most consumed in the year 2013, with the consumption of 41,421 tons (Brazil, 2016).

According to Londres (2011), since 2008, Brazil is the largest consumer market for pesticides in the world, estimated at 5.2 liters of pesticides per person per year, equivalent to 16 liters of agrochemicals per hectare that can be grown in the country.

According to the Ministry of Agriculture, in 2016, 277 new agrochemicals were registered, which is a record, since the annual historical average is 140 registrations. In 2015, there were 177, so there was an increase of 374% in relation to the records that occurred in the year that preceded it. The previous record had occurred in 2007, when 203 new pesticides were registered (Mapa, 2017). Another relevant fact is that Europe authorizes the use of only 22 of the 50 most consumed agrochemicals in Brazil (Londres, 2011).

In 2011, according to Londres (2011), Brazil was already the main destination of banned products abroad. According to data from ANVISA (2010), at least ten banned products were used in Brazilian crops and not in the EU, the United States, China and other countries. This factor was probably leveraged by the tax

exemptions granted to the trade of these products. Through the ICMS Agreement 100/971, the federal government grants a reduction of 60% in the rate of ICMS (Tax on Circulation of Goods and Services) to all agrochemicals. In addition, the Decree 6.006/ 062 completely exempts from the collection of IPI (Industrialized Products Tax) pesticides manufactured from a list of dozens of active ingredients (including some highly dangerous ones such as methamidophos and endosulfan, which have recently been banned determined by ANVISA). The Decree 5.630/ 053 exempts from the collection of PIS/ PASEP (Social Integration Program/ Server Patrimony Training Program). In addition to the federal exemptions, there are the complementary exemptions determined by some states. In Ceará, for example, the exemption of ICMS, IPI, COFINS and PIS/ PASEP for activities involving pesticides can reach 100%.

In 2016, the National Agency of Sanitary Surveillance (ANVISA) released a report prepared by the Program for Analysis of Agrochemical Waste in Foods (PARA), with a research conducted in the period from 2013 to 2015, in which levels of pesticides were monitored in 25 foods, covering the following categories: cereals/ legumes, fruits, hardwood vegetables, non-hardwood vegetables and tubers/ roots/ bulbs. A total of 12,051 samples were analyzed, and in 42.0% no residues were detected, considering the pesticides researched (Brazil, 2016).

In the aforementioned study, 2,211 samples showed residues of pesticides not authorized for cultivation, distributed as follows: 123 samples from the cereals/ legumes group, 740 samples from the fruit category, 298 samples from the leafy vegetables group, 720 samples of non-hardwood vegetables and 330 samples of the root, tuber and bulb categories.

Regarding chronic exposure, studies indicate that the incidence of waste is low in doses that could potentially cause health damage. In 2013, a chronic risk analysis was performed using the data from the 2009 to 2011 PDA and the health risk was considered acceptable, since there was no extrapolation of the Acceptable Daily Intake (ADI) for the monitored pesticides. One of the reasons that led to this conclusion was the fact that, in most cases, it would be necessary to consume several foods containing a certain amount of pesticide always higher than the ceilings established everyday for years. However, the possibility of chronic health risk caused by exposure to the pesticide residues through diet cannot be ruled out. The evaluation of the exposure to pesticide residues by the diet led by the processes of registration of a pesticide, and post-registration changes for the inclusion of a culture, is performed considering the exposure to a single active ingredient at a time. However, as mentioned previously, there are agrochemicals that have the same mechanism of toxic action, which may have an additional effect due to the greater exposure to residues of these substances than that verified in the studies by each active ingredient (Brazil, 2016).

Therefore, the risk assessment due to exposure to these chemicals can also be made from the use of probabilistic statistics, a more complex approach which considers, for example, the cumulative exposure of agrochemicals that have the same mechanism of action and contribute to a harmful effect. The aggregate exposure, which takes into account the various forms and sources of exposure to a pesticide, such as an exposure to the skin and ingestion of other unmonitored foods such as potable water, meat, milk and eggs may also be mentioned. In addition to chronic intoxication, acute intoxication can also occur, caused by the ingestion of pesticide residues in the food consumed within a short period of time. Risks to which the field workers dealing with these chemical substances can suffer (Brazil, 2016).

5. Characteristics of rural workers

Work in the field is an activity that covers both the participation of women and men. However, the predominance of male individuals is found in both agribusiness workers (79%) and family farmers (83.1%). They belong, in the majority, to the age group that comprises of the 16 to the 37 years. Nevertheless, the largest number of young workers (65.2%) is present in the agribusiness segment, while in the family agriculture system it is still high, but far below the share of agribusiness (49.1%) (IBGE , 2017).

Among the family farmers, 81% of the interviewees have low schooling, being divided between illiterates, functional illiterates or those who did not complete the elementary school.

Among the agribusiness workers, the illiterate are 72.1% of the interviewees. Data such as these show the risk to which they are subjected, therefore, this keeps the conditions of these workers extremely vulnerable, considering that they need to read safety instructions because of the activities they perform. An example of this is the information on the pesticide labels for toxicity and handling.

6. Brazilian agribusiness

The term agribusiness originated in the School of Business Administration at Harvard University with the publication of A Concept of Agribusiness by John Davis and Ray Goldberg in 1957. The book brought the idea that the field underwent major transformations from a "technological revolution", based on the scientific "progress" used in agriculture (Mendonça, 2015). From this perspective, it would be necessary to develop public policies to support the large agricultural holding that results in increased costs of production, processing, distribution of agricultural products and transportation.

The essence of agribusiness is the monoculture for export. This type of production cannot live without the pesticide, because it is based on the domain of only one plant species, as it is the case of soybeans. Therefore, everyday, new superplagues appear that, associated with transgenics, have demanded the release of new agrochemicals. The most recent case was the emergency release of emamectin benzoate, used to combat the Helicoverpa caterpillar that is decimating soybean crops from the north to the south of the country. The law that secured the release of this component was processed and approved in just one month by the Congress and by the Presidency of the Republic (Souza & Folgado, 2016).

This all evidences that the dependence of the new technologies created by the scientific field increases the environmental degradation, caused by an hegemonic agricultural model. Therefore, this model of agribusiness must be overcome with the justification that its exploratory and capitalist characteristics are responsible for most of the current ecological conflicts (Oliveira & Paula 2016).

However, from the economic point of view, this has worked, considering that from the 1990s to the present day, the agricultural sector achieved a significant productivity gain. As Nakatani, Faleiros and Vargas (2012) point out, the agricultural production has increased significantly, which demonstrates an accommodation of the old land structure to the interests of the large industry. Between 1996 and 2005 the balances from agricultural activities jumped from 7.9 to 28.6 billion dollars, reaching 63 billion dollars in 2010 and 72.5 billion in 2016 (IPEA, 2017).

Between 2003 and 2010, the area of large properties increased from 214,843,865 to 318,904,739 ha, from 51.3% to 55.8% of the total, a 48.4% increase in this ownership profile in the period. But the other profiles also advanced – smallholdings grew from 38.9 million hectares to 46.6 million, small farms from 74.1 million to 88.7 million, and average properties from 88.1 million to 113.8 million hectares. However, in percentage terms, these three ownership bands have lost ground. And the speed of these changes is explained by a positioning of the Brazilian economy in the sense of a greater specialization in the production of primary commodities (Nakatani; Faleiros & Vargas, 2012).

However, it is observed that the ecological sustainability is especially ensured by groups of peasants, rural workers and traditional populations, which are important targets of agribusiness problems. Such population groups tend to be characterized by socioeconomic vulnerability, formed by people of low social class and with little or no political/ institutional representation, in elective positions, which should also be a motto for a contextualized analysis of the crisis of the representative democracy and its dynamics of power, which are reflections of the concentration of the economic power (Oliveira & Paula, 2016).

Currently, the ruralist group, which defends the specific interests of large landowners and multinationals, has a large number of members of Congress in the Brazilian National Congress, which has caused significant mitigation of rights and setbacks with regard to the socio-environmental protection and space design such as the approval of the new Forest Code, legislation on mineral exploration and demarcation of indigenous lands, among others (Oliveira & Paula, 2016).

The alternative to the agricultural system of agribusiness is the family farming, which is usually characterized by biodiversity, family work, small agricultural areas, polycultures and lower production volume.

7. Risks of using agrochemicals in family farming

The peasant family farmer is the individual of the countryside, who, although subordinated to the capitalist mode of production, struggles daily to maintain his identity with the land (Rigotto, 2011).

And this agricultural system has the following participation in selected crops: it produces 87.0% of the national production of cassava, 46.0% of the corn, 70.0% of the bean production, 34.0% of the rice, 38, 0% of the coffee, 58.0% of the milk, had 59.0% of the pork, 50.0% of the poultry, 30.0% of the cattle, and produced 21.0% of the wheat. The crop with the lowest share of family agriculture was soybeans (16.0%), the main scope of Brazilian export products (IBGE, 2017).

The participation of family agriculture in the agricultural system is conditional on the capital to be part of the agribusiness. The need for capital is given, because it controls the technology, knowledge, market, and agricultural policies. And peasants are subordinate to this system (Rigotto, 2011). For Ridolfi (2015), the large companies of the agricultural sector that form large groups, the so-called Food Empires, use practices of powers at local and world scale to exercise the organization and management of the territory in which they settle, creating barriers to other dynamics of use, access and conception of land, making it difficult to practice family farming.

According to Porto and Soares (2012), the current capitalism model and its incentive policies end up stimulating the use of pesticides. However, the opposite should occur with the implementation of policies

to encourage the reduction of chemical substances in crops, such as rural credit policies to finance organic production; tax incentives based on the increase of the tax on products according to the level of danger by the use of agrochemicals and exempting, on the other hand, the production without agrochemicals. Another viable practice would be the creation of a fund financed by the production and trade of agrochemicals to support clinical, epidemiological and toxicological studies, control measures and educational campaigns; the reduction of capital costs for investments linked to the expansion of technologies and agroecological systems of agricultural production, coupled with the increase of research and development policies in agroecology.

Another factor unfavorable to the family farmer in Brazil are the laws, decrees and norms that regulate the production, commercialization, control and use of agrochemicals, which, since 1989, have incorporated the recommendations of the International Code of Conduct for the Distribution and Use of Agrochemicals as a conceptual basis and having as a guideline the booklet of safe practices as a paradigm for the protection of human health and the environment. This regulatory framework does not consider the incentive to ecologically based food production models nor the development of alternative technologies for the preservation of the production. In addition, it excludes 12.3 million rural self-employed workers, a category that corresponds to 84% of the rural establishments in the country, employs 74% of the rural labor force and provides 70% of the food consumed by Brazilians. These farmers have free access to agrochemicals, but they have not defined the supervision and labor guarantees for the safe use of these products (Abreu & Herling, 2016).

As shown by the research reported by IBGE (2009), more than 1/3 of the family farming properties in Brazil used agrochemicals. This is the case of the state of Rio de Janeiro, which grows mainly sugarcane, banana, cassava and coffee, and has the predominance of family agriculture in the highland region of the state. In spite of this, it stands out for the great concentration of pesticides applied per hectare, showing the highest relation between the commercialization of pesticides by planted area in Brazil in 2013 (Brazil, 2016).

As a consequence of this state and industrial stimulus to the intensive use of agrochemicals, concomitant with public health, environment and labor policies, which is based on the paradigm of what supposedly should be the safe use of pesticides, has, unlike which claims to be the goal, revealed something harmful to the health of rural workers and the environment. As a result, there are increasing cases of acute and chronic intoxication, mainly among family farmers (Santana et al., 2013).

A significant part of the application of agrochemicals in family farms occurs with great risk of accidents, since farmers are often unaware of the dangers to which they are exposed when carrying out this task. In many cases, this is because they do not know how to read (Ridolfi, 2015), since the 2006 Census of Agriculture shows that 81% of those working in family farms have low levels of education, which contributes to difficult access to information. And even more serious is that they are often held responsible for such risks, which is a situation that refers to social inequality, since it is the most vulnerable part that is blamed for the effects of the risk scenario to which they are inserted (IBGE, 2009) .

In the country, there are no estimates that quantify the mortality by occupational intoxications due to the use of pesticides. However, it is possible from the data analysis of the National Toxic Pharmacological

Information System (SINITOX) throughout the country, from 1986 to 2003, to identify 3,012 deaths from poisonings related to pesticides, thus obtaining the mortality coefficient of 1.58 / 1,000,000, higher in the Midwest (3.1), Northeast (2.7) and South of the country (2.2), respectively (Santana et al., 2013).

However, when some data are analyzed with more caution, it is noticed that some information is omitted, which makes it difficult to determine with more accuracy in which conditions the death occurred. An example of this is when analyzing the database of the Mortality Information System, between 2000 and 2009. It is possible to identify 2,052 deaths caused by intoxication due to the use of pesticides, with 36.2% not having information on the occupation. From the people who presented this information, 51.9% were identified as agricultural workers. However, 7.2% of those considered "accidental" were not recorded as work accidents. In addition, the majority of diagnoses of the underlying cause (47.8%) were classified in the pesticide intoxication group of undetermined intention, due to the use of pesticides. And only 30% of cases had a diagnosis of pesticide poisoning as an associated cause. From this total, only 9.6% had the chemical compounds identified, being the organophosphates and carbamates, representing 56.9% of the cases that had the identified compounds (Santana et al., 2013).

Abreu and Herling (2016) point out that, as a result of the increase in the cases of pesticide poisoning in developing countries and the pressure exerted by non-governmental organizations and international health organizations such as the World Health Organization (WHO) and by the environment, such as the United Nations Environment Program (UNEP), FAO/ UN Food and Agriculture Organization (FAO) launched in 1986, the International Code of Conduct for the Distribution and Use of Agrochemicals (FAO, 2016). This was later adopted in Brazil, as already mentioned, with the close participation of the International Group of National Associations of Agrochemical Manufacturers (GIFAP) - an association of chemical industries responsible for guaranteeing the interests of the industry in the international arena. The Code sets standards of conduct for the trade and efficient and safe use of pesticides, listing guidelines for governments, industries, employers and rural workers. In short, the code states the safety of pesticides provided they are used correctly.

However, the way pesticides are sold to small producers leads to a lack of guidance due to the conflict of interest on the part of the sellers. Although the manuals emphasize that it is "fundamental to consult an agronomist, so that the crop problems are properly evaluated" and that the presentation of an agronomic recipe, prepared by an agronomist, is essential for the purchase, this does not always occur. Researches carried out in Lavras-MG found that agronomists and employees of agrochemicals marketing sites often provide agronomic recipes with more interest in the sale of products than with the proper use of agrochemicals. The acquisition activity is one of the pillars of the paradigm of what is expected of the safe use of agrochemicals and is determinant for the potentiality of the risk in the other activities. It is in the moment of buyng the products that the toxicity of the pesticide is defined and it will be transported, stored, prepared, applied, and will have the empty packaging returned or discarded after use and the contaminated clothes will be washed. In addition, the moment of purchase is, according to the safety manuals, important to provide information and instructions on the procedures and care that should be followed in each of the pesticide handling activities (Abreu & Herling, 2016, Oliveira & Paula, 2016).

The Agrochemical Waste Analysis Program (PARA) found that the illegal use of agrochemicals is common in crops where family farming is predominant. Besides that, small and medium producers usually apply the poisons through the costal sprayer, admittedly the equipment that most exposes the worker to the risks of intoxication (Brazil, 2016).

Thus, in Brazil, in the context of family farming, there is no viability of a safe use of pesticides. This conclusion is extended to the other productive units of family agriculture in the country due to the similarities of the structural data of this category identified in Lavras-MG with the national data presented by the Agricultural Census of 2006 (IBGE, 2009). It has been systematically verified that the control of intoxication risks in the general context of family agriculture cannot be done through the paradigm of the expected safe use of pesticides. Because the incentive and support to the free areas of pesticides and more fair, independent, efficient and profitable production technologies, as a way of valuing the characteristics and tradition of family agriculture, must be priorities of the State and the civil society (Abreu & Herling, 2016).

Such indications lead to consider that it is increasingly necessary to search for alternatives to conventional agricultural systems in order to cope with the high vulnerability of small farmers to the use of agrochemicals, as well as to enable the production of food free from these substances. Encouraging and raising awareness among small farmers about the risks of agrochemicals and the advantages of organic production, since they are the ones that have the greatest potential for conversion to agricultural production systems based on agroecological principles. And as the data from the last agricultural census show, there is a great potential for the inclusion of small farmers in a fairer and healthier process, since 84% of the rural properties are classified as belonging to families, considering that they are around 5.2 million establishments registered in Brazil. However, according to the census, only 1.8% of the producers are organic (Porto & Soares, 2012).

Agroecology is an agro-ecological alternative, with a broader perspective. It incorporates the social and cultural dimension, recognizing the importance of local producers' knowledge and culture, as well as the importance of integrating environmental sustainability with social justice. However, if agroecology is to be consolidated as a sustainable option, it is necessary to combat barriers that avoid the expansion of the market for organic products. One way to prevent organic production would be through the state support, as it did in the period of the "green revolution", when it actively participated in the development and sustainability of this agricultural model that underpinned the development of agribusiness (Porto & Soares, 2012).

8. Conclusions

This study allows us to conclude that in Brazil, the modern agricultural structure based on large areas of monoculture and public policies to encourage agribusiness, has encouraged the constant release of large quantities of agrochemicals for use in the field and a significant part of these components generates health risks such as: allergies, obesity, non-Hodgkin's lymphoma, and pregnancy disorders that can cause risks to both mothers and fetuses. These problems are caused by several substances that are released for use in Brazil, but banned in several parts of the world as in Europe, which prohibits 28 of the 50 most consumed pesticides in Brazil.

The study also suggests that, although Brazil has an economy focused on the production of *commodities*, mainly agricultural, this should not be justified as a practice that disrespects the health of farmers and consumers. Even more if one considers the dependence caused by agrochemicals that demand the constant increase of its application in the crops, as the last agricultural census shows, in a period in which there was an increase of 4.6% of cultivated lands and 44,6% in the consumption of agrochemicals.

The data related to rural workers show that they do not receive proper care and that they are commonly subjected to risks. And, some vulnerabilities such as illiteracy, prevent the reading of instruction manuals on the handling of pesticides, substances that are widely used both in agribusiness and family agriculture - which they declared in the last census to use in more than 33% of the plantations - , but other studies presented in this work indicate that the amount used is higher, which is worrying, since family farming could use polyculture techniques to reduce or eliminate the need to use agrochemicals in crops, which seems unfeasible in monoculture productions.

It should be understood that the climate and the type of agriculture in Brazil are quite different from that in Europe, but this should not give the right to consume substances that are proven to be highly toxic. And, reports like the one of PARA, divulged by ANVISA, are important like a base of information on the quality of the food, because sustainability and food security must play an important role in decision-making, imposing the idea that it is necessary to set limits to growth and set goals that respect all those involved in the process.

Currently, most of the proposals approved in the Congress, which relate to agriculture, are presented by the ruralist group, which defends the specific interests of large rural and multinational landowners and has a large number of members of Congress in the Brazilian National Congress. Most of these proposals only foster the existing capitalist model, and their incentive policies end up encouraging the use of pesticides, while the opposite should occur, with the implementation of policies to support the reduction of chemical substances in crops, as the adoption of agroecology as a guiding practice of public policies to encourage agriculture, as occurred in the period of the "green revolution."

Finally, this study raises arguments that show that the great challenge is to rethink the industrial agriculture and start a transition of food systems. It would be possible through the definition of a new model, which would foster an agricultural structure based on diversity, sustainable and socially fair; which would replace the current one, controlled by multinational corporations, oriented to export, and favored by neoliberal governments. This could probably be an indication of how to stop the spiral of poverty, hunger, rural migration and environmental degradation.

9. References

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