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Possibilities and limits of transgenics in ensuring food security and food sovereignty

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ABSTRACT

In view of the fast increase in demand for food some researchers argue that transgenics are the only alternative to counter the food crisis that looms over us(the planet). In this article we point out the factual growth of transgenic plant cultivation worldwide, as well as the great promise of genetically modified organisms (GMO) vis-à-vis the increase in food demand. Notwithstanding, we cannot overlook the fierce controversy that surrounds this theme, and considering the arguments of both the enthusiasts and of the critics of the GMOs, we discuss the real possibility of GMOs being an effective way to ensure the food security and the food sovereignty of all nations.

Key words: food security and food sovereignty; technology transfer; biotechnology; transgenic seeds;

INTRODUCTION

In this paper it is intended to discuss about the possibilities and limits of transgenic crops being a viable tool to ensure food security and food sovereignty as it was expected from the First Green Revolution in the 1960s years. Initially it is presented the context in which arise the Genetically Modified Organisms (GMO), when (it) is established a new plant breeding paradigm. Then it is punctuated the concept of food security and the promises of the transgenics to increase the global food supply because they could increase the agricultural production and productivity, improving the nutritional quality of food, besides of demanding less quantity of agrochemicals and preserving the environment.

Later it is presented the argument of the critics of the GMO, discussing about the economic, social and environmental malefactions resulted from the production and consumption of transgenic. It is seen like a Second Green Revolution and a lot of its critics draw attention to the possible process of global homogenization of agricultural practices as well as the monopolization of transgenics by multinationals of agricultural sector, and intensify the dependence of the food production upon these firms.

In face of the existent divergences around the “transgenic subject”, it is questioned in this article the possibility of the GMO to ensure food security. For this purpose it is considered two kinds of arguments: the first one that defends being the transgenics the

only technique able to increase the food supply in face of the current increasing demand; the second one which defends that the transgenics are only multinationals products mitigating a sustainable agrarian development and, thus, the food sovereignty, mainly of the less developed countries.

WHAT IS THE CONTEXT IN WHICH DO EMERGE THE GENETICALLY MODIFIED ORGANISMS?

In the years 1970 and 1980 the standard of wealth based on intensive mass production of goods and services of materials and energy began to decline, occurring a set of chances in the economic, social, political, organizational, institutional and technological scope. As the power goes beyond the dominion of material means and the political and institutional dimensions, its basis turns to and incorporate the control of the immaterial and the intangible, such as information, knowledge and ideas. These elements assume new and strategic roles, becoming source of higher productivity and economic development (LASTRES, 1999). In the so called Scientific-Technological Revolution the access to a wide base of information and scientific and technological knowledge, which was an advantage in the past becomes of fundamental importance. In this intensive techno-productive model in knowledge, the human activities are focused and organized around actions of creation, recovery and use of information and knowledge. (LASTRES e ALBAGLI [org], 1999). In this way:

> the skills gained and the possibilities of creation and use of knowledge are seen as having a more central and strategic role, not only in the competitivity but also to the survival of individuals, organizations and countries. (LASTRES, 2000:19)

In the establishment of the Knowledge Economy the information and the new technologies increase drastically their importance as well in the agriculture, creating strategic competitive advantages. The information and the knowledge come to have a more and more determinant role in the acquisition of control and power within of a lot of sectors in the agriculture, amplifying the possibilities of increasing the profits and decreasing costs with the possibility to transfer risks to people that do not have access to this knowledge and information. The reasons that have culminated in this new role played by information and knowledge in the agricultural world are, not only the

increase of sophistication and complexation of the food production system (it is required a higher diversity and a more exact control on the production quality) but also the intensive spread of knowledge in the chemical, biological and physical process implanted in the agricultural production. Nowadays, the large agrochemical and seed companies keep in the information and knowledge the central and strategic tools of competitive advantage. (BOEHLJE, 1998)

> the physical resources of land, and capital combined with a bit of knowledge and information has and will likely become more important in the future for successful management of a farm business. Superior knowledge and information will be the cornerstone for success – it will enable the producer to obtain the physical resources of land, labor, and capital and combine them in an efficient manner. Knowledge and information about a broader and more complex set of issues (…) is increasingly important for profitable and socially responsible farm operations. (BOEHJE, 1998: 24)

Specifically in the agriculture, the establishment of this new order occurs through the process of exhaustion of techno-productive model spread by the Green Revolution – as a result of its homogenization process of agricultural practices, lost of ecological diversity, pollution of water and soil by intensive use of chemical inputs (indispensable for the practice of the technological pattern of Green Revolution), amongst other factors. The emergence of GMO in the agricultural sector, as an alternative to the conciliation of great productions with the sustainable usage of the environment, represents the conformation of these new international technological dynamics, in an economy even stronger and steadily rooted in the production and use of knowledge[2].

genetic pattern

The Green Revolution corresponded to the process whereby the chemical agricultural and, created in the United States, Europe and Japan, was spread to a lot of developing countries mainly from the 1960's years on, substituting the local techniques of production by a more homogeneous set of technological practice that promise to mitigate the hungry problems in the world. Through the introduction of the high productivity seeds, also known as "miracle seeds" (which demanded higher use of fertilizers, pesticides and a more rigorous irrigation system for achieving the expected productivity) it was intended to increase the basic cereals production in the poor

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countries, allowing the possible elimination of the problem of food supply and mitigating the hungry in the world.

Notwithstanding, the critics of Green Revolution highlight that in despite of the effective increase of agricultural total production, in the 1980's years, the vitality of great crops succumbed as a result of a set of concerns linked to the socio-economic and environmental problems created by these productive pattern, such as the erosion and the loss of soil fertility; the destruction of genetic heritage and of biodiversity, among others. Thus, in face of the failure of the Green Revolution in mitigating the hungry in the world arise the transgenic, like a segment of modern biotechnology, as a possible "Second Green Revolution", promising great productivity rates with the concomitant preservation of environment[3].

The biotechnological concept "refers to a wide set of technologies used in several economic sectors and has in common the use of live organisms (or parts of them, such as cells and molecules) for the production of goods and services". (SILVEIRA; DAL POZ and ASSAD [org.], 2004:18). According to the scientific and technological level existing, it is distinguished the difference between traditional and modern biotechnology. In the former, the live organisms are used in the form that they are found in the nature or they are modified through traditional breeding methods, such as the case of seeds of high productivity from the first Green Revolution. The modern biotechnology, on the other hand, use the genetically modified live organisms through "genetic engineering (…) – technology that permits to cut and tie chemically the DNA and in this way to transfer genes from one specie to another and, in doing so, create new forms of life". (ib.:19) The possibility to produce transgenic plants, with new characteristics and independent of sexual compatibility amongst species, overcoming the natural barriers amongst different species of plants, corresponds to the major impact of modern biotechnology in the agriculture.

The "trend is the current agricultural revolution to depend less on mechanical and chemical innovations and to be based in the intensive usage of scientific knowledge and of the molecular and cellular techniques". (ib.: 23) To Norman Ernest Boulaug, considered the father of the Green Revolution, to whom was granted the Nobel prize in

[3] ib. (2008 a)

1970, it will be the responsibility of transgenic technique "to exert the role that the other plant breeding technologies and other modern methods performed in the last 50 years[4]". The transgenic technique changes, hence, the paradigms of plant breeding methods [5].

Amongst the promises of the new Revolution would be, besides the increase of the productivity and of the use of sustainable agricultural practices, the reduction of the costs and improvement in the quality of the food. Would it be the transgenics the sole viable alternative to the guarantee of food security in face of growth of global food demand?

FOOD SECURITY AND THE "PROMISES" OF THE TRANSGENICS

According to the Department of Social Development and Combat against Hungry of Brazil, the definition of food security[6] corresponds to:

> The compliance of the human rights to the regular and permanent access to quality food, in enough quantity, without compromising the access to other essential basic needs, supported by food practices which promote health, that respect the cultural diversity being social, economic and environmental sustainable.

It is evident that the food security is not linked only to the capacity of food production, but to embrace notions of equity, justice and environmental sustainability as well. In this sense, the States should establish a political, legal and institutional system that permit to all citizens feed themselves properly. Before being just a political goal, the food security must be seen as a right. The right to the food is a human right.

The concept of food security has, basically, four elements:

1) The guarantee of agricultural production and supply, related to the problem of scarcity of production and of the supply of food products.

2) The guarantee of the right to the access to the food, related to the unequal food distribution in the market economies.

3) The guarantee of sanity and nutritional quality of the food, what remit to the problems of low nutritional quality and of contamination of the food consumed by population.

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[4] KISS, Janice.
[5] MARTINS, A . R. A., (2008 b)
[6] We have to bear in mind that in Brazil food security includes food safety, so when we talk about food security there are included the concepts of food safety also.

4) The guarantee of conservation and control of the genetic basis of food system, which refers to the lack of access, destruction or to the monopoly upon the genetic base of the food system (PESSANHA and WILKINSON, 2003: 265)

Generically, the two first are related to the theme of food security, while the others are linked to the theme of food safety. Back to the central theme of this article, it is important to discuss: in what sense would the transgenic foods accomplish these requirements?

Corresponding to a Second Green Revolution, the transgenic crops are for many specialists the great alternative to ensuring food security. In the 1980's years, a set of worries appeared, related to the environmental and socio-economic problems created by the productive standard of the Green Revolution. Thus, to supply the demand of 1 billion of people living nowadays in the state of food insecurity it will be necessary the support of technological innovations that can contribute to increase the work productivity and the yielding land lowing the pressure upon the natural resources and the environmental contamination by the usage of chemical products. And the modern biotechnology would be the best answer to these pressures, defend the enthusiasts of transgenic food. Amongst the promises of GMO, are:

i) The decrease of production costs, with the increment of production and the agricultural productivity, contributing to the food security.

ii) The creation of plants resistant to damaging weeds reducing, thus, the usage of pesticides. With this, it would be diminished the possibility of producers intoxication as well as the environmental impacts.

iii) Nutritional gains of food inasmuch it can produce transgenic varieties with a major concentration of nutrients.

iv) Mitigate the hungry in the world.

v) To insert the small farmers and regions in the current market.

vi) Providing the cost-effective production of biofuels.

vii) Alleviating climate change and reducing greenhouse gases.

The enthusiasts of transgenic techniques believe that with the expectative of global population achieving 8 billion in 2030 the traditional plant breeding methods would not supply these increasing demands. The GMO would be the unique viable alternative inasmuch it would increase the agricultural yield without using more energy or chemical products. Around the beginning of the competition between the biofuels and

the food industry for sources such as sugarcane and maize, as well as the emergence of middle class in China and India demanding for higher quantity of food, there is a consensus related to the necessity to increase the production aiming the enhance of supply for the food demand. Ban Ki-moon has affirmed in a UN meeting the necessity to increase in 50% the food production until 2030. In this context people say, such as Boulaug, that:

> It is necessary to face the reality, the watch cannot be delayed and regress to the old times of 1930's years, when the global population was 2 billion and it was used lower fertilizers and chemical inputs. It cannot be lost the vision of the giant task of feeding 8 to 10 billion of people in the future (…) the biotechnology would be the way to the food supply in the world. (SOUZA, 1999b, cited by CAVALLI, 2001)

Thus, it is sought the expansion of the transgenic cultivation. The number of countries planting GMO crops soars to 25, with 3 new biotech countries in 2008: two in Africa (Burkina Faso and Egypt) and Bolivia (the ninth country in Latin America to adopt GMO crops). In 2007 the transgenic cultivated area in the world grew 12,3 million hectares, and reached 125 million hectares of transgenic crops. It is an increase of 10.7% million hectare compared to 2007. In Brazil, now the third largest hectarage of GMO crops in the world, it reached 15.8 million hectares of transgenic crops in 2008, a growth of 5% compared from 2007 – 15.0 million hectares (JAMES, 2008). The transgenic soybean cultivation in Brazil can achieve 80% of national cultivation soon, such as USA, the major global transgenic producer; in sequence comes Argentina, Brazil, Canada and India (GMO-COMPASS).

In the European Union (EU), where it is traditional the restriction of the cultivation of GMO crops, it reached 107,719 hectares of transgenic maize in 2008. It represents a year-on-year increase of 19,046 hectares or 21% compared to 2007 (88,673 hectares). The seven EU countries growing transgenic maize (sole kind of transgenic crop approved for cultivation in EU) are Spain, Czech Republic, Romania, Portugal, Germany, Poland and Slovaquia. In opposition, in 2007 France (the EU's biggest agricultural producer) suspended the commercial planting of transgenic maize. According to James (2008:142), transgenic maize "provides significant benefits to farmers, to the environment and a more affordable feed source for animals, which in turn benefits consumers who eat meat". In "September 2008, LibertyLink A2704

herbicide tolerant soybean received final clearance for import into the EU for use as food and feed"(JAMES, 2008: 143).

Brazil had the major absolute global scale increase in transgenic crops in 2007. The Brazilian Agricultural Research Corporation (EMBRAPA) warrants the transgenic crops as an alternative tool of Brazilian agricultural sustentation, and recognizes that the obtainment of transgenic crops is only a plant breeding method when it is exhausted the possibilities of traditional plant breeding methods, where the precaution is always highlighted" (VALOIS, 2001: 4).

In this way, EMBRAPA seeks to produce plants that are not only resistant and tolerant to biotic and abiotic factors, but also being able to provide improvement in the products quality acting in favor of individual health. EMBRAPA always respect the rules of National Technique Commission of Bio-security and it proposes to analyze its transgenic products considering the environment and food security, besides of agreeing with the trade and socialization of transgenic products (ib.)[7]

According to the FAO's article World Agriculture: towards 2015/2030 - summary report 2003, the transgenic foods can be one more alternative to the combat of hunger and poverty in developing countries. To Silveira and Buainain (VEIGA [org.], 2007) the transgenic technique is fundamental to the creation of biofortified products, improved in vitamins and iron. For example, the rice fortification, the basis of feed in the Southeast Asia, with A vitamin (also known as golden rice), allows the overcome of food deficiency that there is in the population of this region, reducing its state of food insecurity. In this way, the less developed countries could reach more profit with the transgenics than the developed countries.

In April 2009, European scientists announced the creation of a variety of genetically modified maizes enriched with three vitamins. The transgenic maize has higher quantity of beta-carotene, C vitamin and folic acid [8], which can help in the improvement of diet

[7] MARTINS (2008 b)

[8] Beta -carotene (is transformed in A vitamin) is good to the skin, the sight, embryonic development, the fertility and the immunity system; folic acid – contribute in the formation of red blood cells and also helps the fetal development during the pregnancy; C vitamin – is fundamental to the skin and its healing process, besides to stimulate the immunity system. (CIB, 4/2009)

in the poor countries. Published by the magazine Proceedings of the National Academy of Sciences (PNAS), the study is oriented specifically to the Sub-Saharan Africa. It looks like the golden rice, and its vitamin quantities analyzed goes beyond any other variety created by conventional production methods for plants. According to the Council for Biotechnology Information (CIB), from Brazil, this GMO maize is the first transgenic plant that has more than one kind of vitamin. (CIB, 2009)

Researchers also asseverate that in developing countries, the conventional maize stays in storages for a long time becoming vulnerable to the fungus proliferation. The transgenic maize resistant to the insects has lower rates of mycrotoxins compared to the same conditions of the non-transgenic maize. In this way the transgenics could stimulate a more healthy feed, supported by the consume of *in natura* products.

In this way, the GMO would guarantee food security inasmuch as it would promote sufficient quantity of food, with nutritional improvement (increase in the food quality), besides of theoretically not degrading the environment (whereas it would demand lower quantity of pesticides), being, thus, an environmentally sustainable technique according to this point of view.

According to James (2008:42) the political will for biotechnology is evident in Brazil, China and India, and these three countries represent "a formidable force in agricultural biotechnology that can deliver enormous humanitarian benefits that can be mobilized to alleviate poverty and hunger for resource-poor farmers by 2015, under the Millennium Development Goals, when it is expected that all three major staples, maize, rice and wheat, as well as several orphan crops will benefit from biotechnology".

The transgenics represent the great and maybe the sole alternative able to supply the growing global demand for food co-operating, thus, to the ensuring of food security. Notwithstanding, the transgenic technique being a subject essentially divergent and its critics argue as if the modern biotechnology actually mitigates the guarantee of food security and food sovereignty. It is asked ultimately how the technological advancement

can mitigate the agrarian development and guarantee the food security and food sovereignty.

THE OPPOSITE VISION

Pessanha and Wilkinson (2003) assert that GMO can cause an alteration of the plant or animal metabolism, which can propitiate the emergence of new toxins or allergens, besides of the modification of the food nutritional composition, decreasing the available quantities of essential nutrients or elevating the quantity of elements that can cause malefactions to the health, amongst others. According to Fernandes (VEIGA, [org.], 2007) amongst the unexpected effects of the transgenics are: modification of plant interactions with soil microorganisms; susceptibility to pathogens; modification in the resistance to the insects; alteration of the reproductive traits of the plants; lower productivity of transgenic soybean; variation in the level of expression of transgenic protein along the cultivation cycle.

Researchers argue that to insert resistant pesticide genes in the food can give to the weeds higher resistance, transforming them in super weeds, which results in a higher usage of pesticides, contaminating even more the food, rivers and soils. Other specialists affirm that it has not been realized sufficient tests referring to the risks of GMO to the health and environment. Besides of this, in some finished tests there were found high levels of liver and renal toxicity (RATTNER, 2008).

In the event of Brazil, it is cited that the transgenic maize released to production did not produce more than the conventional maize, beside of its production cost of long term being higher. Also it is argued about the consequences to the ecosystem through the usage of GMO. According to the article Seguridad Alimentaria: El Derecho de los Pueblos a la Vida, the transgenics:

> Will make disappear the native and sylvan kinds of rice, wheat, fish and other source of food".(…) " According to a recent report to the House of Commons of the United Kingdom talking about the expansion of the GMO cultivation in North America, in the USA more than "two-thirds of the conventional cultivation are contaminated with genetically modified materials. The report cites data of the Union of Concerned Scientists (UCS), arguing that the contamination to GMO is bad to the system. (CIP-ECOSOCIAL, 2008:38-9)

In this same article Vandana Shiva cites the example of India, where it was authorized in 2002 the cultivation of the cotton *Bacillus thuringiensis* (Bt). There was the argument that the seeds have been released to production according to Indians methods, that would not be necessary the usage of pesticides, as well as it would be achieved a higher production promoting an improvement in the agriculture gains. According to a study of the Foundation for Science, Technology and Ecology, cited by Shiva, the Bt cotton does not resist the weeds. It was devastated by weeds, besides of its root being putrefied. It did not accomplish the promise to obtain higher production as well.

It was observed also that the farmers' gains did not increase. A lot of them did not earn enough money to overcome the costs with the seeds and labour, that stayed between 187 and 214 dollars to hectare. Those who planted cotton lost near 24 million dollars in just one crop, despite the arguments of Monsanto-Mahyco to the GMO effectively increases the middle incomes, affirm Shiva.

Therefore, many specialists argue that the reality of genetic engineering is much more confusing than it can be initially imagined, however much the geneticists are able to insert a gene into cell nucleus, they do not know, nevertheless, if the cell will incorporate the new gene in its DNA, neither which would the effects be upon the organism. "Thus, the genetic engineering works in basis of tentative and mistake and opts for the waste. (VEIGA [org.] 2007: 92). In this sense:

> The contamination of the seeds supply will leave us completely undefended if it is demonstrated that whom create the GMO are mistaken. According to the report to the UCS 'the seeds will be our sole resource in the event it is demonstrated that the faith that prevails nowadays about the safety of GMO is mistaken… if the genetic engineering fails down, our capacity to close the gap would be seriously limited. (CIP-ECOSOCIAL, 2008: 138-9)

As demonstrated by Vandana Shiva, there are critics that do not indicate the transgenic's specifics traits and its possible malefaction to the health and environment (even it is a theme of incontestable importance to the subject of GMO) but attend first of all to its political and economic aspects. In this sense, many specialists argue about the possible global standardization of agriculture and the total dependence of farmers upon a small group of multinational companies. This issue is related to the so called food sovereignty.

FOOD SOVEREIGNTY

So many critics of the first Green Revolution argue not only to the environmental and health problems created by it, but also to its socio-economic consequences. They focus on the increase of dependence of the poor countries on the agro-industry as they have produced and delivered the agricultural inputs in nearly all cases. They have developed searchers to increase and improve the productive in the farms, whether in association with institutions or individually, which allows them to control all the food production, from farms to the table, that is, the production (farmer), manufacture (industry) and the delivery (trade, transportation, storage). In the field there was a process of polarization in consequence of the land concentration, between agriculture-entrepreneurs and landless. In many developing countries the production was guided mainly to the exportation and not to the provision to the internal market, in many opportunities replacing the production from one kind of nutritive and staple food to another commodity. Those that already had resources were benefited from the opportunities created by the Green Revolution, but to the landless and illiterate farmers the tendency was to impoverish even more. In this way, the Green Revolution was first of all a discriminated revolution, argue its critics. And these same consequences of the Green Revolution are being observed by many specialists in the GMO case as well.

These non-expected consequences of the GMO are against the concept of food sovereignty, that is related to the autonomy of a country to produce its own needed food to supply and feed its population. Additionally, it includes the political and economic decisions to distribution, importation, trade, etc, of food.

In the Economic Knowledge – context in which the GMO arises – it is formed new geopolitical hierarchies, based on new socio-spatial differences that highlight the asymmetrical availability of strategic information and knowledge. Explicit dividing lines are raised among those who are trained to participate actively in an uninterrupted dynamic of innovations and learning and those who tend to be excluded and subordinate. (LASTRES et.al., 2002) The establishment of this new global order, instead of being the presumed integrated world, actually requires levels of capacity and quality higher than in the past. In this way the major part of research already done and almost all the commercial gains go to the hands of private companies that have their headquarters in the developed countries. With the primacy of the private sector in research and diffusion of agricultural biotechnologies and the consequent lost of the

importance of Public Institutions of Agricultural Research, there are also increased costs of technologies exchange, limiting the access and possibility of their usage to the developing countries:

> The predominance of the private sector in the agricultural biotechnology causes the fear that the farmers of developing countries, especially the poor farmers, cannot be benefited from it, whether they do not have for at their disposal the appropriate innovations or these are too much expensive. (FAO, 2004)

The new technologies are more expensive and complex and, thus, have the tendency to exclude more than to include producers and regions nowadays marginalized. In this context, however much the cultivated area with transgenics are increasing, the transgenic technique co-operates to uncertainties as for the future of food production and of food security of countries, mainly the poorest. Instead of propitiating the agricultural development, actually the defenders of GMO seek to establish a global standardization of agriculture and a total dependence of the farmer upon the few multinational companies of the agricultural sector.

It is important to note that to use the technology is different from the capacity to create it. Specifically about the transgenic technology, in Argentina, South Africa and Mexico:

> (...) the GMO utilized was developed by Monsanto to the USA market. Researches were only developed researches in order to adequate the local seeds to the transgenic genes. But there are many countries that have neither the conditions to perform this kind of adaptive research. (FUCK and BONACELLI, 2007:95)

Out of the 25 countries that plant and commercialize the transgenic seeds nowadays, 15 are developing countries. Based on the above this fact proves not being true, however, the affirmation that all the countries have autonomy in the creation of agricultural technologies. Quite the contrary, the spread in the cultivation of transgenic plants means an increase of dependence of these upon those that have the knowledge of this technology (that is, the richer countries, able to invest in Research and Development – R&D). In the case of food production, these less developed countries' technological dependence can mitigate their food security and food sovereignty in medium and long term.

The existent techniques in the transgenic plants allow the patent registration and guarantee the consequent monopoly rights to the these large companies [9].

> The evidence that the logic of biotechnological innovation, with its high necessity of capital and of extensive long and risky periods of generation and the need of extensive systems of delivery, is altering its gravitational center in favor of multinational corporations […] is evident. [these] using their experience in R&D, vast resource and flexible methods of financing, domain nowadays the commercial biotechnology and, progressively, the direction of the fundamental research. This domination […] was achieved by the acquisition of stakeholders or the integral control of firms of genetic research, formation of joint-ventures or limited partnership of R&D, by the financing […] of private firms that invest in biotechnology, contracts of research with universities and expansion of their own activities in R&D. These alternatives of involvement are, frequently, done by Monsanto… (GOODMAN; SORJ and WILKINSON,1990:98)

It can be noted a process of fusion amongst seeds companies already existent with the large agrochemicals, with the major part of the private sector's researches in agricultural biotechnology in the hands of these companies. These large companies are centered in the varieties of commercial interest to the farmers of developed countries and seek (doing these acquisitions) to guarantee a whole strategic of tests and spread of transgenic crops that extend the participation of herbicides commercialized by the company that did the acquisition. (SILVEIRA; DAL POZ and ASSAD [org.], 2004)

> If it is begun by the first part of the chain, the seeds, it can be observed as the ten great global companies (such as Monsanto, Dupont, Syngenta, Bayer…) control half of the sales of the seeds. It is a market with a total annual value of 21 million of dollars, a sector relatively small if compared to the pesticide or pharmaceutical sectors (ETC Group, 2005), but it is necessary to consider that it is the basis of the agro-food chain and, thus, the risks that this control can cause to the food security. The international property laws, that give to the companies exclusive rights to the seeds, stimulate even more the sectorial company concentration and mitigate the right of the farmer to the maintenance of the native seeds and the biodiversity. (CIP-ECOSOCIAL, 2008: 16)

In this way, the biotechnology can be used to strengthen, instead of weaken, the dependence of food production.: "Thus, as the Green Revolution, the new seeds again will form a nucleus of 'technological package', but the seeds originated from genetic

[9] MARTINS (2008b)

engineering will guarantee that the farmers be much more dependent on the patented agrochemicals". (GOODMAN; SORJ and WILKINSON, 1990:98) This fact difficulties the possibilities of competition in this sector for the small and medium firms because the large multinationals do define the level of investment and technology necessaries to the competition.

The predominance of multinationals in the R&D sector represents a clear process of technological monopolization, which results in an economic concentration of the rich countries' companies in the biotechnological field. In the same way, the development of forms of privatization of knowledge and information also represents a limiting factor of access to these elements to certain groups, assuring for a few the knowledge and information monopoly. Herewith, the principal results of advanced scientific activity stay upon the control of the big economic agents, increasing the gap of information and knowledge that separate the developed from the developing countries. In this point of view the transgenics are seen as multinationals' products, and the latter are moved simply by the greed for profit, assuming monopoly postures. They do not have engagement with sustainable development, neither with the social dimension that characterizes the agriculture (VEIGA, [org], 2007).

This concentration of agricultural production and the intention to transform the transgenics in the new basis of global agriculture demonstrate the extreme vulnerability of our food system to mitigate the food security.

> The food merchandizing converted the feed in trade to maximize the benefits of an agents' chain (…). This brings risks to the basic right to the food, to the human health and environment, whether to the lack of access to food or to the introduction of new techniques (…). The food trade has a different logic and so many times opposite to the life logic and bring risks to the healthy survival of millions of people. (CIP-ECOSOCIAL, 2008: 3)

The Green Revolution has propitiated, through its technological package, the increase of agricultural production and productivity of developing countries. Notwithstanding, a lot of these countries, concomitant to these productiveness increase, amplified their importation of basic food. In the peak of the Green Revolution, in the 1970's years, part of the improvement in the "food availability for habitant in the developing countries was assured by rapid increase of food importation from developed countries. The cereal net importation more than triplicated amongst 1969-1971 and 1979-

1981"(CHONCHOL, 2005:34). Thus, however much of the Latin America has been one of the regions where the agriculture had a rapid increase, passing from 59 million hectares cultivated to 160 million between 1950 and 1975, half of Latin American population continued to not having enough food to satisfy their physiological necessities (the consume of minimal indispensable calories), argues Chonchol (MINAYO [org.], 1985). To counterpart, the developed countries have increased even more their cereal production exportation. The occidental Europe became a legitimate exporter region of cereals since the 1980's years.

Chonchol (2005) argues as well that the developing countries' agricultural products net importation will possibly prosper faster than their net exportation of basic products. From 1960 to the beginning of 1990 the developing countries increased their food importation from around 20 million tons to 120 million. If nothing be made to change this scenario, the importation can achieve 160 million of tons in 2010. This food dependence is against the concept of food sovereignty that consists in the rights of each country to produce its food, with autonomy upon its food production and then be culturally adequate. Nowadays, the new technologies are influenced by the current economic model, and in this way the agrarian and food researches are inserted in a context of business economic greed, not being worried about the human health, food quality, environment and welfare of food producers and consumers (CIP-ECOSOCIAL: 2008). And the transgenics, seeking to be the new standard of global agriculture in the same time that guarantee monopolistic rights to the owners of agricultural technologies, do not insure (not nowadays) the establishment of the food sovereignty of the less developed countries. On this context the transgenics perpetuate and intensify the dependence of rural producers upon the large multinationals of agricultural sector.

One of the great paradoxes of the Green Revolution, the misery in abundance – as in face of big crops and storages never seen before, there are more famine people nowadays than in none moment in the history – this corresponds to a kind of " symptom" also present in the Second Green Revolution, supported in the genetically modified seeds. Therefore, the "plenitude paradox" of Green Revolution is being intensified with the spread of GMO in the agriculture.

This situation can be minimized only through the establishment of auto-sufficiency in the staple food production, breaking off with the market and firms requirements,

contributing thus to the rural development. The food sovereignty is a concept that intends to give back to the feed its primordial role of nourishing the people co-operating to the guarantee of their health. For this, the production need to be adapted to the local physical specificities.

With this, it is the intent to demonstrate how the food security and food sovereignty do not exclude the food trade, but claim a commercialization criteria distinct from the current ones. It is necessary, thus, that the present agroindustrial model does not consider only the potential economic benefits, but also the political, environmental, social and cultural impacts resultant from its actions. Would it be the seed multinational companies' monopolistic attitudes compatible to these principles?

FINAL CONSIDERATIONS

To discuss about transgenics one cannot avoid the great divergence of the subject. With the increase of food demand in global scale, the GMO for many specialists represents the way to the increase of food supply in face of the limits of traditional improving breeding process, being an alternative to the food security and food sovereignty of nations. Not only it could insure the amplification of the production, but also proportionate an improvement in the nutritional food quality. Besides, it would claim fewer pesticides and water quantities thus, preserving the environment.

Notwithstanding, it is questioned the possibilities of having the GMO as an effective solution to ensure food security and food sovereignty. Amongst the critics to the genetically modified organisms, there are those who observe in great part the possible malefaction to the environment, the animal and human health caused by GMO. According to them, it is not so much known about the real effects to the health as a result of the consume of this kind of food and empirical researches could prove the non compliance of transgenic's promises. Actually, it is a more expensive and unstable technique related to effective results. On the other hand, there are other critics to GMO that are worried about the privatization and concentration of investments in researches and the development of transgenic technique by few firms and countries, guaranteeing to them the monopoly in the production and commercialization of transgenics. With this, given the great promises of GMO of being the sole technique able to proportionate

the increase of food productivity in face of the amplifying of the demand, this concentration and monopolization could mitigate the food security and food sovereignty of the countries that do not have this technical capacity. There are factors that transcend the technical issue and, in this way, are related and depended upon the "political and social context in which the technology is being developed, produced and consumed" (SILVEIRA; DAL POZ and ASSAD [org.], 2004: 29).

In fact, while the transgenic continues to be produced to attending to strictly economic objectives, it will only intensify the same non-expected consequences of the First Green Revolution. In these circumstances, only increase the dependence of the producers upon the large agrochemical and seed multinational companies and their member countries, imposing a standardization of agricultural practices threatening the food security and food sovereignty of the less developed countries.

Anyway, the fact of on one hand the transgenic allows the productivity increase and on the other hand cause environmental and health damages, exemplifies the difficulty in conciliating interests in consequence of the high uncertainty with reference to impacts of the transgenics. Either as the great promise of ensuring the food security in a near future or as precursor to a global standardization of agriculture, mitigating the autonomy of the food production of the small producers and less developed countries, the transgenics are a subject of extreme importance to any country because they are connected to two highly sensitive and interrelated themes: food security and food sovereignty.

Perhaps what can be more difficult in face of the debate around the transgenics is the possibility to conciliate the objectives of economic increase and firms and countries competitiveness to the goal of development and social equity. The adoption of more sustainable socio-political environmental strategies, with ethical principles, recovering the role of political strategies in face of the ideological imperative of globalization and financialization giving back to the agriculture its central role, which corresponds to the new door that is opened in the third millennium (LASTRES and ALBAGLI, [org.],1999). Critics or enthusiasts to GMO, there is no way to escape this current and inconclusive subject.

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