A sustainability rereading of agrarian production systems

Uma releitura da sustentabilidade dos sistemas agrários de produção

La durabilité de relisant des systèmes de production agricoles

Una releitura de la sostenibilidad del sistemas de producción agraria

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Abstract: This review criticizes the origin and insertion of agricultural production systems and local development. It is concluded that these have met socioeconomic and environmental requirements. Conventional agriculture supplies food needs, but faces serious socio-environmental problems. Precision agriculture, more rational, is not feasible for small producers. Organic agriculture, which is more sustainable, does not compete with conventional production.

Key words: conventional farming; organic agriculture; precision agriculture.

Resumo: Esta revisão é uma crítica a origem e inserção dos sistemas de produção agrícola e o desenvolvimento local. Conclui-se que esses vieram suprir exigências socioeconômicas e ambientais. A agricultura convencional supri as necessidades por alimentos, mas enfrenta sérios problemas socioambientais. A agricultura de precisão, mais racional, é inviável para pequenos produtores. A agricultura orgânica, mais sustentável, não compete, em produção, com a convencional.

Palavras-chave: agricultura convencional; agricultura orgânica; agricultura de precisão.

Résumé: Cet avis est une critique de l'origine et l'insertion de la production agricole et les systèmes de développement local. Il est conclu que ceux-ci viennent répondre aux besoins socio-économiques et environnementaux. L'agriculture conventionnelle fournir dos besoins alimentaires, mais fait face à de graves problèmes environnementaux. L'agriculture de précision, plus rationnelle, il est impossible pour les petits agriculteurs. L'agriculture biologique plus durable, il est dans la production, avec le classique.

Mots-clés: l'agriculture conventionnelle; l'agriculture biologique; agriculture de précision.

Resumen: Esta revisión es una crítica del origen y inserción del sistemas de producción agrícola y el desarrollo local. Se concluye que estos vienen cumplir con requisitos socioeconómicos y ambientales. La agricultura convencional satisfecho las necesidades de alimentación, pero se enfrenta a graves problemas ambientales. La agricultura de precisión, más racional, no es práctico para los pequeños agricultores. La agricultura orgánica más sostenible, no compete, en la producion, con la convencional.

Palabras clave: agricultura convencional; la agricultura ecológica; la agricultura de precisión.

1 INTRODUCTION

Agriculture has always been in evolution, and it can be seen in the transformation of old systems, such as the hydraulic systems in the Nile valley, of temperate regions of Europe, the agrarian hydro in tropical humid areas, even the modern revolutions, which generate the current agrarian crisis (ASSIS; ROMEIRO, 2002).

Just like humanity the agriculture has been undergoing changes over the years, and through these, changing the way of life in the course of human history.

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The first agricultural revolution which the mankind underwent was in the Neolithic period, in which the societies changed from predators to growers (MAZOYER; ROUDART, 2010). Since then, new forms of crops and cultivations have emerged. Thus historically, the man has adopted, different forms of cultivation, adapting them according to their needs.

The more the world's population increased, the more the demand for food increased. Since then, the man began to live a paradox between increasing food production without causing a collapse to the global ecosystems. Within this context, the models of agricultural production have been placed as more impacting or less impacting. It is worth noting that all models of agriculture are impacting, however, in recent decades many efforts have been engaged in pursuit of sustainable development, as an alternative to the global development.

In Brazil, the concentration of agricultural income in the hands of few producers, and consequently the technological inequality between the productive systems of the national agriculture is a situation that interferes with the equity of development. National regions with higher technological inputs have higher productivity and, therefore, generate higher levels of income for local producers, thus presenting higher rates of agricultural development (ALVES et al., 2012).

To Sachs (2004), the dimensions of sustainable development are the ecology, society and economy. The concept highlights the importance of using flexible means, negotiated and contractual arrangements, where the political economy surpasses the traditional economy, as a way of reconciling the cries of economic, environmental and social factors.

In this direction, Jared Diamond (2005, p. 17), in his analysis of "How Societies Choose to Fail or Succeed," reports an important set of environmental problems that modern societies face, tracing a catastrophic panorama, to accentuate the situation in which natural resources are not used in a sustainable manner. According to the author, "even the richest societies and more technologically advanced nowadays face environmental and economic problems, that should not be overlooked" (DIAMOND, 2005, p. 17).

It is understood as desirable a sustainable development when this provides with process of social changes, be them political, economic or institutional, in order to ensure the "satisfaction of the basic needs of the population and social equity, both at present and in the future, promoting opportunities for economic well-being, being, in addition to the more compatible with the long-term ecological circumstances" (JARA, 1998, p. 34). This development has necessarily to involve the human being, in satisfaction of their needs and the sustainable use of natural resources. In this sense the development can be conceptualised as local development when it is promoted by local actors, taking advantage of the existing potential on site, developing the solidarity and cooperation in search of greater well-being and to the surroundings, from here to the global (JARA, 1998).

The Local Development should not depend necessarily on resources (financial or human) external to the Community, under penalty of becoming unsustainable; for this reason, the internal resources must go through a process of organization and planning around common goals (ÁVILA, 2000).

Thus, an analysis of the agrarian systems today and its contribution to sustainable development is important, considering that the conventional agriculture is considered a watershed and fundamental factor so that the prerogatives of Malthus, that there would be hunger in the world, would not become true. This technicized model optimized and increased food production in the world. However, it was deployed bottom-up causing a techno-economic selection in rural

areas. Another problem concerns the environmental issues, which due to lack of direction in its deployment, has caused many environmental disasters due, mainly, to deforestation and application of pesticides indiscriminately that were highly toxic.

In the face of these problems organic agriculture has emerged as an alternative proposal, with the local participation and empowerment of farmers. This model was already practiced as the first form of agriculture in the world, it has as a priority the local ecosystem and the surrounding community. However, there are many discussions if this model of less impacting agriculture can meet the the growing demand for food.

The precision agriculture emerged in the midst of concerns with the reduction of losses, optimizing production processes and also certain environmental concerns with waste, is managed in a small scale, yet it is still exclusionary due to the high costs for its implementation.

Therefore, the objective of this study is to conduct a review and analyze criticism of the agrarian models, conventional agriculture, organic agriculture and precision farming and its contribution to local development.

2 CONVENTIONAL AGRICULTURE

The term conventional agriculture appeared around the 1970s, and was consolidated in the form of agriculture that develops a production model known as modern agriculture. This modern agriculture is based on a combination of a technological package, a group formed by several techniques, which used a large amount of external inputs, and processes highly mechanized (ALTAFIN, 1999).

The term "conventional agriculture" is reductionist to define the systems of cultivation adopted until the agricultural revolution that led to the modernisation of nowadays. This expression, conventional farming, emerged to differentiate the type of agriculture practiced until the 1970s, the new agricultural model created to oppose the environmental difficulties and social factors which emerge during the process of agriculture modernization (ASSIS; ROMERO, 2002).

The apex of the agricultural revolution of modern times, third revolution to Assis and Romero (2002) and Second Revolution of modern times to Mazoyer and Roudart (2010), occurred in the mid-20th century, due to a broad program designed to increase agricultural production in the world. This program is introduced through genetic improvement of plants and animals, intensive use of industrial inputs, mechanization and reduction in the management cost. A transition process in agricultural development that was known as the green revolution (BRUM, 1988).

The green revolution was a process of agriculture modernization, which culminated with the dissemination of a technological package driven by industries of agricultural inputs of first world countries, and disseminated as a process of agrarian "modernization". The levels of modernization were evaluated by the amount of equipment and machines, as well as the use of inputs in plantations (FRANCO, 2001).

The green revolution occurred in two phases, the first from 1943 to 1965. Period when the world was recovering from the second world war, and the demand for food was intense in countries in reconstruction. During the period of the first phase of the green revolution, it was deployed pilot projects in the United States and included Mexico, Colombia and Brazil. These were deployed by the Rockefeller Foundation, an American foundation that defines its mission as to promote the stimulus to public health, education, research and philanthropy. The second

phase of the modernization of agriculture was of great expansion of food production, developed by the companies, which was spread to the whole world. This phase occurs from 1965 on and has the influence of transnational corporations, which rearticulate the strategies of food production in the world (BRUM, 1988).

In Brazil, the green revolution stood out between the 1960s and 1970s, a period when the subsidies of credits were expanded in order to start the increase in agricultural production, as well as the agro-industries; the industrial inputs and agricultural machinery; the companies incentivizing exportation and the processing of production for exportation (MOREIRA, 1999).

This modernization of agriculture occurred with the introduction of new technologies in rural areas. Centers of research in the Empresa Brasileira de Pesquisa Agropecuária- EMBRAPA were created which is the largest responsible for dissemination, throughout the country, the technological package brought in by the Green Revolution, whose goal was to ensure the increase of agricultural production in the country for the exportation and hence to balance the trade balance (FRANCO, 2001). However, this technology, did not have the local participation in its implementation and it was used, many times, so irresponsibly. This way negative consequences for agriculture are generated, which has always been the misery and hunger, which destabilises the development process of the civilizations (MAZOYER; ROUDART, 2010).

However, the production was more than the double in the entire world with the green revolution. According to Theis and Tomkin (2012), there was an increase in food production in extraordinary levels with this agriculture modernization. The use of the techniques suggested by technology enabled the food production to grow at rates higher than the rates of population growth, which according to the authors was the fact that avoided the Malthusian tragedy.

But this explosion in farm incomes fell, because there was a stagnation of productive factors. There was also a world population growth, as even if the rates of growth in developed countries have a tendency to stabilize, in poor countries the tendency is to increase in the coming years. Therefore, with the increase in demand, the overall inputs productivity generated by technology, in the long term, tends to decrease. The countries that have a higher amount of land for agriculture, have opportunities to increase their income, however, the countries with the least amount of land tends to decrease the income, unless there is an increase in some input or a new increment in technological process (VARIAN, 2000).

Beyruth (1996) and Theis and Tomkin (2012), warn about the problem of water scarcity, which could be an input used to increase yields in agriculture, however, this is a limited resource, even if it is essential to agricultural production.

Another challenging issue is the shortage of fertilizers, which could be inputs that would increase the yields, because its intensive use could increase productivity. However, the majority of fertilizers is derived from fossil fuels, oil, coal or, more common nowadays, natural gas. Fossil fuels are limited resources and phosphorus, another type of fertilizer, requires extraction, which requires energy expenditure, and intensive use of water, making its production expensive, which may increase the food price (THEIS; TOMKIN, 2012).

3 PRECISION AGRICULTURE

The precision agriculture is an agricultural model, which is turned to the optimized management optimized of crops. This cultivation system is a tool of great environmental and

economic potential with the aim at providing the farmer greater profits in decision-making in their plantations, taking into account the area in a differentiated way, in order to rationalize the use of raw materials and energy consumption, increasing productivity (MORGAN, 1997).

The precision agriculture is not a new agricultural model, because the first farmers produced in a smaller scale than the current farmers and the small areas were almost all cultivated manually, being included individualized treatment for each plant or small areas. With the increase of the cultivated areas and the development of agricultural mechanization, it became impossible for the individualized treatment of plants and the large areas began to be worked in a uniform way (MANTOVANI et al., 1998).

In 1929, in the United States, it was carried out the first theorist records of precision farming, but the spread around the world occurred during the 1980s, due to the modern systems of data processing, dissemination of geographical positioning systems, harvest monitoring and geographic information systems (PINHEIRO, 2001).

The title of precision agriculture is adopted by Brazil, since farmers in countries with more advanced technology, adopt the terms *Precision Agriculture, Precision Farming, Site-Specific Crop Management* (MANZATTO; BHERING; SIMÕES, 1999).

The main objective of precision agriculture is the use of inputs in exact locations, at the proper time, in quantities necessary for culture that is being produced (AUERNHAMMER, 2001).

The management of crops in specific locations can be performed by means of yield maps that describe the variability of parameters of soil and crops. This for the judgment on the use of inputs directed only to those areas neecessary that provide greater productivity (GOMES; MANTOVANI, 2001). The application in variable rates are based on two methods: use of maps and response of sensors in real time.

The authors, Gomes and Mantovani (2001), point out that the use of sensors provides data to the system controller, so as to allow a variation in the quantity of inputs over small areas, within the production fields. This technique uses the system of positioning; however, it is necessary that the sensors used for automatically controlling the machines can also be used in data collection.

In this context, the results are recorded and geo-referenced that will be used in applications of variable rates or on the transcription of the maps intended for the control of the field operations (GOMES; MANTOVANI, 2001).

The use of technology as a tool in the production management, allows visualization of space and time variables and climatic factors of each agricultural area, considering the specificities of each part of the area at the time of the management, rather than manage it as a single cultivaton sector (AUERNHAMMER, 2001).

According to Reetz and Fixen (1999) the techniques applied in precision farming are considered by most experts in information and sensing, as a management system of agricultural production, where they are defined and technologies and procedures are applied. Those with the aim of improving agricultural production, being the main focus the differences in the chain and the factors that involve the process of the species cultivation.

The procedure applied in precision agriculture is turned to the existence of agricultural areas requiring conditions of management and take into account the diversity of each locality. Thus, the precision agriculture is a technique used by the farmer, where this is able to identify the variables within a field and use the techniques to compensate for the deviations of production (REETZ; FIXEN, 1999). Through this technique corrective treatments are applied, in specific areas

with the purpose of monitoring agricultural activities more uniformly, looking for a pattern of production.

According to Miller and Supalla (1996, p. 42), "the detailed mapping of factors of production and application of inputs are the basic principles of this system". Thus, the highlight factor of precision agriculture is the use of technology in an appropriate manner, according to the necessity of production, allied to the cost factor.

The defenders of precision agriculture consider it as an approximation of several systems, which requires an understanding of the processes involved to reach a specific goal. The goal may not be the income maximization, but to give financial advantage in the use of inputs, minimizing losses in environmental impact (BLACKMORE, 1997).

According to Miranda (1999), this system provides great benefits to its users, such as the control of all production by the use of this information, reducing the risk of agricultural activity, quick and correct decision making, higher productivity of the crop, more free time for the administrator and improvement of the environment through the decreased use of defensive. These advantages allow a better knowledge of the field, allowing, thus, to make decisions with better background.

The global positioning system (GPS) and geographic information systems (GIS) are highlighted by Coelho and Silva (2009), because they are very important in establishing the level of accuracy required. Thus, one of the first steps is the obtainment of the agricultural area mapping explored, particularly in relation to the use of the soil (fertility, pH, availability of water and nutrients, and other data) since this information enables the analysis and operations of the production system to be invested. SIG also allows control of the storage, treatment, analysis and visualization of spatial information collected in the area, as well as the analysis and interpretation of the set of maps obtained in an integrated manner, being that these are adapted to the innovation of precision agriculture and the generation of new knowledge (GONDONOU; STOMBAUGH; DILLON, 2001).

According to Coelho and Silva (2009, p. 44), before the farmer moves to a precision agriculture it is necessary "to estimate the availability of nutrients in the soil collected through sample; assess the environmental conditions and the techniques of precision measures; mapping the productions relating them with the characteristics of the soil". There is still the possibility to assess the risk degree of increased profit generated by precision agriculture; estimate fixed costs necessary for precision agriculture (depreciation, interest, insurance, taxes and others), as well as to evaluate the variable costs (repair and maintenance, oils, fuels, labor and others); to compare the variable costs of rent (if it is possible this modality) of the equipment with the acquisition of the same and estimate the minimum size of the activity (area, number of animals, or others) that make it advantageous to purchase equipment.

According to Davis (1998, p. 178), the precision agriculture is "a system of management of integrated production, which seeks to match the type and the amount of inputs that go into the property with the needs of the culture in small areas within a field of the property".

To Plant (2001), one of the criticisms to the practices of precision agriculture is that it provides more benefits for the large agricultural producers. A lot of the technologies, equipment is not accessible for small producers due to the high cost of acquisition.

In Brazil, there are few people in the field that have access to the knowledge necessary for the use of these technologies (GENTIL; FERREIRA, 1999).

The precision agriculture can be the most widely adopted model in the near future because of low labor supply in the field and the environmental pressure for adoption of less impacting

agricultural practices. However, it is necessary public policies to support agriculture, in order to make the technologies adopted accessible to all farmers.

4 ORGANIC AGRICULTURE

Organic agriculture is part of the agricultural group called alternative agriculture or agroecological, the same emerged to differentiate the type of agriculture practiced until the 1970s, the new agricultural model created to oppose the environmental difficulties and social factors which emerge during the process of modernization of agriculture. This new model was denominated by some authors, as alternative agriculture and / or agroecological (ASSIS; ROMEIRO, 2002).

The model of organic agriculture first emerged in developed countries, as a new standard production, which required technological innovations to minimize losses, preserve the environment and the well-being of the population. This was possible through the use of non-conventional technologies that require innovation and behavior change, not only by moral and ethnic values, but also to meet customers and consumers, increasingly concerned with their health, with their quality of life and their descendants (CAPORAL, 2009).

For Altieri et al. (2012) organic agriculture is a chain that recommends the sustainability, and for that it must be worked to integrate four maxims in their respective dimensions: environmentally friendly, socially just, economically viable and culturally acceptable. For their supporters, the same is a counterpoint to green revolution, which uses the concept of productivism through agrochemicals, large machinery, including with high energy consumption. While organic agriculture, as part of the agroecology, seeks convergence with the techniques of sustainability, with environmental concerns, seeking the ecological, economic and social balance.

The agroecology, according to Caporal (2009), has a holistic character and is more than a farming technique, being an area of study with participatory approach and collective agricultural production, based on the small traditional, alternative and local agriculture. This means a local analysis of crops that are more appropriate for each particular environment. This system takes advantage of local knowledge, and uses the consensus of the group, of the farmer, in deciding what to plant, giving priority to the needs of the local community, at the expense of the influences of the global market.

The discussions and practices, of organic agriculture, began in the 1920s, when Howard, who is considered the father of agriculture, during a trip to India, was surprised with the composting agricultural practices and fertilization of the peasants used for decades. Thus, by means of his observations, he published relevant works such as Manufacture of humus by Indore process in 1935 and an agriculture testament in 1940, where he formulated the concept of "Organic Farming" (MORO, 2012).

As for the environmental impacts, it is believed that the organic practices reduce the impacts on natural resources, by using cultural, biological and mechanical methods, as opposed to the use of synthetic materials (CAPORAL, 2009).

Campanhola and Valarini (2001) highlight that the environmental effects of organic practices are positive. The authors argue, however, that if poorly managed, these practices can be harmful. Thus, organic agriculture is defended as less harmful even to cause impacts in the environment.

The international certification of organic products is granted by the International Federation of Organic Agriculture Movements (IFOAM) and the national by the Ministry of Agriculture,

Livestock and Food Supply (MAPA). The organic certification of agricultural products is the procedure by which a certifying body accredited by the regulatory agency is "Accredited" (WILLER; LERNOUD; SCHLATTER, 2014).

In Brazil, the accreditation occurs through the National Institute of Metrology, Standardization and Industrial Quality (INMETRO). Since this product is certified it must meet a series of standards and procedures to maintain this condition. The marketing of organic presents a constant growth, being that in the African continent the growth was 7.7%, in Asia 10.4%, in Europe 10%, in Latin America 0.2%, in North America 0.8% and Oceania 3.3%. This growth was greater in periods between 2011 to 2012. Totalizing 1.9 million of products commercialized, according to research *The World of Organic Agriculture* performed by IFOAM in 2014 (WILLER; LERNOUD; SCHLATTER, 2014). Some authors such as Santos and Monteiro (2004) point to the increase in the cost of the product with the production on a smaller scale, as one of the factors of price increase of organic products.

In a study conducted by the Institute Cepa/SC (2003), in the region of Florianópolis city, presented as a main reason for organic products consumption, the concern with personal health (more than 66%), being the main organic product consumed the vegetables (more than 77% of organic product purchases). Respondents also presented as the main problem for consumption of such products the high price (58% of customers of small establishments, 53% of customers of supermarkets and 45% of customers fair). The production is turned, mainly for the local population, being that what differentiates the productive chain of organic products and conventional is the issue of certification, the absence of the middleman or intermediary, as well as a production more concentrated on the local and the absence of the wholesaler (ORMOND et al*.,* 2002).

As to the profile of consumers, when it is performed the analysis of the market for these products, there are many variables for analysis, because the consumers of these products have differential features, in relation to the customers who consume conventional products, where the price is not a primary factor. In the marketing of organic product there is a factor to be considered, that is the concept of fair trade. This concept is justified in the unfair practices of the global market, as regards the distribution of income, which mainly affects the underdeveloped countries. The origin of this concept is based on "Ethical Consumption", a concept that started in Europe with the emergence of organizations of Alternative Trade (ACTS), as *Ten Thousand Villages* (1946), *Fair Trade Organisatie* (1967) and *Global Exchange* (1988) (LEVI; LINTON, 2003).

Research carried out by Kluth, Bocchi Jr. and Censkowsky (2010) in seven Brazilian cities, on the habits of consumption of organic products, showed that 72% buy in supermarkets, 41% in organic products shops, and 35% in markets. Out of these 29% is willing to pay more for an organic product. As for the time of consumption it was demonstrated faithfulness, being that 41% has consumed for more than five years. A lot of these, 72%, has argued that the concern with the health was the main reason of their choice. The vast majority, 94% consumes more fruits, vegetables and legumes.

Beyond the health issue, another factor argued is the ecological concern. The public that consumes organic products, are people who are looking for differentiated products, an ecologically correct consumer This consumer is not specifically concerned with price, but with the other factors that are added to the product (PEREIRA, 2003). The concern with the health preservation, through products free from pesticides, are factors that make the expectation

regarding agricultural products higher. These factors are determinant in the social sustainability of organic products, because people feel safe to consume them, because they believe they are superior quality products to the conventional, and more beneficial to health.

However, there is the factor of lower productivity, in relation to conventional farming, creating uncertainty as to the amount of food available in the future. Thus, the organic practices, as the conventional, have possibility to be sustainable and unsustainable.

5 FINAL CONSIDERATIONS

Thompson (2010) presents two philosophies in the debate of sustainable agriculture, the first philosophy refers to industrial agriculture, where agriculture is a sector of an industrial society, and the products are produced at the lowest possible cost and in a way that can provide enough food for the society. According to this philosophy, the tendency is to have fewer, larger commercial farms, a possibility to produce economies of scale and lower the costs of food production. For the advocates of this philosophy, the production in scale is important for the structure and self-sufficiency in the guarantee of food around the world. In this type of production there is a strong dependence of inputs purchased, especially chemicals for agriculture.

The other philosophical current, cited by Thompson (2010), is a multifunctional agriculture, for which agriculture has a social function, above that of food production. According to this current, the social functions of agriculture, include the provision of ecological services, its protection, integrity and functioning. Supporters of this point of view, often advocate the reduction of manufactured chemical products in agriculture, and proposes the elimination of such practices. In addition, this philosophy focuses on social sustainability, in the welfare of surrounding workers and residents and the animals.

Some authors, supporters of the first philosophy, defend the conventional farming, its modernization with the green revolution, as well as the possible increase of NGOs, to raise productivity, regardless, at the time, the natural resources, the important thing is to feed the population. They also accept the precision agriculture as a possibility to reduce the damaging effects to the environment, maintaining the productivity of conventional products (XAVIER et al., 2009; JAMES, 2010).

Whereas for the advocates of the second chain, the green revolution has generated greater inequality within countries, marked by the latifundia, by monoculture and the use of chemical inputs. Without much concern with the environment or with the people who work in the field or with the local development. There is a certain fear, from part of this group, concerning the expansion of the adoption of genetically modified organisms, by not knowing the consequences of their production on the environment, as well as on people's health. In relation to the precision farming, they believe they can bring possibilities, as they would keep producers dependent on external technologies (ALTIERI et al., 2012; COLLI, 2011).

Therefore, there is disagreement concerning the sustainability of agriculture, i.e., there are different philosophical beliefs about the function of the agri-food sector system, and these differences are based on different perceptions about the various ways of organising agricultural production. Thus, a final evaluation of the sustainability of any practice or agricultural system, is a social and political act. The role of science is to document the impacts of different agricultural practices, predict the outcomes and develop indicators to measure the progress towards the

targets for sustainability, as well as to extend the technological apparatus and possibilities for farm management.

The practices analyzed can be sustainable. Being that any of the techniques of systems presented may mark a new phase of agriculture. However, unlike the agricultural revolutions, nowadays, the agricultural practices adopted must be seen as socially acceptable, if these are accessible and effective, and if its adoption is not accompanied by undesirable or harmful side effects, then eventual losses as a result of increased production can be seen as sustainable.

The governments, through incentives and government policies can enable loans anc credit lines, as well as to deploy system of partnerships that allow any practice. It is necessary, therefore, a democratic, deliberative and participatory process, for which the expressions, discoveries, transformations, creations of social beliefs and political preferences might happen. In other words, there is a need for good governance to decide on a sustainable trajectory of contemporary agriculture.

It was concluded that each model met the demands of socioeconomic and environmental factors. Agriculture as well as society is constantly changing to meet the needs of social, economic and environmental factors. Conventional agriculture is meeting the global demands of food, but this model faces serious environmental problems that question its sustainability. Precision agriculture is a conventional agriculture practiced in a more rational way, with greater technological contribution and, in turn, seeks to be the most appropriate model for the themes mentioned: economic, social and environmental issues. However, it is only accessible to large agricultural producers, requiring political support to be made accessible to small farmers. Organic agriculture has emerged as an alternative to conventional agriculture, although its products have better quality compared to conventional agriculture, this model alone does not yet compete in production with conventional agriculture, even in the context of local development is the one that has the greatest potential.

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