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Feasibility of agricultural transition in family agriculture

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Abstract*—*The agroecological transition is a slow, non-uniform agricultural, political, economic and socio-cultural process. In Brazil, the diversities are proportional to the size of the continent, a fact that makes it important to report the most diverse successful experiences in order to contribute to the construction of this transition process. Considering the need for a transition with biological efficiency and respect for sustainability, several properties have opted for a change in their "conservative status". From the articles found, the study of Silva; Gemim; Silva (2020) entitled "The complexity of four practical experiences", published in the GeoPantanal Journal in 2020 was selected to demonstrate characterization of all stages, dimensions and levels of agroecological transition. Thus, this article aims to identify the agroecological transition processes in family farming. The picked study brings production units in different transition stages that made it possible to achieve a proposal to identify the transition processes. Of the four producing units, we chose to analyze the exemplary case of unit 3, as it characterized all stages, dimensions and levels of agroecological transition. There was a comparison of the data found with the bibliographic review pertinent to the theme, showing that a successful agroecological transition is possible and providing information to farmers who choose the agroecological transition.

I. INTRODUCTION

The agroecological transition supports a sustainable approach to food cultivation as a result of negative social and environmental effects already experienced by conventional agriculture, and shows that profits can be obtained in a new way with the promotion of environmental sustainability (SILVA; GEMIM; SILVA, 2020).

For Santos et al. (2014), after the negative environmental and social impacts of the end of the twentieth century, due to the Green Revolution, agroecology emerges placing sustainability as a key point in agriculture and rural territorial development.

The social sciences and earth sciences come together in search of a sustainable goal for both points of view. It is a civilizing change in search of preserving the planet. In this model, peasant communities with their ancestral practices

of land and animal management, as well as cultural diversity and popular knowledge, strengthen agroecology and fit as an agroecological model that can be used as a guide in the transition period, respecting the particularities of each reality (LEFF, 2011; SILVA; GEMIM; SILVA, 2020).

According to Caporal and Costabeber (2004), the agroecological transition is a non-uniform process. In Brazil, the dimensions are territorial: each region's particularities are innumerable and the successful experiences have inestimable value to assist other farmers who still are on this transition journey. Therefore, as an object of analysis, the unit described is located in the city of Barra do Turvo, São Paulo, with an area of 43 bushels, obtained in the early 1990s. It happens in the period of 1986, when the Report appeared Bruntland, putting sustainability as a key point in agriculture, and rural territorial development. At that time, the family invested in cattle breeding, but due to factors such as: relief, soil type and environmental degradation, they started to look for production alternatives more suited to the local reality.

Therefore, a family member participated in a course on agroforestry and decided to work with the theme. Together with other farmers and technicians, in 2003 they created the Agroforestry Farmers Association of Barra do Turvo and Adrianópolis (COOPERAFLORESTA) and the Agroforestry Center of the Ecovida Agroecology Network.

As of 2009, the property becomes a training center in agroforestry, organizing courses, experiences and exchanges.

II. METHOD

This is a case study, addressing the technical and socio-ecological processes that characterize the levels of agroecological transition, comparing this information with the bibliographic review relevant to the theme in Scielo, CAPES and Google Escolar databases in the months of January and February 2021.

According to Gil (2002), the case study is a modality of research that consists in the deep and exhaustive study of one or a few objects so that allows its broad and detailed knowledge.

A general characterization of the experience was carried out, covering several aspects such as: context, history, subjects involved, organizations, sources of resources, time, results achieved, as well as the technical and socio-ecological processes that characterize stages, dimensions and levels of transition were identified and discussed. In addition, the limits and possibilities of the experience and their contributions to the debate on the Agroecological Transition were analyzed.

III. DISCUSSION AND RESULTS

3.1 Identification of Technical and Socio-Ecological Processes that characterize the Transition Levels

Food systems are in a critical situation and thus the populations of the countryside and the city are directly affected by this situation (SIMÃO; NUNES, 2020). In contrast to the conventional model employed, the use of a production system based on organic agriculture and agroecological practices are proving to be viable solutions to be adopted at local cultures (GERMINO et al. 2015). The use of agroecological techniques by farmers in their production systems and the consumption of these foods by the population can also be seen as a strategy that, adopted by the population, can assist in health and sustainability promotion. (SIMÃO; NUNES, 2020).

Agroecology is a technique used by the population, especially in small towns and communities, where spaces are formed for the exchange of knowledge that provide a new interaction between producers and consumers (SIMÃO, 2020). Agroecology proposes a set of participatory principles and methodologies that support the process of transition from conventional agriculture models to a style of agriculture and sustainable rural development (AGUIAR et al. 2017).

In this sense, Schmitt (2013) states that the transition to sustainable agriculture based on agroecological approaches, encompasses a complex reflection of the correlation between the modes of production and social organization characteristic of family farming, and the management of agroecosystems based on ecological principles.

Unlike conventional agriculture, ecologically-based production does not follow ready-made packages: the way forward depends on each property and producer, on their specific characteristics on the use of modern inputs, on investment conditions, on the local market, on knowledge and available technical assistance (FEIDEN; BORSATO, 2011). In this scenario, agroecology has increasingly become a necessity in order to achieve more sustainable agricultural systems, not only nationally but worldwide, in view of the reality of the depletion of natural resources that is occurring all over the planet. Reading the agroecological transition in different realities is the key to understand the complexity of the factors that influence this process (SILVA; GEMIM; SILVA, 2020).

In this context, in order to understand the processes involved in the agroecological transition, an

agroecological transition experience was identified on an unit focused on agroforestry systems and experiences on the topic located in the city of Barra do Turvo, SP, in the region of Vale do Ribeira (UF3). This experience is being reported in Silva's Gemim; Silva's study (2020) together with 3 more experiences in other units of farming families which were selected for having characterized the phases of the agroecological transition.

The discussion about the technical and socio-ecological processes that characterize stages, dimensions and levels of transition was based on the description of Gliessman (2000; 2010), which didactically describes the agroecological transition on four levels: (i) Level 1: Advanced, increasing the efficiency of conventional practices in order to reduce the use and consumption of scarce, expensive or environmentally harmful inputs, that is, for situations where each stage is identified in its entirety; (ii) Level 2: Partial - Substitution of conventional inputs and practices with alternative practices, that is, partial, for cases in which activities are in progress, but less intensely; (iii) Level 3: Initial - Redesign of the agroecosystem so that it works based on a new set of ecological processes, that is, where actions happen sporadically or moderately; and (iv) Level 4: Without starting - Reestablishing a more direct connection between those who grow the food and those who consume, that is, without starting, relative to the scenarios in which no procedures were identified.

According to what was described in the experience report at UF3, the agroecological transition of the property was entirely without the use of any input or management technique that was not agroecological. This decision was also taken by all members of COOPERAFLORESTA. These families opted for the full transition and showed that it is possible to initiate a total change and obtain achievements.

3.2 Transition process levels of the studied family unit

The first efforts related to Level 1 of conversion were focused on enhancing forest succession as the main source of energy for the transition of the system. This first phase in the transition process refers to increasing efficiency in the use of inputs, and for that, the cultivation system was redesigned resulting in a set of landscapes formed by agroforestry of different ages, areas of regenerating forests, an "agrosilvopastoral" system and a space for pig breeding.

This local transformation into an agroforestry mosaic provided a greater input of inputs from the pruned material from the trees. In addition, they used in a small amount the natural phosphate, poultry litter and limestone, together with a compost made in the unit based on swine manure and straw.

At Level 2 of conversion aims to replace products and practices that use a lot of resources and degrade the environment with those which are more benign from the environmental point of view. At this level, partial or total tree pruning techniques were used, where they opened gaps in agroforestry or in regenerating forests.

The pruned material was neatly placed on the ground with the help of a machete and chainsaw. Depending on the availability of input and the fertility of the place, natural phosphate and limestone were also spread. Then species of short, medium and long cycles were planted, seasonally selective weeding and pruning were performed for maintenance and availability of inputs.

At Level 3, the property is redesigned, integrating Levels 1 and 2 which, according to Gliessman (2015), works based on a new set of ecological processes. At this level, the fundamental changes in the general design of the system made it possible to eliminate the root causes of many of the problems that still exist at Levels 1 and 2. In the UF3 experience, the redesign of the property was established for all families that were part of COPERAFLORESTA: the crop systems have been redesigned and transformed into agroforestry of different ages, regenerating forest areas, an "agrosilvopastoral" system and a space for pig breeding.

Regarding level 4, even if the central element of the transition at that level is to imitate the natural ecosystem, that is, a forest, there were simultaneous actions related to the regional reorganization, such as the construction of a marketing channel, landscape redesign and integration between them.

In addition, another level of transition was identified, Level 5, described by Titonell (2019) as socio-ecological processes that are generated by external stimuli such as market opportunities, regulation or legislation, or intrinsic, associated with aspirations, objectives and values rural families, communities or individual producers. At Level 5, the families involved in the conversion process are involved in issues related to sustainability, as well as more complex social issues. Through the actions carried out by COPERAFLORESTA, the farming families established a strong relationship with the articulated society through visits, exchanges and experiences, local representatives constantly participate in awareness-raising activities, courses and in other contexts: one of the most important COOPERAFLORESTA contribution.

As a new field of study, the transition model as a whole can contribute to the design of sustainable rural development strategies, reinforcing the need to build and

reconstruct the knowledge of the local population, as a basic strategy for agroecological transition processes (GUZMÁN, 2001).

In general, agroecology brings the idea and the expectation of being a new agriculture, capable of doing good to society and the environment as a whole, and capable of moving away from the orientation of dominant agriculture, which is intensive in capital, energy and non-renewable natural resources, in addition to being aggressive to the environment, exclusion from the social point of view and causing economic dependence (CAPORAL; COSTABEBER, 2002).

It is important mentioning that the experiences mentioned by the family unit are a situation where the agroecological transition was carried out in the most efficient way possible. When there are real efforts to promote agroecological transition at the community, territorial or regional level, whether through development projects or public policies, it is important to characterize the community's agroecological starting point. In such cases, at least three types of producers usually appear: (i) those who are in agroecological transition as a result of a conscious and planned choice; (ii) those who are not in transition and (iii) those who are in advanced stages of agroecological transition, or who directly employ an agroecological management approach, but without knowing, or having never heard of the term agroecology (TITTONELL, 2019).

The experience of the agroecological transition presented here aimed at reducing and replacing synthetic inputs and use agroecological alternatives for fertilizing the soil and plants in family agricultural production systems. In view of the correct knowledge of what agroecology is essential to rectify some conceptual misconceptions that can often hinder the advancement of the agroecological transition (CAPORAL, 2009), it is increasingly necessary to propose appropriate public policies for development. family farming, adaptation and coexistence with different biomes in addition to promoting Agroecology, as a sustainable local/regional development strategy through the agroecological transition (FREITAS et. al, 2015).

1.3 Limits and possibilities for agricultural transition

The Agroecological Transition, due to its complexity, can't be understood in a single and linear model. The environmental conditions of the property, local climatic conditions, norms and regulations are some of the aspects that can configure a multiplicity of forms or models that make this transition possible in a productive unit. It is in this perspective of complexity that it is possible to consider some limits to the implementation of the agroecological transition to the farmer and family's farmer, without losing sight of the possibilities that contribute to the optimization of the process and to the improvement of productivity, both in the quality of the product as in preservation and conservation of available natural resources.

The challenges of an agroecological transition can start from what can be called the "cultural tradition" passed on to each generation, which constitute traditional or conventional models, which are judged as more comfortable options, which require less effort when compared to the transition that takes place in a gradual process of changes and restoration of the natural environment, restoring its structural functions in its biodiversity, as well as in the physical-chemical properties of the soil and water.

The efforts that promote the agroecological transition also present themselves as limits, given that the farmer, according to Tittonnell (2019), should invest more time and labor.

Starting from the levels of agroecological transition, addressed by Gliessman (2002), Level 3, which deals with the redesign of the agroecosystem to function based on a new set of ecological processes, is considered by Tittonnell (2019) as the starting point of the transition, followed due to the change in management practices; however, it is another point that imposes limitation since many producers consider it more difficult to redesign the system than to adopt new practices gradually. Perhaps this point can be analyzed from the perspective that changes can cause insecurities in the process and the adoption of a more gradual work helps familiarize and more concretely visualize the benefits that a sustainable agro-ecosystem can offer.

The redesign of the agro-ecosystem adopted as the beginning of the transition could allow the resolution of situations that would eliminate possible problems that still exist at Levels 1 and 2, avoiding the appearance of other problems, in a preventive way. In this sense, Hill (1985) points out that in a redesigned agro-ecosystem it is necessary to invest time so that the environment can act naturally, maintaining the integration of the elements present, respecting the cycles and limits; crop rotation, and consortia as sustainable practices.

In addition to the efforts mentioned above, another aspect that deserves attention in the transition process, when in the interest of family farmers, is the low availability of accessory technologies, especially in the period when replacing chemical inputs with natural ones, considering that the replacement of some of these chemical inputs doesn't necessarily means changes in the production

system; this is still a very delicate moment, as they can cause a certain economic and productive vulnerability if there is no adequate planning for such a situation.

Silva et. al (2020), in their study to understand the complexity of the factors that influence the agroecological transition process, bring the example of some small producers who presented themselves in different stages of the transition: Family Unit 3 (UF3) is the one that has made the most progress making integrally the transition to agroecological production.

However, it is important to note that the process presented as one of the limits to the replacement of cattle raising by an agroforestry system. This was due to the initial need for survival of UF3 given the difficulties with the relief of the region, the type of soil and environmental degradation.

Starting from this initial need, there was an insight to create, in 2003, the Association of Agroforestry Farmers of Barra do Turvo and Adrianópolis (COOPERAFLORESTA) and the Agroforestry Center of the Ecovida Network of Agroecology, opening opportunities for the creation, in 2009, of a center of training in agroforestry. Another important point that deserves to be highlighted at UF3 was the need for inputs to be generated by family units and for agroecological techniques to be worked on throughout the process (full transition): this was defined as a limit that could not serve two gentlemen, that is, to practice the technological package of the green revolution and make use of agroecology in different spaces within the same family context.

IV. FINAL CONSIDERATIONS

4.1 Contribution to the debate on the Agroecological Transition

UF3 includes all the attributes of the agroecological transition at an advanced level, showing that it is possible to initiate a total change and obtain excellent results. The agroecological transition of UF3 suggests that the unit contemplated the stages for such a process, namely: substitution of inputs, diversification and integration of activities, redesign of the landscape, complex production systems and regional reorganization.

There is a strong relationship between UF3 and articulated society through visits, exchanges and experiences. Local representatives frequently participate in awareness-raising activities in other discussion spaces, also contributing to the formation of COOPERAFLORESTA. The relationship with other producers also occurs with the development and socialization of technologies for planting and transporting production.

From the ecosystem's point of view, the complexity of the agroecological transition, in itself, is challenging and is also necessary because it is the most sensible moment of the relationship between mankind and the environment.

Although several models are adopted to better suit local and territorial realities, the fact is that the transition requires a joint effort where not only changes the production system, but also an organizational effort of development policies, given that the many that occur in the local landscape go beyond the physical limits of the family unit and should add other units in the surroundings, which consequently will be reflected in the issues of marketing and adding value to products originating from sustainable agro-ecosystems.

According to Tittonnell (2019), the political-institutional transition takes place on a territorial scale, but also on a regional or national scale and is strongly linked to the generation of favorable situations for all levels of transition to occur. This transition occurs through incentives, opportunities, regulations which in general can promote the implementation of public policies, the rules that emerge in distribution and commerce's sectors of or the collective action of various organizations that represent and channel social demands.

The author also considers that the political-institutional transition may foster a transformation, not only of the productive systems but also of the agro-food system, going through socio-environmental, economic, political-cultural issues, being an agenda for debates in the agroecological transition processes.

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