CHAPTER 1: PEASANT FAMILY FARMING: THE INITIAL FACTOR OF AGROECOLOGY

Author:

Roberto Aguilera Peña, MA.
https://orcid.org/0000-0002-4841-0792
Master in Agricultural Environmental Management (Spain).
Universidad Tecnológica ECOTEC, Ecuador
raguilera@ecotec.edu.ec

1.1. Introduction

Ecuador is a mega-diverse country of great heterogeneity, with four geographical zones: Coast, Highlands, Amazon and Galapagos, where 14 nationalities and 18 ethnic groups with different ways of observing ecosystems coexist.

Agroecology gained momentum as a discipline from the seventies, whose goal was to remedy the impacts of the green revolution by improving the biological profitability of the soil, social justice and the economic situation of the peasant sectors. The progress and results obtained in the last years of the current decade, understood as the 21st century, are a forceful response by the indigenous communities of the Ecuadorian highlands to the conventional agriculture model responsible for soil degradation, population of rural peasantry reduction, alteration of culture and increased poverty in the rural sector.

The contributions in research and validation of agroecological technologies coming from research institutions and the academy, and the adoption of agroecological technologies in organic agriculture, allow us to speak of a symbiosis between agronomic science and the ancestral knowledge of the communities. In order to clarify this point, it is important to point out that agroecology is not ecological agriculture or organic agriculture, but rather it is the discipline that provides the technologies that serve as the basis for the development of these production models.

Peasant agro-ecosystems or farms are the integration of fauna and flora interacting with their physical and chemical environment, which have been modified to produce food and raw materials for processing and human consumption.

Agroecology is defined as the application of ecological concepts and principles in the design of sustainable agroecosystems, processes that become a basis for evaluating the complexity of agroecosystems. Its application is based on the application of strategies and technologies that contribute to the maintenance of the physical, chemical and biological conditions of the soil, through the agroecological management of crops.

There are multiple business spaces where agroecology has been gaining momentum and showcasing its scope to modify the current situation of peasant agricultural sectors. Currently, agroecology has become a modern paradigm for the resilience of natural ecosystems and agroecosystems, providing answers to the various technical problems that have been caused by conventional extractivist agriculture, thus becoming a theoretical reference that serves as a guide for sustainable agriculture and to strengthen the soil's biological system.

Unlike the conventional model, agroecology is not based on recipes, but rather on observation at the field level and is measurably based on the interpretation of laboratory results. This situation hinders agroecological technology transfer processes and the adoption of recommended technologies. Therefore, agroecological technology transfer projects must be long-term, as educating farmers is a crucial part of the process.

Martin Prager (2002) concludes that the application of agroecology takes into consideration the complexity of ecology, which gives rise to many variables and proposes an approach to agriculture linked to the environment and the sustainability of the production system.

Farmers today can no longer pay attention only to the objectives and goals of their production unit and expect that this alone is enough to face the problems of sustainability in the long term. Sustainable agriculture must go beyond what is done or happens within the limits of the individual production unit. Production is currently perceived as a broader system that includes environmental, economic and social components (Gliessman 2001; Soto-Pinto et al., 2022).

According to Suquilanda (2019), agroecology is a theoretical-practical scientific discipline that provides the basic principles to study, design and manage agroecosystems that are sustainable, productive and culturally sensitive, socially fair and economically viable, and are successful at improving biological efficiency and conserving natural resources. This can be translated into objectives, namely, the preservation of biodiversity, the recycling of nutrients, the optimization of the use of local resources and the use of the ancestral knowledge of indigenous communities.

The various models of agri-food systems practiced by small producers in the Ecuadorian highlands present variable surfaces ranging from micro systems (<1.00 to 1.00 hectares), small (>1.00 to 10.00 hectares), medium (>10.00 to 50.00 hectares) or large (>50.00 hectares) models that present diverse subsystems and that vary significantly within the same community and from one region to another. These differences in the surface of the agricultural systems provide a host of important information for agroecology because they obey the characteristics of each ecosystem and the socio-cultural contexts of the population in each territory (Facundo Correa & Cid Aguayo, 2021; Suquilanda, M. 2019).

The Ecuadorian Center of Agricultural Services (CESA), through the Landcare, LAIF and Allialpa projects in the provinces of Cotopaxi, Chimborazo and Tungurahua, and the Food and Agriculture Organization of the United Nations (FAO) through the World Campaign Against Hunger (CMCH) in the provinces of Imbabura and Pichincha, currently carry out training programs in agroecology and short marketing circuits aimed at agricultural technicians and communities in the Ecuadorian highlands.

The organizational capacity of the indigenous communities of the Ecuadorian highlands has contributed to the adoption of agro ecological models that take advantage of the rich biodiversity of the environment, the ancestral heritage and knowledge they possess. However, they face limitations such as land legalization and access to water, which have led to the development of smallholdings.

In the provinces of the coastal region, there are communities with experience in the production of diversified crops such as rice, corn, cocoa, coffee, bananas, fruit and wild bananas. However, we must note that, in this region, the expansion of monocultures has led to a high percentage of the peasant population being absorbed by a system of labor exploitation, which, in turn, has led to peasant farms suffering from biological degradation due to the continuous and indiscriminate use of agricultural pesticides.

1.2. Materials and methods

To meet the objective of this research, a documentary or non-intrusive analysis was carried out, where scientific articles from indexed journals with the search for the following terms "agricultural AND economics","agroecology","family AND agriculture", "agricultural AND economics", "family AND agriculture" and "agroecology" we included. The search was expanded to include articles from the Journal Indexing Citation Report (JCR) and Scimago Journal Rank (SJR). In the case of Web of Science, the Social Sciences Citation Index (SSCI), Science Citation Index Expanded (SCIE), Art and Humanities Citation Index (AHCI) and Emerging Sources Citation Index (ESCI) were included.

Several articles were selected from 2000 to 2021, for a preselection focused on addressing the problem by reading the title, theme, abstract and keywords. A bank of articles was created on the Mendeley platform and the study of these articles was expanded, building a systematization of the indicated field and a comparative analysis between the various studies.

1.3. Developing

The participation of producers in agricultural development programs cannot be passive and there must be interactive communication with technical personnel without discarding ancestral knowledge (Ezquerra et al., 2014; López, M. 2020).

Landini (2016) states that one of the problems in technology transfer services is the distrust and low interest of producers in the adoption and innovation of recommended technologies because, on many occasions, they are far from their needs, and can be difficult to apply due to lack or absence of credit. The results of agroecological strategies on farmers' farms are measured by field observations and by analyses of sample results in laboratories.

One of the most important points to be considered by the institutions that participate in these projects is the value of the ancestral knowledge of each territory, which should be the starting point and institutions should take time to understand it (Bezerra et al., 2022). Whether for research projects or transfer projects, it is important to understand and value what the inhabitants of the communities know, which is the basis for success in implementing and developing an agroecological technology transfer program, and eventually turning this knowledge into an instrument for sustainable agricultural development where social, economic and environmental components interact.

Thus, agroecology constitutes the new model of agricultural production and has been reinforced by the ancestral practices currently used in the agricultural systems and subsystems of peasant families and in social movements. In the last decades of the 21st century, it has become part of the discourse of international organizations and the public policies of some countries of the world.

Agroecological designs allow us to see the agricultural process as an integrated system whose purpose is not only to increase the productivity of the production units but also to optimize the system as a whole and preserve its sustainability over time (Altieri 2002; Khadse & Rosset, 2019).

Management of the same nature must also be guaranteed from a rational and environmentally safe perspective, managed from the State to the citizens (Severe & Vera, 2014; Vergara-Romero, 2019). This management should seek the stabilization and improvement of the world's ecological situation, creating favorable living conditions to raise the level of agroecological culture of citizens.

To achieve an optimal articulation of the new processes that demand the most sustainable agricultural practices, it is important to correctly link agricultural development policies and agroecology interventions developed in organizations, universities and communities, through long-term management projects.

The practices of technologies based on principles of agroecology are presented as a solution by proposing strategies such as Agroecological Crop Management (MAC), Agroecological Pest Management (MAP) and applying designs with temporary and long-term arrangements including various species of fruit and wild trees.

Agriculture worldwide is in a serious crisis caused by social problems such as the unemployment and aging of the rural population; economic problems such as the increase in production costs/ha and price instability at the farm level; ecological problems such as imbalances of ecosystems due to deforestation and erosion, reductions in the size of populations/communities of living organisms, effects on soil biology due to the indiscriminate use of pesticides and agricultural inputs, air pollution, alterations in the flow of surface aquatic systems and underground, concentration of salts in the soil, adding the migration of young populations to other activities unrelated to agriculture.

Floriani & Floriani (2010) conclude that the application of agroecology focuses on the recovery and preservation of biodiversity, which is one of the basic principles to achieve self-regulation and sustainability in agricultural systems and subsystems. The richness of biodiversity is the basis of the balance of natural ecosystems and, consequently, of the sustainability of the surrounding agro-ecosystems (Pozo-Estupiñan et al., 2021; Schwab do Nascimento, 2020).

The agroecological vision considers that the knowledge created and spread by academia and research centers must be complemented with the perception and knowledge of farmers (Vergara-Romero & Moreno Silva, 2019). The knowledge and management of agro ecosystems should be developed based on the convergence of scientific and farmer knowledge, through a process of interaction with rural communities, with the participation of farmers, researchers and technicians with experience in managing the production systems, residents and people who are familiar with the work areas (Ramos-Leal et al., 2021; Vergara-Romero, 2021).

For the success of the programs, there must be a close relationship between research, transfer and knowledge of local technology to establish a synergy between scientific knowledge and ancestral knowledge. This new knowledge must be participatory, articulating proposals and interests of the peasant organizations and agricultural research and development institutions.

The path to agroecological transition is long and complicated and should combine different strategies, and there is no single way to achieve it (Hanclova et al., 2021; Márquez, 1991). The start and duration of a transition process depends on the conviction, needs and predisposition of the actors that make up the process.

One of the limitations that could be observed is the difficulty of changing a model that has been used for years, which has been influenced by the generalized and consolidated conventional model in the region.

It is necessary to consider that the conventional model is based on the application of recipes, whereas the agroecological model focuses on the knowledge and application of science. Therefore, the advances in the transfer processes and the adoption of the recommended agro ecological technologies are slow and long-term.

The National Institute of Agricultural Technologies (INTA, 2012) in the Path Guide to Agroecological Transition, states that the transition process towards agroecological systems in the current context must take into consideration that it is not enough to propose only a set of appropriate technologies, but it is necessary to know the arguments and variables that influence the decision-making of farmers, to support the organizations participating in the training processes, and to include technical personnel specialized in the management of agroecological technologies in the process.

With the above, it is concluded that the agroecological transition is a complex process in which components such as the farm, the community, the territory intervenes and that it is affected by social, economic, technological, cultural, political and environmental factors. In a transition project, it is necessary that the beneficiaries first understand the functioning of the ecosystems and how human activities have transformed them.

1.4. Conclusions

The agri-food production model based on agroecological principles is highly diversified and self-sufficient, where the production items are integrated and complement each other to self-supply.

Peasant agriculture meets the conditions and practices necessary for the development of agroecology by applying the knowledge acquired and transmitted in communities from one generation to another over time, as well as innovative technologies proposed by academia.

The methods and strategies of agroecology reinforce ecological and economic resilience in the face of today's environmental crises. Additionally, they are useful in the development of public policies on sustainability that guide peasant managers to agroecological knowledge and good practices.

The diversity of agroecological production systems such as agroforestry, silvopastoral systems, the integration of subsystems of various species, livestock, aquaculture and polycultures, contribute to a series of socioeconomic, nutritional and environmental benefits.

Although it is true that peasant communities have ancestral knowledge, they also need to be trained to understand agroecological technologies, including mixed strategies that combine ancestral knowledge with modern techniques.

Food systems must be oriented towards sustainability in order to maintain a balance between ecological responsibility, economic viability and social justice.

1.5. Recommendations

Based on the foregoing and on the multiple research works and comprehensive multidisciplinary knowledge, the following points are recommended:

- The academy must intervene in the creation of new proposals for agroecological technologies considering the needs of the peasant communities and not in an independent or isolated manner.
- The training of agro-ecologists should be encouraged; this is recommended by the analysis of the evolution of today's society. Defining a milestone of progress in agriculture as a factor of production within any world economy.
- When it comes to projects considering farmers as the actors, it is imperative that the project proposal has, in itself, an efficient management of financial resources, with training that involves the entire productive apparatus in this sector of the economy.
- Training projects should be developed with the participation of experts in technology transfer of agroecological strategies.
- Agricultural development projects should begin by organizing and supporting groups of homogeneous producers.
- Agroecological strategies should not be based on recipes and should consider the different characteristics and needs of the farms.
- The results and progress of the applications of agroecological strategies on farms should be evaluated through observation at the field level and based on the results of physical, chemical and biological laboratory analyses.

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