14914 - The evolution of Agroecology's concept as a science and a practice

A evolução do conceito de Agroecologia como uma ciência e uma prática

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Abstract: Agroecology is a subject that has gained importance in the scientific domain since the last two decades. The use of the term agroecology in the scientific literature increased 60% in the last five years, comparing to its first citation in 1928 until 2007. In this bibliography our objective is to study the evolution of the concepts of agroecology taking into account these two dimensions: a science and a practice. As conclusion, we understand that the domain of agroecology concerns a lot more than a range of agricultural practices. Different, it searches to understand and to mitigate the social, economic and environmental consequences of modern agriculture, even as to legitimate the important role of agroecology in the food production.
Keywords: bibliography research, food security, agriculture, environment.

Resumo: Agroecologia é um tópico que vem ganhando importância no domínio científico desde as últimas duas décadas. A utilização do termo agroecologia, na literatura científica, aumentou em 60% nos últimos cinco anos, em comparação com a sua primeira citação em 1928 até 2007. Nesta bibliografia nosso objetivo é estudar a evolução do conceito de agroecologia, tendo em conta estas duas dimensões: uma ciência e uma prática. Como conclusão, entendemos que o domínio da agroecologia diz respeito a muito mais do que uma série de práticas agrícolas. Ao contrário, este busca entender e abrandar as consequências sociais, econômicas e ambientais da agricultura moderna, assim como legitimar o importante papel da agroecologia na produção de alimentos.
Palavras-chave: pesquisa bibliografia; segurança alimentar; agricultura; meio-ambiente.

Introduction

Agroecology is a subject that has gained importance in the scientific domain since the last decade. The results of modern agriculture, which the world relies today, have arisen from the significant processes made in agronomy. The use of highly simplified ecosystems with the objective to increase productivity depends on a few high-yielding species and great use of chemical inputs and fossil fuels (Malézieux, 2010). These agricultural practices, based on industrial optimization and economic short-term profits has generated and keep increasing the major environmental problems as reduction of soil quality, loss of biodiversity, disease and pest resistance, deforestation, reduction in water quality and contribution to green-house gases emissions (Altieri, 1999; Malézieux, 2010). Approximately, 40% of the land surface is been used by agriculture and an estimated number of 14-40% of this land is already lightly to severely degraded (Chappell & La Valle, 2011).

On the other hand, green revolution increased harvest production in a way that has never been perceived before. It helped to raise average per capita consumption of food by 17% over the 30 years to 2660 kcal per day, when the population grew from 3.69 to 6.0 billion. Despite these growing numbers, there are an estimated number of one billion people malnourished (FAO, 2008) today; 33 countries have an average per capita food consumption of less than 2200 kcal per day (Pretty et. al., 2003). This

fact shows that increasing food supply does not automatically mean increasing food security. The following scenario with an expectation of 9 billion people inhabiting the world claims for a new paradigm of production.

In the last two decades, agroecology has emerged in the scientific domain as an alternative to conventional agricultural production. It inquires that if it is necessary to reduce food poverty, it is important to know who is producing food, for whom and with what technologies and purposes this food is been generated (Pretty et al., 2003). Also the agroecology search to increase food production by reducing the use of chemicals in agriculture (Altieri et. al., 2012) and maintaining a reasonable amount of biodiversity which provides ecosystem services (Chappell & La Valle, 2011). These ecological services can promote biological control, growth of soil fertility and resilience to climate change (Altieri, 2009; Francis et. al., 2003). Therefore, agroecology arises as a sustainable food production for poor farmers and peasants in marginal environments (Altieri, 2002), those whim evince the highest levels of food insecurity.

Thereby, the last two decades experienced an increasingly use of the term agroecology in the scientific literature. Historically, the word agroecology was first used in two scientific publications by Bersin (1928, 1930) and despite the growing number, since then there's still confusion around its definitions. A study made by Wezel et. al. (2009) shows that the occurrence of the root *agroecolog* or *agro-ecolog* in the Web of Science has increased from six, in 1991 to 141, in 1997. In his review concerning the significations of agroecology, Wezel et. al. (2009) concludes that the three main uses of the term are a science, a movement and a practice. These variations are due to the translations, but also to its meanings within different cultures (Wezel et. al. 2009).

In this bibliography our objective is to study the evolution of the concepts of agroecology taking into account these two dimensions: a science and a practice. As conclusion, we understand that the domain of agroecology concerns a lot more than a range of agricultural practices. Opposing, it considers all the aspects involved in the food production, demanding a holist way of viewing the agricultural process. Thus, the social, economic and environmental consequences are taken into account as their important role in the food production.

Materials and methods

In order to better understand the different definitions of agroecology and its evolution in time, we have made a qualitative analysis of twenty important articles and authors in this subject. The bases for our study are the following two articles, "Agroecology as a science, a movement and a practice. A review" (Wesel et. al., 2009) and "A quantitative and qualitative historical analysis of the scientific discipline of agroecology" (Wesel & Soldat, 2009).

Thus, for the analysis of the articles, we've chosen the papers with more citations, the authors who have a reasonable numbers of publications in agroecology and also the bibliographic works. To improve our investigation, we've made a reading grid and organized the records in a database created in Excel. For the database we indicate the characteristics of the article involved as: title; authors; year of publication; journal; domain and country of publication. We also set the parameters which we wanted to

interpret: definition of agroecology; keywords; agroecology's aims; principles or ecological processes of agroecology and; the practices related to it. If the article treats of a case study, we indicate the geographic zone as well.

Results and Discussions

As results, we analyze the evolution of the concepts, objectives and principles of agroecology and we also discuss the practices that characterize the agroecology and the geographic area in which they are applied.

The definition of agroecology has changed considerably since its first publication in 1928. At the beginning, its scope was restricted to the plot field, being considered as the application of ecology in agronomy. With time, agroecology's definition enlarged to a more systematic range, taking into account the interactions between agriculture and the environment. More recently, the last consolidate definition of agroecology is "the ecology of the food systems" (Francis et. al., 2003), which encompasses the role of society, economy, environment and agriculture in food production, access and discard. In the next paragraph we analyze the evolution of agroecology's concept considering our databases.

At the end of 1990s, agroecology is still focused in the crop field, concerned about the methods of agricultural production and the ecosystem services provided by a more biodiverse plot field. At the beginning of 2000s, the science of agroecology ranges its scopes, addressing social issues in its definitions, considering agroecological production as a path through food sovereignty. Also, it is in this period that agroecology will start conceding the interactions between agriculture, society and environment. During the second half of 2000, the domain of education and science were integrated into agroecology. Francis et. al. (2008) and Warner (2008) regard agroecology as "A transdisciplinary education and practice for sustainable food systems" and as "A participatory science", respectively. This fact will lead to a systemic and holistic definition of agroecology, considering it as "A scientific discipline, a movement and a practice" (Wezel et. al., 2009).

The most quoted objectives of agroecology in the studied articles emerge as an inquiring of the dominant agronomic model of rural development (Stassart et. al., 2011). Starting with the plot field scale, passing through a more systemic range and finishing by a holistic view of agroecology, its principals aims are the followings: biological control, soil conservation, nature's mimicry, increase of agriculture productivity and stability, ecological intensification, promotion of biodiversity, reduction of impact on the environment, resilience to climate change, promotion of traditional and small farmers' market, promotion of food security, promotion of local autonomy, education, sustainable agriculture and multifunctionality landscapes and economies. Therefore, agroecology has a multiplicity of objectives, reaching a very holistic scope.

We consider in our study that every objective of agroecology has a variety of related principles. These principles are, then, essentials to enable agroecology to reach its goals.The most quoted principles in the studied articles are usually related to family farm agriculture (Chappell et. al., 2009;), traditional crop systems (Malézieux, 2011; Doré et. al., 2011; Altieri & Toledo, 2011; Lefroy et. al., 1999; Wezel et. al., 2009; Francis et. al., 2003; Atieri, 1999) and locally adapted exploitations (Francis et. al., 2003; Altieri, 2009; Stassart, 2011; Altieri et. al., 2012). The creation of local markets

and strengthen of farmers' relations are important to consolidate their participation in the local economy. Also, related to their practices, the principles of organic farming and inclusion of biodiversity in the plot system are notably considered in agroecology, they were cited in almost all the studied articles.

Whether as a science, a movement and an alternative production of agriculture, agroecology is characterized by few practices. In the next two paragraphs we review the practical application of agroecology, considering the geographic areas in which they have been applied. This information is important to have a brief scenario of where agroecology is being implemented. The participatory educational process in agroecology is important to help the farmers to reach their autonomy. In this way, the local research and the "Campesino a Campesino" (farmer to farmer) movement are notably considered in the studied articles. This movement is characterized by the relation created between the farmers, strengthening their partnership in the local markets, as changing seeds, experiences and knowledge (Altieri, 2009). The "Campesino a Campesino" is consolidated in Latin America, especially in Mexico.

In addition, local commercialization, distribution schemes, use of fair prices (Altieri, 2009) and partnership with consumers (Wezel et. al., 2009) are practices largely discussed in the considered articles. Other social movements are acknowledged in the educational process targeting the local autonomy, as the "MST" in Brazil and "Via Campesina" in the most counties in Latin America (Altieri, 2009; Altieri et. al., 2012). It is worth mentioning that the partnership with local NGO's are recognized in theses social processes, as well (Koohafkan et. al. 2011; Altieri et. al., 2012).

Also, we've seen that agroecology is considered as agricultural practice. In this way, there is a large range of agricultural techniques which characterize the agroecological production. In the majority of the studied articles, traditional farming practices as the use of terraces, polycultures, rotations, raised field, agroforestry, cover crops and application of manure are considered. These practices help the farming system to optimize the water cycling, to create natural enemies to pest, to regenerate the soil condition and enrich the available nutriments to plants.

Conclusions

While our objective was to understand the relations between agroecology as a science and a practice, we conclude that this process of transferring knowledge has a double sense. As the science of agroecology considers notably the traditional ways of agriculture, the academic domain has gained a lot with the observation of these farmers and case studies. In the other hand, the innovations made in the area of agronomy, with new technologies and learning has helped these family's small plot farmers to improve their exploitations and markets. Thus, the knowledge of sociology and economy are also very important to help these farmers to consolidate local markets, aiming the local needs and eating habits.

Thus, agroecology, whether as a science, a movement or a practice, is a domain that has been helping the small and traditional farmers to achieve their food security. Also, it presents a pathway through a more sustainable and equalitarian food production. Nevertheless there is still a demand of the population to spread and consolidate agroecology over society.

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