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AGROECOLOGY IN BURKINA FASO AND NIGER

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ABSTRACT

Agroecology is considered a science, a practice and a social movement, which shows the centrality of research in agroecology development. Interest in agroecology has been shown in many developing countries such as Burkina Faso and Niger. Therefore, this paper analyses the state of research on agroecology in Burkina Faso and Niger, by drawing upon a search of scholarly publications performed in June 2021 on the Web of Science. The analysis of the scholarly literature suggests that the scientific component of agroecology is underdeveloped in both countries. Despite the recurring discourse on agroecology in West Africa, quality research is far below expectation and this might hamper the development of the agroecological movement as well as the documentation and dissemination of agroecological practices. Agroecology is presented as an instrument to address several environmental (e.g. biodiversity loss, land degradation), social (e.g. food insecurity) and economic (e.g. unemployment, poverty) challenges. Indeed, agroecology could contribute to food security, biodiversity conservation and rural livelihoods. The literature also highlights that agroecological management is knowledge-intensive so farmers' capacities need to be strengthened to increase the adoption of agroecological practices. Agroecology is also labour intensive, which can increase its contribution to local economies and livelihoods (cf. employment) but could also hamper its adoption where there is limited labour availability. Further research is needed to foster agroecological transition in Burkina Faso and Niger, which is fundamental to move towards sustainable agriculture and food systems that ensure food and nutrition security without undermining the fragile natural resource base.

Keywords: *agroecological transition, biodiversity, food security, livelihoods, West Africa.*

INTRODUCTION

Agroecology is gaining ground, both in developed and developing countries, as one of the most prominent and promising pathways for the transition towards sustainable agriculture and food systems (El Bilali, 2019; FAO, 2018; HLPE, 2019; Ollivier et al., 2018; Wezel et al., 2016). The transformative potential of agroecology is nowadays widely recognised not only by many scholars and organic agriculture movements (Herren et al., 2015) but also by several international organisations (FAO, 2015; HLPE, 2019) and expert panels (IPES-Food, 2016). Agroecology is an approach that dates back to the beginning of the 20th century and links together science, practice and movements focused on social change (Wezel et al., 2011). It utilizes ecological principles to design and manage productive, resilient and sustainable farming and food systems (Gliessman 2015; IPES-Food 2016). Recently, Wezel et al. (2020) defined 13 consolidated agroecological principles viz. recycling, biodiversity, land and natural resource governance, input reduction, soil health, animal health, connectivity, synergy, fairness, participation, co-creation of knowledge, social values and diets, and economic diversification. The integration of the three practical forms of agroecology (viz. scientific discipline, agricultural practice, social movement) and linkage with other food movements (e.g. food sovereignty) provided a collective action to contest the dominant agro-food regime and create agro-food alternatives (Levidow et al., 2014). The agroecological philosophy and message have also profoundly influenced and shaped other alternative agro-food movements and communities such as organic agriculture, permaculture and conservation agriculture (El Bilali, 2019; HLPE, 2019). Agroecological practices embrace soil fertility management, pest control, biodiversity conservation and agroecosystem integrity (Lampkin et al. 2017; Wezel et al. 2014) and contribute to food security and livelihoods (HLPE, 2019). However, despite the well-documented positive impacts of agroecology, the agroecological transition is hampered by many context-specific (technical, political, social, cultural, economic) obstacles of different nature requiring solutions from different fields of competence (Beudou et al., 2017; El Bilali, 2019). West Africa and Sahel regions face the challenge of feeding a growing population in a context of accelerated degradation of natural resources and climate change. Therefore, agroecological interventions have been promoted by a network of stakeholders to increase food production while conserving the natural resource base (Tapsoba et al., 2020). Agroecology has a longstanding history in Burkina Faso and Niger. For instance, in Burkina Faso, the agroecological alternative is rooted in the revolutionary period of president Sankara in the 1980s who was strongly concerned about environmental issues linked to agricultural development and supported endogenous development principles. The agroecological movement was reactivated in the country in the 21st century, among others, through small projects supported by different NGOs such as the French association *Terre et Humanisme* (Gross & Jaubert, 2019). However, it is widely recognised that research is fundamental for the development of agroecology and there are still many knowledge gaps to be addressed (HLPE, 2019). In this context, it is not clear

whether the agroecological movement is supported by evidence from science in Burkina Faso and Niger. Therefore, the present review paper analyses the state of research on agroecology in Burkina Faso and Niger.

METHODS

The paper is based on a systematic review of all documents about agroecology in Burkina Faso and Niger indexed in Clarivate Analytics - Web of Science (WoS), following the PRISMA guidelines (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) (Moher et al., 2009). It draws upon a search performed on June 19th, 2021, on WoS using the following search string: *(agroecology OR "agro-ecology" OR "agro-ecologic" OR agroecologic) AND (Burkina OR Niger OR "West* Africa" OR Sahel)*. The initial search yielded 44 documents published between 1990 and 2021. Three inclusion criteria were considered for the selection of documents to be included in the systematic review: geographical coverage (viz. document deals with Burkina Faso and/or Niger); thematic focus (viz. main topic is agroecology); and document type (viz. only research articles, book chapters or conference papers were selected; letters to editors, commentaries and/or notes as well as reviews were excluded). The screening of titles allowed excluding 8 ineligible documents that do not refer to Burkina Faso, Niger or the wider West Africa/Sahel region; the excluded documents deal with Benin, Brazil, Cameroon, Ghana, Nigeria, and Sierra Leone. Additional 22 documents were excluded following the scrutiny of abstracts as they do not deal with Burkina Faso and/or Niger (9 documents) or agroecology (12 documents) as well as one editorial material without abstract. Furthermore, 3 reviews (El Bilali, 2021; Kanlindogbe et al., 2020; Tapsoba et al., 2020) were discarded after the analysis of full-texts. Therefore, only 11 documents were included in the systematic review: Dowd-Uribe (2014); Gross and Jaubert (2019); Guébré et al. (2020); Lappé (2013); Masse et al. (2013); Nana et al. (2015); Osbahr and Allan (2003); Ouédraogo et al. (2019); Ratnadass et al. (2011); Saqalli et al. (2010); and Vidal et al. (2020).

RESULTS AND DISCUSSION

Agroecology has several impacts on the environment and natural capital. Some studies show that agroecological practices have positive effects not only on soil fertility but also on its biological activity. For instance, Guébré et al. (2020) found that plant residue amendments from stems and leaves of agroforestry shrubs increased nitrogen availability and triggered the soil macro-faunal activity (cf. termites, earthworms) with a consequent improvement in crop performance in Burkina Faso. Ouédraogo et al. (2019) found that in gardening farms in Bobo-Dioulasso (Burkina Faso), there is a widespread practice of crop rotations and associations, and organic fertilization. However, different factors affect soil fertility; according to Osbahr and Allan (2003), drawing upon local ethno-pedological knowledge in Fandou Beri village (Niger), "*Local soil fertility management depends on individuals' capabilities, perceptions of constraints and*

opportunities, and their ability to mediate access to different types of resources" (p. 457). Indeed, villagers in Fandou Beri were able to define soils based on location, production potential and interaction with the wider ecological environment.

There is a dual relationship between agroecology and biodiversity. On the one hand, agro-ecological practices contribute to enhancing biodiversity in farming systems. On the other hand, biodiversity is essential for providing some ecosystem services (e.g. pest regulation) that are crucial for successful agroecological management. For instance, Ratnadass et al. (2011) refer to a 'strategic' approach based on the exploitation of preventive, agroecological methods for the control of various pests and diseases in horticulture. These include the use of trap plants for reducing the infestation and damage of *Helicoverpa armigera*, tomato fruit worm, on okra in Niger.

Food insecurity is still a challenge in Sub-Saharan African countries. Therefore, Sub-Saharan African agriculture is called to increase agricultural production to achieve food security while reducing its footprints and impacts on the environment. For that, innovative practices, that consider the complexity of the social and biophysical systems of agricultural production and accommodate the ongoing environmental and socio-economic changes, are needed. In this context, Masse et al. (2013) highlight the benefit of this 'ecological engineering approach' and put that "*Innovative agricultural practices will be based on an intensification of ecological processes that determine the functioning of the soil plant system, farmers' fields and agro-ecosystems*" (p. 289). Also Lappé (2013), drawing upon case studies and success stories from Andhra Pradesh (India) and Niger, suggests that agroecology is transforming food systems in ways to address hunger and food insecurity. Indeed, agroecology allows to "*strengthen human relationships, enabling farmers to gain a greater voice in food production and fairer access to the food produced*" (p. 219). Therefore, agroecology supports food sovereignty and the control of local communities over their farming and food systems.

Many studies suggest that agroecology is labour intensive (Nana et al., 2015; Ouédraogo et al., 2019), since agroecological practices reduce input costs but increase labour requirements. This means that agroecology can contribute to local economies and livelihoods by creating job opportunities, but it can also be a barrier to the adoption of agroecology. For instance, Ouédraogo et al. (2019) found that the labour intensiveness of agroecological practices hamper their adoption by irrigated vegetable producers in Réo area (central-western Burkina Faso) since the majority of families cannot or are not willing to allocate more labour to their farming activities. Nana et al. (2015) show that conservation agriculture has positive effects on income.

A network of stakeholders is developing promising initiatives for scaling up agroecological practices and achieving agroecological transition in Burkina Faso, Niger and West Africa at large. However, there are different understandings and conceptualisations of agroecological transitions. Some scholars consider agroecology as similar to organic agriculture and, consequently, conceptualise agroecological transition as conversion to organic agriculture (Vidal et al., 2020).

However, Ouédraogo et al. (2019) found that no gardener in Bobo-Dioulasso (Burkina Faso) practices exclusively organic or agro-ecological production methods. Also Gross and Jaubert (2019) underline that the large diversity of situations and livelihood strategies makes it evident that agroecological gardening can only be adopted by a very small number of family farms in Réo area (central-western Burkina Faso).

Agroecological transitions can follow different pathways. Vidal et al. (2020) identified four trajectories of transformation of agro-pastoral dairy farms in Burkina Faso and France that correspond to different stages of conversion to organic farming and adoption of organic practices at the farm level i.e. organic farms with the use of pastoral resources and integrated animal health, organic farms, farms under conversion to organic agriculture, and conventional farms. Agroecological transition brings about changes in agro-pastoral practices regarding animal health and welfare, reproduction, milking (duration, period), fodder and forage management (harvesting, storage), and rangeland and pasture use. Similarly, Ouédraogo et al. (2019) identify four types of gardening farms in Bobo-Dioulasso (Burkina Faso) based on their location, size and intensity of use of pesticides and fertilizers viz. very intensive, intensive, moderately intensive and lowly intensive farms.

It is widely recognised that agroecological transition processes are context-specific as well as the importance of the direct involvement of the concerned stakeholders, especially farmers, in their framing. In this regard, Vidal et al. (2020) put that "*Agroecological transition would benefit from being co-constructed, by taking into account the diversity of local contexts through research, in partnership with farmers, technical supervision, NGOs and policy makers*". Osbahr and Allan (2003) call for paying more attention to farmers' physical, biological and agroecological knowledge and mechanisms through which it is used to make management decisions at the farm level. Meanwhile, Gross and Jaubert (2019) call on development organisations and public institutions to consider the diversity of family farms in Burkina Faso, as well as diverse farming families' needs and capacities, in supporting their transition to agroecology.

Different factors can enable or hamper the development and dissemination of agroecology. One of the most important constraints relates to the lack of reliable data on the economic, demographic and agro-ecological environments in Sahelian villages and households (Saqalli et al., 2010). The study of Dowd-Uribe (2014) suggests that both social and agro-ecological factors (viz. credit, governance, seed price and pest dynamics) affect not only the processes but also the outcomes of the adoption of new production systems, such as agroecology. Vidal et al. (2020) point to the market as one of the most important drivers of the agroecological transition of agro-pastoral dairy farms in Burkina Faso and France. Further drivers include resource management schemes. One problem faced by agro-pastoralists in West Africa in their move towards reducing reliance on purchased feed is the difficult access to pastures and rangelands for grazing (Vidal et al., 2020). This shows that land-use strategies at the territorial level have implications for the management

choices and decisions of single farmers and pastoralists. Ouédraogo et al. (2019) suggest that the main challenges faced by farms Bobo-Dioulasso (Burkina Faso) relate to pesticide use and sustainable fertilization for an agro-ecological transition. Furthermore, gardeners have a weak and imprecise knowledge of the health and environmental impacts of their practices. Moreover, agroecological farming relies on organic inputs (manure, plant biomass) that are scarce during the dry season. Last but not least, the systemic agroecological approach is complex to master for most farmers in Burkina Faso (Ouédraogo et al., 2019). This shows the importance of building the capacities of the involved actors, especially farmers. In this respect, Nana et al. (2015) point out the need to develop collective organizational innovations, especially for the management of crop residues.

By reading the papers in chronological order, it is possible to formulate a reflection on the evolution and maturity of the concept of agroecology in Burkina Faso and Niger. It can be noticed that since 2003, there has been a change in the focus of the topics and interests revolving around the concept of agroecology. At first, the greatest interest was of technical nature; it concerned the possibility of addressing some urgent issues related to the yield gap or of great interest for production purposes by applying agroecological concepts and practices. For instance, Osbahr and Allan (2003) focus on the possibility of managing soil fertility by applying agroecological concepts and practices. Subsequently, in line with international reflections on issues relating to biodiversity and to the provision of ecosystem services able to support farm production, attention in the papers shifted to aspects related to functional biodiversity and to the ability of the agroecological approach to improve the management of agroecosystems, namely ecosystem services regarding pest and disease regulation (Ratnadass et al., 2011). Then, in a later moment, the effectiveness of the agroecological approach in addressing food insecurity was widely verified (Masse et al., 2013) and the interest of scholars was on how agroecology can have a positive impact on the whole food system (Lappé, 2013). The reflection on agroecology, therefore, moved on to how far it is possible to push its adoption among farmers and on what are the factors that limit the adoption of agroecological practices (Dowd-Uribe, 2014; Saqalli et al., 2010). From these analyses arose how important is to consider the level of knowledge of farmers and the possibility of accessing ecological knowledge; a possible solution is identified in developing collective experiences that promote the adoption of organizational innovations through the exchange of knowledge and good practices (Nana et al., 2015). As the reflection on agroecology in Niger and Burkina Faso proceeded, the discourse moved on the need to facilitate the agroecological transition of local production contexts and it is enriched with a series of proposals and solutions by scholars dealing with socio-economic aspects. Gross and Jaubert (2019) and Ouédraogo et al. (2019) underline that the greatest difficulty in adopting agroecological practices lies in the need for a deep knowledge of individual environmental and socio-economic contexts. Other scholars highlight the need to activate research and experimentation activities to provide specific answers for each context and case (Guébré et al., 2020; Ouédraogo et al., 2019;

Vidal et al., 2020). Reading such papers provides not only a picture of the research needs on agroecology in both countries, but above all confirms how a joint reflection by local researchers and experts can lead to identifying political solutions that would allow making decisions and allocate funds for specific research priorities. This approach would allow overcoming the problems of adopting agroecological practices and identifying research priorities that provide technical indications suitable for the different production contexts.

CONCLUSIONS

Agroecology is widely recognised as a promising pathway of transition to sustainable agriculture and food systems. Therefore, interest in agroecology has been growing in many developing countries such as Burkina Faso and Niger not only from governments but also international organisations and NGOs. However, it is not clear whether such an increase in interest determined higher attention to agroecology by the research systems in these countries. Therefore, this paper analysed the state of research on agroecology in both countries. The analysis of the scholarly literature confirms the positive impacts of agroecology in terms of food security, biodiversity conservation and rural livelihoods. Agroecology represents a valid instrument to address several environmental (e.g. biodiversity loss, land degradation), social (e.g. food insecurity) and economic (e.g. unemployment, poverty) challenges. However, the literature review also suggests that, despite the recurring discourse on agroecology, there is a research gap. Indeed, there is a low number of articles addressing agroecology in both countries. This implies that the scientific component of agroecology (which along practices and movement constitute the pillars of agroecology) is underdeveloped. This gap in research might hamper the development of the agroecological movement as well as the documentation and dissemination of agroecological practices, thus slowing down the whole agroecological transition process in the region. Indeed, the literature also highlights that agroecology is knowledge-intensive and the need to strengthen the capacities of all actors involved in the agricultural knowledge and innovation system (AKIS), especially farmers. Further investments in research are needed to bridge the existing knowledge gap and unlock the potential of agroecological transition in Burkina and Niger, which is fundamental to move towards sustainable agriculture and food systems that ensure food and nutrition security without undermining the fragile natural resource base. The development of agroecology can contribute to the achievement of the Sustainable Development Goals (SDGs) in Burkina Faso, Niger and Sahel at large.

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