

**Professional paper**

10.7251/AGREN2402076G

UDC 631.147:574.1(662.5:662.6)

**AGROBIODIVERSITY MANAGEMENT: EXPLORING HOW THE ITALIAN EXPERIENCE CAN HELP PROMOTING NEGLECTED AND UNDERUTILIZED SPECIES IN BURKINA FASO AND NIGER**

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**ABSTRACT**

The project SUSTLIVES (SUSTaining and improving local crop patrimony in Burkina Faso and Niger for better LIVEs and EcoSystems), implemented in Burkina Faso and Niger, aims to promote the transition towards sustainable agricultural and food systems more resilient to climate change, ensure food security and improve the livelihoods of rural communities. This transition is driven by the promotion of local agro-biodiversity. Moreover, SUSTLIVES also aims to strengthen the research and innovation capacities of actors in the Agricultural Knowledge and Innovation System (AKIS) on the value chains of neglected and underutilized species (NUS) in Burkina Faso and Niger. To this end, an internship was carried out in March - April 2024 at the National Research Council (CNR) of Italy. The main objective of the internship was to undertake training on agrobiodiversity management and nutritional and functional properties of NUS by addressing, inter alia, the topics of custodian farmers; community seed banks; techniques for multiplication and conservation of genetic resources; agronomic and qualitative characterization of crops; nutritional and functional aspects of NUS and their beneficial health effects; food quality and safety; potential for processing, product development and commercialization. These topics were addressed through lessons, technical visits and discussions with various actors, including farmers growing local varieties and processing companies or associations involved in seed conservation. At the end of the internship, numerous points for reflection emerged. The internship provided insights into (i) organization and support of seed custodian farmers in Burkina Faso and Niger; (ii) development of NUS value chains through raising awareness among stakeholders; (iii) support for all stages in the agri-food

value chain; (iv) creation of a multi-actor framework around the valorisation of certain agricultural products, in particular NUS, in Burkina Faso and Niger.

**Keywords:** *Agrobiodiversity, NUS, value chain, case study, SUSTLIVES.*

## INTRODUCTION

Burkina Faso and Niger are two countries in the sub-Saharan Africa, included in the Sahelian area. They are afflicted by a strong vulnerability due to four major risks identified as 1) climate change, 2) food insecurity; 3) conflicts, and, 4) displacement (Blocher et al., 2022). Mainly climate change and conflicts impact food and livelihood insecurity. In both countries, more than 70% of the population is employed in the agricultural sector and, according to future projections, the Sahelian countries will be affected by repeated cycles of drought and flood. It is expected that the major food crops (viz. maize, rice, millet and sorghum), less resilient to climate change, will show a significant decline in yields in the future decades, with consequent repercussions on food security (Blocher et al., 2022). Aiming to address undernutrition and achieve food security, governments have promoted staple crops (rice, maize) and some cash crops (such as cotton, groundnuts, sesame) by providing seeds, fertilizers and chemicals to farmers through input subsidy programs (Ahmad et al., 2022). The effect of the fertiliser subsidy on target crops (e.g. maize, rice and cotton) was an increase in land allocated to target crops, compared to non-target crops, reducing crop diversity on farms (Ahmad et al., 2022). On the contrary, promoting the sustainable use and conservation of biodiversity within farming systems is relevant to ensure food security and healthy nutrition (greater intake of micronutrients and vitamins) through more stable crop production due to the use of species more adaptable to climate change and resistant to pests and diseases. Finally, crop diversity improves farmers' and rural community's livelihoods by providing production for both direct consumption and additional family income. The shift from subsistence agriculture to a production system that allows income generation passes through the development of value chains based on neglected and underutilised species (NUS) preserved within rural communities. Assessing the potential of these value chains can help building small-scale processing systems and promote economic development.

In this perspective, aiming to pursue these issues, the European Union has recently funded the project SUSTLIVES (SUSTaining and improving local crop patrimony in Burkina Faso and Niger for better LIVes and EcoSystems), a cooperation program started in August 2021 and lasting four years. The project aims at valorising neglected and underutilized crops (NUS), through the strengthening of the research and innovation capacities, the development of inclusive supply chains (particularly of women and young people) and the improvement of national and regional policies to support the sector. A data collection carried out through direct interviews with value chain actors at the national level in both Niger and Burkina Faso, as part of the project SUSTLIVES, highlighted that some common points are relevant for the analysis of the potential development of NUS value chains in the

two countries. In addition, to facilitate access to production inputs (seeds, fertilizers, pesticides), other two points emerged concerning farmers' need to acquire expertise in good practices (organic production or use of technical inputs) and the need to structure the supply of the raw and processed products into cooperatives or groups of villages to facilitate the transportation and marketing of NUS production (SUSTLIVES, 2023a; 2023b).

Conservation programs of biodiversity for food and agriculture have been implemented in several regions of the world. These programs are largely constrained by knowledge gaps, resource limitations and policy weaknesses, consequently, in their implementation they should include management strategies covering research, resource allocation and policy development (FAO, 2022). All these aspects have been applied in European countries through financial support from the Rural Development Program to custodian farmers and farms engaged in conservation and valorisation activities of local agrobiodiversity, developing specific agri-food productions, and research activities. The financial support arrived promptly to save most of the local genotypes held by custodian farmers (so-called 'bio-patriarchs') before their definitive loss. The support of the Rural Development Program, for instance, allowed to maintain some very local Italian agri-food production that would otherwise be at risk of extinction as older farmers died. The complex of factors (several local genotypes preserved from extinction, agronomical and gastronomic traditions, increasing interest and consciousness by consumers for these products) cooperated to create small-scale businesses and diversified resilient and healthy food productions.

In this context, the exchange of experiences and knowledge regarding the Italian agro-biodiversity system, on the one hand, and the Burkinabé/Nigerien one, on the other hand, is useful to strengthen the research and innovation capacities of actors in the Agricultural Knowledge and Innovation System (AKIS). An internship was organized to bring two students from Burkina Faso and Niger to analyse the agrobiodiversity system in some regions of Southern Italy. Complementary training covering all aspects of cultivation, characterization and processing of NUS selected in the framework of the project SUSTLIVE was carried out. This paper describes the organisation and content of the internship and explores how the Italian experience in agrobiodiversity management can help promoting NUS in Burkina Faso and Niger.

### **MATERIALS AND METHODS**

In the framework of the project SUSTLIVES, an internship was organized in Italy as a result of collaboration between the National Research Council (CNR, [www.cnr.it](http://www.cnr.it)), the Joseph KI-ZERBO University of Burkina Faso and Abdou Moumouni University of Niamey, Niger. The internship took place at two institutes of CNR, namely, at the Institute of Sciences of Food Production (ISPA, <https://www.ispacnr.it>) in Bari and the Institute of Food Sciences (ISA, [www.isa.cnr.it](http://www.isa.cnr.it)) in Avellino. These research institutes have well-established interdisciplinary and complementary expertise in several issues in the field of food

quality and safety. The internship was organized for two interns, one from each University, and completely funded by the project SUSTLIVES.

The internship was implemented according to the principle of a training of trainers, providing the participants with case studies, examples and instruments to be transferred to other stakeholders (students, researchers, extension workers, farmers and value chain actors) during the training sessions and workshops to be held in Burkina Faso and Niger.

In this light, the interns were selected by the two Universities to choose persons with the most appropriate scientific background to fully understand the topics of the internship and properly transfer these experiences to the stakeholders of their countries. Before the internship period, a program was scheduled that listed the activities to be carried out through lessons, laboratory training, technical visits and discussions with various actors (farmers, processing entrepreneurs, associations) in the field. The internship of six weeks was planned, and the interns were going to spend four weeks at the Institute of Sciences of Food Production (ISPA) in Bari and two weeks at the Institute of Food Sciences (ISA) in Avellino.

The contents of the internship included the following topics: custodian farmers; community seed banks; techniques of multiplication and conservation of genetic resources; agronomic, morphological and qualitative characterization of plant species; nutritional, functional and healthy features of NUS; food security; food quality and safety; potential processing, product development and marketing. The contents of the internship were selected to fulfill the specific objectives of Activity 2.2 (Training and capacity building of actors in the value chain) of the project SUSTLIVES. However, the topics of the internship were of great interest also for other project activities: Act. 1.2: Identification of guardian farmers, community gene banks and good practices; Act. 1.3: Access, selection, multiplication and distribution of target stress-tolerant NUS seeds; Act. 1.5: Exchange of knowledge and information between stakeholders; 2.1: Participatory analysis of value chains and markets of priority stress-tolerant NUS.

The administrative organization of the internship was carried out mainly through the drawing up and signing of an internal agreement between the CNR and the Universities of Burkina Faso and Niger, and the signing of an invitation letter to the beneficiaries of the internship.

## **RESULTS AND DISCUSSION**

The intern from the Joseph Ki-Zerbo University of Burkina Faso is Mr. Nebie Billy Moussa, an economist specializing in agricultural economics, natural resources and environment, a specialist in project management and a master's student at the end of the Master's cycle in Innovation and Development in rural areas of the AGRINOVIA program. He is responsible for the Program of the Association of Professionals in Private Irrigation and Related Activities (APIPAC). The intern from the Abdou Moumouni University of Niamey, Niger, is Mr. Moudi Kabirou, a specialist in plant protection and improvement of Sahelian agrarian systems, a doctoral student in the second year of his thesis on the theme: Optimization of the

productivity of the cultivation of cassava and sweet potato to improve the resilience of the rural population of Niger. Moudi Kabirou also works at the Federation of market gardening cooperatives of Niger (FCMN Niya) with more than 42,000 producers from all regions of Niger.

Based on the expertise of the two CNR institutes, the activities developed at ISPA concerned the management of agro-biodiversity, seed conservation systems, agronomic, qualitative and nutritional characterization of the selected NUS in the project SUSLIVES, food safety, product processing perspectives; the activities developed at ISA concerned the main problems of human nutrition and the nutritional value of NUS in relation to the improvement of the diet quality in Burkina Faso and Niger, the nutritional, functional and healthy features of the NUS of interest, with reference to specific groups of nutrients and bioactive compounds and through a specific laboratory activity of analysis carried out on okra, one of the selected NUS.

One of the objectives of the internship was to allow trainees to draw inspiration from the practices applied by value chain actors in Italy to co-construct with the actors of Niger and Burkina Faso possible solutions around the issues of developing the value chains of the main NUS selected by the project SUSTLIVES. Considering this aim, the technical and field visits had a great impact in the experience of the internship due to the discussion about the topics listed above and to the observation of different situations with high value as case studies to be transferred. Visits to farmers' organizations in Italy revealed innovative strategies to address agricultural challenges and enhance biodiversity. Two case studies stand out for their effectiveness in integrating research, collaborations and sustainability. The local association "Salento Km0" (Zollino, Lecce) involves over 40 farmers, municipal authorities and universities for the development of local crops. Among these, the "Pisello Nano" (dwarf pea) has been characterized by its nutritional values and its historical identity. Now exported to the United States, it represents an example of synergy between municipal bodies, universities and farmers to enhance local products at risk of extinction. The visit to the 'seed guardian' Angelo Giordano highlighted the global commitment to seed protection. In fact, seed reproduction and exchanges between seed savers are fundamental. Moreover, some local genotypes, saved by Giordano and other seed savers, do not require much water for production and for centuries farmers in Southern Italy have developed a specific technical practice that is potentially crucial for horticulture in these regions, traditionally affected by scarcity of water. This constitutes a wealth of knowledge that can animate an effective exchange of experiences and expertise between Southern Italy and the Sahel countries afflicted by the climate crisis. These cases demonstrate how collaboration, together with innovation, can create added value in agricultural activities, promoting the survival of local products and biodiversity.

Other field excursions to Italian agricultural companies provided interesting insights into challenges and solutions related to agricultural production in complex contexts. Three companies stood out for their innovation and commitment to

sustainability. The farm ‘Terzeria’ in Villapiana, Calabria, extends over 400 hectares, cropped with rice, citrus fruits and vegetables, has the main challenge of finding the right solution to face soil salinity due to its location below sea level and to the constitutional nature of its soils and the sediments from which they originate. Collaborations with universities and research institutes made soil improvement techniques through improving soil microbial activity and the utilization of specific crops and cultivars in a circular economy conduction with solar panels for irrigation and management of greenhouses and a plant to compost urban waste to increase the soil organic matter. The commitment to social projects of the ‘Semi di Vita’ cooperative (Bari, Apulia region) is another example of a case study under the philosophy of organic production, of fruit and vegetables, with progressively increasing surfaces, and the production of eggs from laying hens. The last case is the “Colle di Seta - Agricola Cantatore” company in Ruvo (Bari, Apulia region), with a family-run business integrating scientific research into product processing, obtaining the development of innovative food products, very appreciated on the market. These case studies show the way of tackling environmental, social and market challenges, contributing to the growth of a sustainable and cutting-edge sector, without neglecting local traditions, which could be a topic of discussion between the countries involved in the project SUSTLIVES.

The internship allowed the interns to discuss several issues related to the improvement of value chains of NUS and seed systems in Burkina Faso and Niger. The following critical points were defined: (i) difficult access to quality seeds and propagation material; (ii) low agronomic skills and knowledge of farmers; (iii) low performance; (iv) variation in product quality; (v) lack of appropriate storage/packaging infrastructure; (vi) limited processing knowledge; (vii) disorganized or non-existent value chain and market; (viii) discouragement of investment due to low market value; (ix) high consumer prices due to lack of economy of scale; (x) low consumption in production areas (El Bilali et al., 2023).

The exchange of knowledge during the internship allowed to foresee that a better organization of seed producers could improve access and reproduction of quality seeds for the benefit of stakeholders. The integration of Burkinabè and Nigerien seed guardian organizations into international networks could improve agronomic skills and yields. Intensifying advocacy by agricultural organizations could greatly contribute to establishing a legislative environment conducive to the promotion of biodiversity and better consideration of local seeds in public policies and agricultural development strategies. This could encourage investments and improve storage infrastructure. The creation of economies of scale around plant species could contribute to the development of significant and sustainable value chains around these NUS.

Moreover, promoting the consumption of these NUS through better marketing around their important nutritional and functional values could boost the consumption of these products, which have already started to take a significant part in urban populations and especially the very popular middle class, based on the quality of food and its origin. The proper consumption of these NUS could also

play a central role in alleviating malnutrition problems, as they represent a rich source of micronutrients, such as vitamins and minerals, and bioactive molecules, such as antioxidant compounds, that can positively affect human health, especially among city dwellers. According to Bricas et al. (2014) more than 60% of urban dwellers in Africa suffer from malnutrition. So, increasing the awareness of the importance of vegetable consumption in fighting malnutrition and, more generally, food insecurity problems could prompt the vegetable market and the development of a sustainable value chain thus providing employment opportunities, especially for unemployed women and young people. The development of niche markets through awareness raising among certain key players could help to strengthen the sustainability of the value chains of NUS. This is the case of amaranth grains in the manufacture of gluten-free bread for the benefit of diabetics, the number of whom has been increasing in Burkina Faso (WHO, 2016). The same is true for the use of okra in bread making, roselle seeds in cosmetics and medicine, moringa seeds in medicine.

To sum up, this internship was a real opportunity to bring together the practices of Italian, Burkinabè and Nigerien actors, with the aim of making them mutually feed on their knowledge, for the benefit of agriculture that is more respectful of biodiversity and creates sustainable opportunities.

### CONCLUSIONS

The internship – carried out in Italy from March 10 to April 18, at the Institute of Sciences of Food Production (ISPA) in Bari and at the Institute of Food Sciences (ISA) in Avellino, both institutes of the National Research Council of Italy (CNR) – made it possible to deepen the trainees' knowledge on biodiversity and the nutritional and functional properties of NUS. Above all, it showed the need of good practices that could contribute to the improvement of sustainable practices of biodiversity conservation and the roles of actors and stakeholders in Burkina Faso and Niger: (i) The organization and the support of farmer seed guardians; (ii) the development of NUS value chains through awareness-raising and advocacy among different stakeholders; (iii) the support for the links in production towards the processing of agricultural products; (iv) the creation of a multi-actor framework around the valorisation of certain agricultural products, particularly the NUS. These issues will fuel the co-construction of solutions adapted to the realities of Burkina Faso and Niger. The internship highlighted that establishing multi-stakeholder frameworks involving researchers, farmer organizations, public authorities, local communities, and other actors can be key to valorise local products and creating sustainable value chains. In Burkina Faso, such frameworks could promote and enhance typical regional products like “Fabirama de Arbolé” and “Chitoumou” (caterpillars from the Hauts Bassins region), as realized in Italy for Zollino’s “Pisello Nano”. Finally, encouraging collaboration between businesses and scientific research, supported by advocacy efforts from projects, programs, farmer organizations, and civil society, is essential in order to initiate the sustainable development of the NUS value chains in Burkina Faso and Niger.

### ACKNOWLEDGEMENT

This work was carried out within the project SUSTLIVES (SUSTaining and improving local crop patrimony in Burkina Faso and Niger for better LIVES and EcoSystems - <https://www.sustlives.eu>), of the DeSIRA initiative (Development Smart Innovation through Research in Agriculture), financed by the European Union (agreement FOOD/2021/422-681).

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