Food and Agriculture Organization of the United Nations

Scaling up agroecological techniques in the millet-groundnut and market gardening value chains

Opportunities, challenges and solutions in Senegal's Groundnut Basin and Niayes Region

SENEGAL

Key messages

- The resilience of the millet-groundnut and market gardening value chains is threatened by the impacts of climate change, including longer dry periods between rainfall events during the rainy season, overall reduced rainfall, rising temperatures and water table depletion.
- The adoption of priority agroecological techniques and practices, which strengthen systems resilience to climate hazards and optimize the use of natural resources, presents a major opportunity to enhance climate change adaptation and mitigation efforts, while ensuring the long-term sustainability of agricultural value chains.
- It is essential to remove barriers to access to finance and to enhance women's access to agricultural resources to facilitate the adoption of agroecological practices and accelerate the transition towards more resilient farming systems.

The following practices are recommended for their transformative potential:

- **Large-scale composting**, which can be promoted by integrating it with agroforestry and by harnessing livestock droppings from farming households, as well as through partnerships with municipal waste management programmes.
- **Growing climate-resilient millet and groundnut varieties**, which can be promoted by raising farmers' awareness and facilitating access to seeds through local distribution points.
- **Agroforestry practices**, which can be promoted through living fences, known for their profitability and positive impact on farm sustainability.

Required citation:
UNDP and FAO. 2025. *Scaling up agroecological techniques in the millet-groundnut and market gardening value chains: Opportunities, challenges and solutions in Senegal's Groundnut Basin and Niayes Region.* New York.

INTRODUCTION

In Senegal, agriculture employs nearly 60 percent of the working population and is a key driver of economic growth, contributing 9.4 percent to the gross domestic product (GDP) in 2019[1]. It is also the backbone of the country's food security. However, agriculture in Senegal is heavily dependent on rainfall and is dominated by small family farms[2], making it particularly vulnerable to the effects of climate change.

Millet and groundnut crops are essential to Senegal's economy and food security. They are the country's main rainfed crops and accounted for 53.34 percent of the coarse grain production and 92.97 percent of the legume production respectively in 2018[3]. In addition, groundnuts are the main cash crop around which the rural economy of the Groundnut Basin is structured, while millet is a staple food for the local population. Vegetable production in the major hub of the Niayes Region is an important source of cash income for the country. It generates an increasing number of jobs and makes a significant contribution to the country's food and nutritional security.

Given this context, Senegal's Nationally Determined Contribution (NDC) identifies agriculture, livestock and fisheries as the sectors most vulnerable to the impacts of climate change. The National Adaptation Plan for the agriculture sector (NAP-Ag), which is expected to be validated shortly, is set to provide key directions on soil fertility restoration, water management, and improved crop varieties to support the development of sustainable value chains. As part of the implementation of these plans, Senegal is benefiting from technical and financial support from the SCALA programme (Scaling up Climate Ambition on Land Use and Agriculture through Nationally Determined Contributions (NDCs) and National Adaptation Plans (NAPs)).

Funded by the German Federal Ministry for the Environment, Climate Action, Nature Conservation and Nuclear Safety (BMUKN), the SCALA programme is designed to support 12 countries in Africa, Asia, and Latin America to build adaptive capacity and reduce greenhouse gas emissions to meet targets set out in their NAPs and NDCs. Its main objective is to help partner countries translate their NDCs and NAPs into practical and transformative climate solutions in land use and agriculture, with multistakeholder collaboration.

The SCALA programme developed the Climate Action Review (CAR) tool to help countries prioritize climate actions that have transformative potential, that is, actions that are based on climate considerations, adopt a systemic approach, promote gender equality and social inclusion, contribute to sustainable development, favour a whole-of-government approach, and encourage private sector engagement. The CAR tool supports adaptation practitioners to screen the adaptation actions outlined in NDCs and NAPs and identify concrete entry points for transformative change. In Senegal, the application of the CAR tool and the participatory diagnoses carried out by SCALA identified the millet-groundnut and market gardening value

[1] National Agency for Statistics and Demography. 2022. *Situation Economique et Sociale Nationale 2019 [National Economic and Social Situation 2019]*. ANSD, Dakar. p. 150.

[2] Agricultural Analysis, Forecasting and Statistics Department, Ministry of Agriculture and Rural Equipment (MAE). 2021. *Les exploitations agricoles de type familial au Sénégal. Mise en application avec les données de l'Enquête Agricole Annuelle [Family-type farms in Senegal. Application to data from the Annual Agricultural Survey]*. DAPSA/MAER, Dakar. p.21.

[3] National Agency for Statistics and Demography. 2020. *Situation Economique et Sociale Nationale 2017-2018 [National Economic and Social Situation 2017-2018]*. ANSD, Dakar. p. 225.

chains as having the greatest transformative potential for resilient, low-carbon agriculture in the Groundnut Basin and Niayes Region.

Based on this finding, the SCALA programme supported an analysis of agroecological techniques and practices in the millet-groundnut and market gardening value chains that promote climate change adaptation. This brief summarizes the findings of that analysis, which specifically explored the impact of climate change on these systems, their adaptive capacity, and identified agroecological solutions for adaptation and reduction of greenhouse gases (GHG). Additionally, it evaluated the feasibility and suitability of these solutions within the millet-groundnut and market gardening value chains.

The Groundnut Basin is Senegal's main agricultural region. Located in the central-western part of the country, it includes the administrative regions of Kaolack, Fatick, Kaffrine, Diourbel, Thiès, and Louga. Groundnut and millet are the dominant crops in the region, occupying 90 percent of the cultivated land. However, agriculture in the region faces a growing number of challenges. In the north-central part of the Basin, these include recurrent droughts, degradation of plant cover and soil fertility, and poor water availability. In the southern part of the Basin, the main challenges are marked soil degradation, declining rainfall and high population growth leading to an increased pressure on resources. The Niayes Region is characterized by a succession of dunes and closed inter-dune depressions with an outcropping water table. It benefits from favourable biophysical conditions for horticultural crops, establishing it as Senegal's leading vegetable-producing region. However, increasing climatic variability, characterized by alternating periods of excessive and insufficient rainfall, presents significant challenges.

Photo: Association of the Niayes Market Gardening Unions (AUMN). Cabbage production farm. (Viviane Umulisa/FAO).

METHODOLOGY

This study examined the agroecological technologies implemented within the millet-groundnut and market gardening value chains to evaluate their ability to reduce vulnerability and offer technical solutions adapted to the challenges posed by climate change. The solutions are prioritized based on their potential to enhance resilience, reduce GHG emissions, and their feasibility and profitability. This approach helps formulate concrete recommendations for targeted actions that can be scaled up to enhance the resilience of people involved in these value chains while contributing to the objectives of national climate policies.

Using a participatory and inclusive approach, this methodology involved producers and stakeholders and was complemented by comprehensive documentary research in collaboration with national research institutions. A literature review was carried out by consulting resources from libraries and documentation centres of institutions working on agriculture and the environment. Documented databases of projects and non-governmental organizations (NGOs) focusing on climate change and agriculture were also utilized. This research provided an in-depth understanding of existing concepts, methodologies and achievements, and facilitated a structured analysis of the agroecological technologies implemented within the millet-groundnut and market gardening value chains.

Subsequently, the main stakeholders in the two value chains were identified and characterized. They include individual producers and producer organizations, traders, distribution and transport networks, processors, seed operators, fertilizer and phytosanitary product suppliers, craftspeople, and suppliers of small agricultural equipment. Microfinance institutions offering credit for the purchase of agricultural inputs and equipment, national and regional research and advisory institutions, and projects and NGOs playing a facilitative and supportive role for producers were also included.

Field surveys were then carried out in two stages. The first field survey involved workshops with various stakeholders at different levels in the millet, groundnut and market gardening value chains. Three workshops were organized in Darou Khoudoss for the Niayes Region (market gardening), Thiès for the Central-Northern Groundnut Basin (millet-groundnut) and Kaolack for the Southern Groundnut Basin (millet-groundnut). These workshops were attended by 31 participants in Darou, 9 percent of whom were women; 25 participants in Thiès, 16 percent of whom were women; and 29 participants in Kaolack, 27 percent of whom were women. A structured interview guide was used for data collection. The second type of field survey consisted of in-depth surveys with focus groups aimed at expanding the results of the previous surveys. These surveys involved farmers' organizations and producer associations. The targeted groups included a smaller number of stakeholders, specifically those using the agroecological techniques and practices identified as priorities during the initial workshops. The aim was to supplement the field data obtained during the first three workshops. The interview guide was used with a specific emphasis on exploring the financing aspects related to the adoption of agroecological practices.

The exercise concluded with a final meeting, held in Dakar, for collegial analysis and validation of the results. Two key areas were given particular attention: the gender and social inclusion aspects of agroecological transformation, and the assessment of profitable opportunities and barriers for large-scale dissemination.

RESULTS

Local stakeholders’ perceptions of major climate risks

The workshops confirmed that the main climatic risks affecting farming activities in these areas are longer dry spells in the rainy season, rising temperatures, and high inter-annual variability in rainfall. These findings align with scientific observations, which indicate a higher likelihood of these risks in the North-Central Groundnut Basin (NCBA) and the Niayes Region compared to the Southern Groundnut Basin (SBA). Such climate impacts threaten the sustainability and resilience of agricultural value chains in these regions, as they result in damage and a drop in yields and agricultural production.

Groundnuts are more vulnerable to these risks. Millet is a semi-arid crop, hardy and tolerant to water stress. Groundnuts, on the other hand, require more regular and abundant rainfall to guarantee good growth and production. The surveys also showed that market gardening crops, particularly potatoes, are severely affected by rising temperatures, longer dry spells in the rainy season and shorter rainy seasons. These changing climatic conditions are causing significant reductions in yields for all crops and increasing production costs. Robust adaptation strategies and practices need to be adopted and implemented to address these challenges.

Farmers' perceptions of priority agroecological techniques and practices, their adaptability and potential for adaptation

The surveyed farmers indicated that they were familiar with or used various agroecological techniques and practices as sustainable strategies for adapting to climate change. A total of 22 agroecological techniques were identified and were grouped into five categories: i) soil fertility restoration and conservation techniques, ii) biodiversity-based techniques for regenerating degraded land, iii) techniques for using renewable energy in agriculture, iv) pest management techniques, and v) techniques for the economic management of climate risks.

Six agroecological techniques and practices were identified as priorities for the millet-groundnut value chains in the Groundnut Basin, based on proven effectiveness and scalability:

1. Use of adapted varieties
2. Composting
3. Assisted natural regeneration
4. Cultural associations
5. Conservation agriculture
6. Use of biopesticides such as neem

Similarly, three techniques were prioritized in the market gardening value chain in the Niayes Region:

1. Composting
2. Living fences
3. Use of liquid biofertilizer

Composting is the only technique identified as a priority for both value chains.

Although some financing opportunities have been identified for both the millet-groundnut and market gardening systems, significant barriers continue to hinder access to resources needed for the large-scale deployment of these practices. Producers and cooperatives face obstacles such as high interest rates, limited knowledge of financial products and the processes required to access them, and insufficient information on available financing opportunities, particularly concerning the Green Climate Fund. For financial institutions, the main barriers include a lack of familiarity with effective agroecological practices and a lack of information on their profitability.

Furthermore, the surveys highlighted limited opportunities for women to adopt these practices, thereby reducing their potential to contribute more actively to the agroecological transition, despite their predominant roles in the targeted agricultural value chains. These constraints include restricted access to livestock, essential for organic manure production; the physically demanding nature of certain tasks associated with agroforestry and composting practices; and limited land access or ownership.

Stakeholders have pointed out, however, that endogenous or cooperative financing systems can facilitate the dissemination of high-yield varieties. This model could also present a solution for funding the adoption of agroecological practices.

RECOMMENDATIONS

Based on the feedback gathered from participatory research and consultations with farmers and stakeholders across all stages of the value chains, the following recommendations emerged. These are directed at policymakers to facilitate the adoption and scaling up of agroecological practices and techniques in these two key value chains for the country's agricultural sector.

Strengthening agricultural technologies and knowledge

- **Promote large-scale composting at micro and meso levels.** This requires overcoming the challenge of the limited availability of compostable organic matter on family farms. This can be done by increasing access to compostable livestock or plant resources at the farm level, with agroforestry (living fences, assisted natural regeneration, compostable biomass-producing shrubs), or by promoting faster alternative techniques such as "bokashi"[4]. In addition, scaling up larger-scale composting models tested under initiatives such as the Project to Promote the Integrated Management and Economy of Solid Waste (PROMOGED) has the potential to turn fermented municipal waste into a valuable economic resource. Finally, it is essential to build the capacity of the stakeholders involved, to master various composting processes and optimize their economic value from an entrepreneurial perspective.

- **Widely disseminate climate-adapted millet and groundnut varieties and crop association practices in the Groundnut Basin.** This requires raising awareness and providing information to farmers to overcome the lack of knowledge about these varieties and the appropriate financing arrangements. In addition, establishing local stores will improve access to these seeds and strengthen farmer networks, which will facilitate the multiplication and dissemination of these adapted seeds. These efforts will contribute to creating a profitable sector.

- **Strengthen agroforestry, focusing on the dissemination of living fences in the market gardening system and assisted natural regeneration in the millet-groundnut system.** The respondents of the survey recognized the profitability of these techniques. To ensure their successful implementation, several accompanying measures are needed, such as improving access to agroforestry tree seeds and

[4]Note: Bokashi is an innovative and effective Japanese composting method, suitable for those who want to reduce their food waste while adding essential nutrients to their garden.

strengthening capacities in plant production, planting, and management. In addition, it is essential to broaden the range of financing options available, particularly by introducing subsidies adapted to the longer payback periods associated with these techniques, which are not compatible with the short-term repayment conditions of conventional bank loans.

Promoting financing for the ecological transition

- In collaboration with the private sector, **adapt current agricultural value chain financing mechanisms to align with the realities and needs of stakeholders involved in the agroecological transition.** These adjustments are expected to facilitate the initial investments needed to adopt certain practices that are often at first perceived as onerous. For women involved in the value chains, this measure should contribute to strengthening their capacities and activities in processing agroecological products. These financing solutions must be widely publicized and coupled with capacity-building initiatives for both customers (preparation of financing applications) and financial institutions (better understanding of the profitability of agroecological practices).

Strengthening policy and planning

- **Enhance women's access to land, livestock and biomass, and financing** to unlock their potential in adopting agroecological techniques and practices and in advancing the agroecological transition, particularly in the processing of non-timber agricultural and/or forest products.

- **Strengthen collaboration with research institutions**. This can be achieved by supporting diploma theses that provide development programmes and the government with reliable and in-depth data. This will help address key challenges in scaling up best agroecological practices and supporting the agroecological transition, and tackle the gaps identified in this study, including knowledge dissemination, financing mechanisms, inclusion of women, and profitability analysis, among others.

The activities implemented under the SCALA programme will aim to promote the recommendations from this analysis. They will focus on identifying additional sources of funding for the deployment and upscaling of prioritized agroecological practices; training stakeholders in transformative practices; and supporting local small and medium enterprises and farmers in accessing finance. Finally, the programme will aim to establish a monitoring and evaluation system to assess the impact of these actions on achieving the country's climate goals and raising their ambition.

This assessment took place as part of the Scaling Up Climate Ambition on Land Use and Agriculture through Nationally Determined Contributions and National Adaptation Plans (SCALA) programme, jointly led by the Food and Agriculture Organization of the United Nations (FAO) and the United Nations Development Programme (UNDP). SCALA aims to strengthen the evidence base for transformative climate action in agriculture and land use in more than a dozen countries in Africa, Asia-Pacific, and Latin America, SCALA is supported by the German Federal Ministry for the Environment, Climate Action, Nature Conservation and Nuclear Safety (BMUKN) through the International Climate Initiative (IKI).

Food and Agriculture Organization of the United Nations
www.fao.org/in-action/scala/en

United Nations Development Programme
www.adaptation-undp.org/scala

Supported by:

Federal Ministry
for the Environment, Climate Action,
Nature Conservation and Nuclear Safety

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the German Bundestag