

## TreeFood

### Reducing of malnutrition through the food supplements from native tree species in Sub-Saharan Africa

#### ABSTRACT

According to FAO and WHO, Benin, Mali, Niger and Burkina Faso from the Sub-Saharan region of Africa (SSA) are 4 Brouillon characterized by: 1) rapidly increasing populations; 2) high rates of rural poverty; 3) high rates of malnutrition; 4) unsustainable use of natural resources. To combat malnutrition, which has become a brake on socio-economic development, populations from these countries need a balance diet and diversified food. An alternative to bridging this gap could come from sustainably sourcing native edible tree/shrub products in order to contribute to food security and mitigate malnutrition. The project has highlighted a precious marriage between traditional and scientific knowledge enabling Benin, Burkina Faso, Mali and Niger poor populations to be aware that the solution to malnutrition is found in their own lands by consuming traditional dishes enriched with the juice or pulp or almond of local forest species. These are, in this case, baobab tree (*Adansonia digitata*), desert date palm (*Balanites aegyptiaca*), jujube tree (*Ziziphus mauritiana*), saba liana (*Saba senegalensis*), wild mango tree (*Irvingia manguifera*) and palmyra palm (*Borassus aethiopum*). These five species have an unmatched strong physico-chemical and nutritional potential (proximal composition, mineral and vitamin A and C content, antioxidant capacity and anti-nutritional factors). Consumption patterns, food customs, local conservation strategies and constraints on the use of the selected species were documented. In order to enable these brave populations to benefit economically and to promote these species, the project has made available to all stakeholders information on their low-cost reproduction and economic profitability. The project has been documented in scientific articles, technical manual, leaflet, video films, radio programs, doctoral and master theses and Bachelor degrees. To better manage the post-project period, these results were appropriated by the innovation platforms and then integrated into the economic and social development plans of the rural communes as well as the basic education curricula in order to increase the high rate of adoption of the enhanced nutritional mixtures. Newspaper and television interviews as well as the restitution of the key results were widely disseminated on the project website and to the rural and scientific communities. It is urgent for our governments to take incentive measures for the creation of semi-industrial transformation units of forest species edibles parts for better livelihoods of vulnerable households.

**Keywords :** Shrub, Innovation platform, Sub-Saharan Africa, *Adansonia digitata* et *Irvingia gabonensis*, Burkina Faso, Benin, *Borassus aethiopum*, *Balanites aegyptiaca*, *Saba senegalensis*, *Ziziphus mauritiana*, Niger, Mali, Native edible tree, Agro-biodiversity, Food security

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**Project leader :** Amadou Malé Kouyaté

**Project leader's institution :** Centre Régional Recherche Agronomique/Institut d'Economie Rurale

**Project leader's RU :** Hors\_réseau

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**Funding :** Labex

## GOAL

The overall developmental objective of TREEFOOD is to contribute to food security and the fight against malnutrition through improved sustainable management and use of a selected number of edible tree/shrub species. The overall research objectives are : i) Make a literature review and inventory local knowledge and practices on native edible tree/shrub species and products ; ii) Assess/characterize biochemical compounds and nutritional value of native edible tree/shrub products ; iii) Analyze and develop value chains and improve marketing and processing of selected edible tree/shrub products for longer shelf life and improved nutritional quality ; iv) Develop locally adapted domestication of high-potential native edible tree/shrub species ; v) Strengthen institutional and innovation capacity of local communities. This project is based on Sustainable agro-food processing for more sustainable and healthy diets. Its objectives are to achieve the following goals of the initiative which are three-fold: (1) To advance understanding of food systems sustainability; (2) To facilitate the emergence of excellent, new and potentially high-impact research; and (3) To generate leverage effect that encourages new collaboration across disciplines and across diverse stakeholders. The main scientific hypotheses or questions are:

- Sub-Saharan Africa cannot meet its food needs due to its exponential growth rate;
- Local forest species used in the fight against malnutrition are not widely available;
- Diets of higher income groups are more diversified than those of the lower income group;
- Diets based on non-timber forest products are low in vitamins, minerals and trace elements;
- Diversification of food resources is needed in sub-Saharan Africa.

## ACTION

The project was carried out in Southern Sahara four countries (Benin, Burkina Faso, Mali, Niger) in collaboration with two European countries (Belgium, Denmark). Its realization required the synergy of actions that were initiated by research institutes (IER-Mali, INRAN-Niger) and universities (UAC-Benin, UJKZ-Burkina Faso, UA-Denmark, Ugent-Belgium). The researchers involved have more than 20 years of experience and belong to several disciplines (forest management, agroforestry, nutrition, biometry, plant improvement, ethnobotany, agro-economics, rural sociology).

The research approach was focused on a holistic approach with high rural community participation from the four African countries. This holistic approach allowed the sustainable development, use and conservation of a number of local tree species occurring in the different agro-ecological zones. In addition, the project focused on gender equity and the ethnobotanical approach. This approach made it possible to integrate food diversity situations, but also diversity forms in social and administrative organizations from the various countries. In each study area, field research was conducted in two different agro-ecological zones per country. In each agro-ecological zone, field research was conducted in two villages. The four study villages were chosen as they combined high agricultural production and high prevalence of malnutrition based on literature reviews (Dury & Bocoum. 2012; Diallo & Toah. 2019).

These four villages hosted the “Deployment of improved vegetable technologies to tackle malnutrition. This indicated that the concept of malnutrition was already well known by local people. People saw malnutrition as an illness characterized by children stunt growth and physical weakness.

To achieve the objectives, the main activities were covered traditional knowledge and literature review, biochemical characterization, domestication, value chain, and capacity building.

The main activities are grouped in 5 activities :

- 1- Literature review and traditional knowledge survey on native edible tree/shrub species ;
- 2- Assessment of biochemical compounds and nutritional value of selected native edible tree/shrub species products ;
- 3- Analysis and development of value chains and improvement of marketing and processing of selected edible tree/shrub products ;
- 4- Development of locally adapted domestication of selected native edible tree/shrub species ;
- and 5-capacity building

## RESULTS

As results, the project has identified 6 priority species in the fight against malnutrition in the four African countries among which 2 species have been selected per country for the research activities of the project. These are: *Adansonia digitata* et *Irvingia gabonensis* in Benin; *Saba senegalensis* et *Ziziphus mauritiana* in Burkina Faso ; *Balanites aegyptiaca* et *Ziziphus mauritiana* in Niger ; *Saba senegalensis* et *Borassus aethiopum* in Mali. These six species were documented in the areas of consumption, conservation as well as the constraints of their use in human food. In addition to a synthetic document on the biochemical composition of West African forest species, the work showed that these 6 species are rich in vitamins, minerals and trace elements and can be used as fortifying, energetic and nutritional. To strengthen the capacity of women of reproductive age and to improve the growth of children under 5 years of age, traditional dishes enriched with the edible parts of the six species showed potential for tackling malnutrition. It's the case of Mutchayan (fermented cereal porridge enriched with baobab fruit pulp), the *Cochlospermum tinctorium* root powder, the *A. digitata* fruit pulp and *Moringa oleifera* leaf powder, the *S. senegalensis* juice and millet porridge, the *B. aethiopum* juice and maize porridge, the *Z. mauritiana* cookie. To valorize these practices, the characterization and mapping of the value chains of the edible parts of the selected species by country showed that: i) women are the main collectors; the activity of harvesting edible organs is economically profitable; iii) semi-industrial processing of the edible parts of the selected species has started. All these results must be sustained by the availability of the resource. The profitability indicators showed that the collect/harvesting of these species is a profitable activity in the four African countries. Therefore, high regeneration potential was found for *I. gabonensis* in Benin, *B. aegyptiaca* and *Z. mauritiana* in Niger, *Z. mauritiana* in Burkina Faso, *S. senegalensis* in Burkina Faso and Mali. Among these 6 species, some are suitable for grafting and aerial layering which are low cost domestication techniques. The platforms set up enjoyed capacity building actions in the areas of regeneration and vegetative propagation, training on the juice value chains, nutrition health and capacity building, promotion of non-timber forest product. Recipes for improved iron-rich child food based on *A. digitata* were developed.

## PERSPECTIVES

New research questions arising from the project (in terms of knowledge needs, practices, methodology...)

Should we formalize innovation platforms?

In what form should food supplements fortified with NTFPs be presented?

What strategy should be developed to better sensitize political decision-makers?

What communication plan to support recipes from food supplements fortified with NTFPs?

What economic promotion for NTFPs?

Initial ideas/suggestions :

It will be necessary to create optimal conditions for increasing the share of local forest species in daily household consumption, to popularize techniques for sustainable domestication of local forest species for nutritional purposes, to increase the income of stakeholders in non-timber forest products for food, improve the livelihoods of rural communities, empower direct and indirect actors by building their capacity to create and develop competitive and diverse product value chains, and build institutional capacity to promote interactive learning and multi-stakeholder innovation. An action plan of 5 years will be developed with emphasis on: i) the integration of the highlighted results in the economic and social development plans of the rural municipalities, ii) the realization of enhanced vegetative orchards of 100 ha per year based on the five selected species that are *A. digitata*, *B. aegyptiaca*, *B. aethiopum*, *I. gabonensis*, *S. senegalensis* and *Z. mauritiana*, iii) the ongoing strengthening of the capacities for the processing units of fruits/leaves into juice or others, iii) the ongoing development of the value chains. However, we recommend future research on the genetic diversity of these five species and its planting in situ under drought stress conditions to confirm this finding.

The results should be disseminated to the CGIAR Research Program on Climate Change, Agriculture and Food Security (CCAFS), the West and Central African Council for Agricultural Research and Development (CORAF), the Economic Community of West African States (ECOWAS), and the Permanent Interstate Committee for Drought Control in the Sahel (CLISS).