



## NUTRITION

### Diversified Agriculture for a balanced nutrition in Sub-Saharan Africa

***BAOFOOD: Enhancing local food security and nutrition through promoting the use of Baobab (*Adansonia digitata L.*) in rural communities in Eastern Africa***

<b>country/countries</b>	Kenya and Sudan
<b>funding agency</b>	Federal Ministry of Food and Agriculture – BMEL
<b>project management</b>	Federal Office for Agriculture and Food – BLE
<b>project coordinator</b>	Rhine-Waal University of Applied Sciences (HSRW), Germany
<b>project partner(s)</b>	Justus Liebig University (JLU), Giessen, Germany Jomo Kenyatta University of Agriculture and Technology (JKUAT), Nairobi, Kenya University of Kordofan (UKORD), El Obeid, Sudan University of Khartoum (UKHART), Khartoum, Sudan Mzuzu University (MU), Mzuzu, Malawi ttz Bremerhaven (TTZ), Bremerhaven, Germany Wild Living Resources (WLR), Kilifi, Kenya PhytoTrade Africa (PTA), London, UK Baobab Social Business gGmbH (BSB), Munich, Germany

<b>project budget</b>	1,148,427.64€ (+ 277,582.00€, JLU)
<b>project duration</b>	01.03.2016 – 31.12.2019
<b>key words</b>	Baobab ( <i>Adansonia digitata</i> L.); Indigenous fruit tree; Food and nutrition security
<b>background</b>	Baobab ( <i>Adansonia digitata</i> L.) is a tree that is both highly nutritious (through its fruit and leaves) and naturally abundant throughout the drier parts of sub-Saharan Africa. In many regions, the baobab tree has traditionally played an important role in marginalised rural communities by positively contributing to family nutrition, food security and income generation. However in Eastern Africa, the clear opportunities to develop baobab value chains that can improve local diets and livelihoods have been largely missed or ignored by research, development and extension institutions.
<b>objective</b>	The BAOFOOD project aims at promoting the use, processing and market development of baobab for improved food/nutrition security and rural livelihoods in Kenya and the Sudan. To ensure a sufficient and sustainable supply of highly nutritious baobab products for the local communities in the target regions, the project will (i) investigate the current contribution of baobab raw and processed products to local diets, food security and income generation, (ii) assess the distribution and abundance of baobab and its potential for future growth and development (iii) analyse the potential of new processing technologies for maintaining nutrients along the baobab value chain, and (iv) build capacities of local communities, particularly women, on value addition and raise their awareness on the value of baobab products for family nutrition.
<b>results</b>	The most important results of the project can be summarized as follows, considering the different work streams:

**WP1: Sustainable use of baobab resources and initiating the development of domestication technologies**

In both study regions (Kilifi and Kitui County in Kenya as well as North and West Kordofan in Sudan) baobab populations have been mapped and their morphological diversity characterised. Results demonstrate that there is a high variability amongst baobab trees and fruit characteristics in Kenya and Sudan. Results of the mapping exercise indicated stable populations and a potential for further utilization of the tree in Kenya. Focus group discussions and laboratory analysis of fruit samples from the study region led to the identification of superior trees which may be used in future domestication trials. Such trees feature highly valuable characteristics such as sweet pulp, big fruits, or high pulp/low seed content.

**WP2: Nutritional value and bio-active compounds of raw and processed baobab products and the development of nutrient-maintaining processing technologies and new products**

Analysis of nutrient profiles of raw baobab pulp has been carried out from samples from both Sudan and Kenya. Parameters analysed include Vitamin C and different phytochemicals such as phenols; results demonstrated that the variation between but also within a project region can be substantial. With regard to processed baobab products it was found that permissible limits for yeast and moulds are often exceeded, e.g. due to early harvesting of fruits, unhygienic and inadequate drying, or poor storage conditions. In a few cases also the presence of mycotoxins could be detected. Besides laboratory analysis, also a variety of baobab products with potential for the Kenyan market were developed and sensory evaluations conducted in Kenya, results demonstrating a high acceptance rate.

**WP3: Human nutrition and food security**

Intervention studies to assess the impact of baobab pulp consumption on the nutritional and health status of school children have been conducted, where school children received either a drink with baobab pulp (intervention group) or a drink without baobab pulp (control group). Slightly positive benefits with re-

gard to selected health parameters could be observed (e.g. haemoglobin levels, intake of vitamin C and calcium). Overall, the results indicated that baobab consumption in addition to non-heme iron-rich food is an approach to be considered to address iron deficiency in food-insecure settings. Furthermore, it could be shown that baobab fruit and pulp are important food emergency alternatives in rural Kenya (for consumption and income generation). Baobab leaves are a good source of nutrients for minerals and trace elements as well as essential amino acids; they can be utilized in Kordofan/Sudan to improve the common diet.

**WP4: Assessing demand, markets and value chains for baobab**

Different surveys amongst baobab producers, traders, processors and consumers have been conducted in both study regions in Kenya and Sudan. Results show that in Kenya, where baobab is less commercialized than in Sudan, baobab collectors mainly market their baobab via rural markets (assemblers, rural wholesalers) and only seldom through urban buyers (urban wholesalers, urban retailers and processors). The fruits are a substantial source of income to those households who engage in collection and trade. In Sudan, baobab substantially contributes to cash income, reduction of poverty incidence and income inequality for a much larger share of the rural population.

**WP5: Community capacity development and implementation**

In Kilifi, Kenya, a community-based pilot production unit has been established for the production of high quality baobab powder and oil. These products will serve as a baseline for further local value addition (e.g. for cakes, ice-cream, yoghurt, or cosmetic products). A total of 120 community members have been trained in baobab management, its nutritional benefits, as well as improved handling and processing of baobab in order to ensure a sustainable supply of high-quality raw baobab material to the pilot plant. The pilot plant went through all necessary tests at the end of the project and is scheduled to start operating in the next baobab harvest season.

	<p><b>WP6: Outreach and communication</b></p> <p>In order to inform relevant stakeholders about sustainable baobab management and its role in improved nutrition, results of the project were disseminated in a variety of means. Training materials and videos concerning production and utilisation of baobab targeted at farmers as well as extension agents have been developed. Results of the project were presented at various conferences (e.g. World Congress on Agroforestry, Tropentag, IUFRO World Congress) and published in peer-reviewed journals. All MSc and PhD students of the project were able to present their research findings at the final workshop in Kilifi, Kenya to other baobab researchers, practitioners as well as policy makers.</p>
<b>recommendations</b>	<p>Baobab is already making an important contribution to food security and income security in Eastern Africa. However, often baobab producers and processors remain in the informal sector. Product quality often remains limited and especially in Kenya only few products are available on local markets. Therefore, in order to promote the development of the baobab sector and better make use of the potential baobab has to offer in terms of food and nutrition security further efforts in the following areas should be undertaken:</p> <ul style="list-style-type: none"><li>– Carry out further scientific studies to better understand the underlying reasons which cause the high intra-specific diversity (genetics, environmental factors)</li><li>– Initiate long-term domestication trials using superior trees, including the integration of baobabs on farms</li><li>– In situ conservation of natural baobab stands, while ensuring sustainable use of the resource by local populations</li><li>– Ensure/ improve the quality of baobab raw materials and processed products along the entire value chain (e.g. through training measures and investments in processing technologies)</li><li>– Improve the recipes for and develop new, innovative baobab foods</li><li>– Conduct further scientific research to understand better potential health benefits due to baobab consumption, including</li></ul>

the underlying physiological mechanisms

- Raise further awareness on the outstanding nutritional properties of baobab products

photos



**Figures (clockwise):** Baobab fruit; Baobab tree, Sudan; Baobab pilot production unit for powder and oil in Kilifi, Kenya; Baobab intervention trial, Nairobi, Kenya.