



The baobab tree and its contribution to food security in East Africa

The BAOFOOD project

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Figure 1: Baobab tree (*Adansonia digitata L.*) in Sudan

It is one of the most famous and characteristic trees in Africa – the baobab. The tree is traditionally used in a variety of ways. The nutritious fruits and leaves can contribute to reduce micronutrient deficiencies in the region. However, this potential has not yet been fully exploited. This is the entry point of the BAOFOOD project

The baobab tree (*Adansonia digitata L.*), also known as the “upside-down tree” because of its striking appearance, is one of the most important native fruit trees in Africa. It is widespread in the semi-arid regions of Sub-Saharan Africa and thrives under difficult environmental conditions, such as prolonged drought or soil salination. Since the agricultural options in these regions are often very limited, this tree with its nutritious fruits can make a valuable contribution to food security and thus to improving the general living conditions.

The various parts of the baobab tree have been used for different purposes in many parts of Africa since a very long time. Bast fibres under the bark can be extracted for the production of ropes, baskets and other handicrafts. The bark is carefully peeled from the trunk of the tree so that the trees are not seriously damaged and are able to regenerate within a short time. Due to its composition and high water content, the wood is not suitable to be used for furniture or firewood. This is why the baobab has not been affected by defor-

estation unlike other tree species in the region. Baobab roots, leaves and fruits are used in traditional medicine and are supposed to have anti-inflammatory



and antimicrobial properties. Fruits, leaves and seeds are also used for human nutrition. The leaves are rich in calcium and other minerals and have a favourable amino acid profile. When fresh, leaves can be used as a salad or they can be cooked to prepare soups or vegetable side dishes. The seeds are particularly popular when roasted. However, they contain indigestible components. Thus, the seeds are mainly used to extract oil to produce cosmetics (Gebauer et al 2014). However, of utmost importance for human nutrition are the fruits of the tree. A range of different products can be prepared from the dry flesh of the ripe fruits, such as juices, smoothies, jams and sweets. The taste of the fruits vary greatly among individual trees and ranges from “sweet” to “slightly acidic” and “acidic”. Fruit powder is of great importance from a nutritional point of view. It contains extraordinary



Figure 2: Baobab fruits



Figure 3: Baobab fruit pulp on a market in Malawi

Fact sheet

Project title and abbreviation

Enhancing local food security and nutrition through promoting the use of Baobab (*Adansonia digitata L.*) in rural communities in Eastern Africa (BAOFOOD; German title: Verbesserung der lokalen Nahrungsmittelversorgung und Ernährungslage durch die Förderung der Verwendung von Baobab (*Adansonia digitata L.*) in ländlichen Gemeinden in Ostafrika)

Project objective

The BAOFOOD project aims to promote the use, processing and market development of baobab to improve food security and living conditions in rural areas in Kenya and Sudan.

- Study of the current contribution of baobab products to nutrition, food security and the income of the local population
- Inventory of baobab stocks and analysis of morphological properties of trees and fruits
- Market studies, analysis of value chains and development of processing technologies and new product ideas for baobab products in the frame of a pilot processing plant
- Training of agricultural advisors and the local population, especially women, on aspects of baobab processing and the value of baobab products for the nutrition of their families

Project organizations and partners

- Rhein-Waal University of Applied Sciences (Coordinator)
- Justus Liebig University of Giessen
- Jomo Kenyatta University of Agriculture and Technology, Nairobi, Kenya
- University of Kordofan, El Obeid, Sudan
- University of Khartoum, Khartoum, Sudan
- Mzuzu University, Mzuzu, Malawi
- ttz Bremerhaven
- Wild Living Resources, Kilifi, Kenya
- PhytoTrade Africa
- Baobab Social Business gGmbH

Team

Approx. 30 employees, including five doctoral students and 10 master's students

Project locations

- Sudan (North and West Kordofan and Khartoum)
- Kenya (Kilifi and Kitui)
- Malawi (Mzuzu, Lilongwe, Blantyre, Karonga, Mangochi, Salima)

Duration and project budget

1.18 million euros over three years

Funding agency

Federal Ministry of Food and Agriculture (BMEL), project executing agency: Federal Office for Agriculture and Food (BLE)



Figure 4: Project team in the field

rily high amounts of vitamin C, minerals (especially calcium, potassium and magnesium) and dietary fibres (Chadare *et al.* 2008). Due to this nutrient profile and its antioxidant and prebiotic properties, baobab fruit pulp can considerably contribute towards reducing micronutrient deficiencies in the region. Baobab is also becoming increasingly popular in Europe and the USA. Since 2008, the pulp of baobab has been approved as a novel food ingredient within the European Union. The export of baobab products creates an additional source of income for the local population.

Despite the broad variety of possible uses, the current utilization of baobab differs greatly. While in some regions of Sub-Saharan Africa the trees are used intensively (e.g. Malawi or in various West African countries), in other regions is still plenty of room for development, particularly in East Africa. The reasons for the low level of utilization are as follows: The excellent nutritional properties of the fruits and leaves are not well understood in the local population, value chains and marketing channels are not well developed and adequate processing technologies are rare. Baobab has great potentials to contribute directly (through consumption) and indirectly (through the creation of income opportunities) to improving the nutritio-

nal situation of the local population and, in particular, to improving the supply of micronutrients (Gebauer *et al.* 2016).

The BAOFood Project

Funded by the Federal Ministry of Food and Agriculture (BMEL), the project aims to promote the use, processing and market development of baobab for improved nutrition and livelihoods in Kenya and Sudan. To this end, a project consortium consisting of a total of ten partners was formed. It consists not only of research institutions but also NGO's, government and industrial partners are involved. The project deals with research questions along the entire baobab value chain: From biological and ecological investigations of the baobab tree to the analysis of production and marketing to the health effects of the consumption of baobab food. Various qualitative, quantitative and participatory research approaches are used. The findings gathered over the course of the project will be used to set up a pilot processing plant in Kenya to process baobab fruits into nutritious food products for the Kenyan market in cooperation with the local population. This will help to improve the food supply of the local population in the target region.

Examples from the research

Mapping of baobab stands and analysis of tree and fruit properties

In Kenya and Sudan, baobab trees were mapped in two study areas along defined transects. The morphological characteristics of the trees and fruits were determined and fruit samples were taken for laboratory analysis. On the one hand, these investigations provide precise information about the current stock of baobab trees in different agro-ecological zones of the region (e.g. with regard to tree density or the presence of sufficient natural regeneration). This is essential information necessary for the development of more sustainable use and conservation strategies. On the other hand, the information obtained from these investigations can help to identify trees with particularly desirable fruit characteristics (fruit size and yield, vitamin content or taste) together with the local population and to propagate them vegetatively so that plant material from improved baobab trees is available for cultivation. This helps to meet the expected global increase in demand for baobab powder and to reduce the pressure on wild baobab populations.

INTERVIEW

**Interview with Anthony Maina, project partner
Wild Living Resources, Kilifi, Kenya.
(questions asked by Kathrin Meinhold)**



Anthony Maina

How long have you been professionally involved with baobab?

Since 2007, I have been involved in various activities related to baobab, in particular to sensitize the local population on the protection and possible uses of the baobab.

How much do people currently appreciate the baobab in the communities around Kilifi?

Mostly, people know "Mabuyu", the coloured and flavoured baobab fruit pulp. This is a popular sweet made and sold from the baobab fruit. Apart from that, the current use in the villages is still rather limited. For example, leaves and the oil are currently not used at all. People of the upper middle class in the cities use the baobab oil occasionally as a cosmetic product. In general, the contribution of baobab products to the diet or income of the local population in Kilifi is still insignificant, especially compared to other economic sectors. Partly, people have baobab trees on their farms, but do not use them to generate economic benefits.

How do you assess the potential of baobab in Kilifi?

The potential is very high, because there are many unused baobab trees in the region. Furthermore, we expect the demand for baobab products to increase in the long-term. In order to ensure a sustainable use of this resource, targeted education and sensitization campaigns are necessary. On the one hand, these campaigns should raise awareness of the possible uses of baobab and, on the other hand, convey sustainable use and management practices so that the resource can also be used by future generations.

How does the BAOFOOD project contribute to improve the use of baobab in the communities?

The project is a first step to increase the awareness of utilizing baobab in the local communities around Kilifi. The continuous participation of the local population in the project and in follow-up measures aims to ensure the long-term and sustainable use of baobab in the communities.



Figure 5: "Mabuyu" a sweet from the baobab fruit

The results so far show, that in Kenya as well as in Sudan, there is a high variability between the examined trees. For example, the average fruit weight of all sampled trees in Kilifi, Kenya was 376 g, the fruit of one tree even weighed 696 g on average. In 42% of the samples the taste was described as sweet. In Sudan, the average fruit weight was only 135 g (maximum 242 g). The taste of the fruit was classified as sweet in 23% of the samples. Thus, baobab trees with very valuable properties (sweet fruit taste, large fruits) are available in the project regions, which are well suited as a source of seeds for future domestication programmes. The fruits are currently being tested for their nutrient composition in the laboratory. The focus is on the content of secondary plant substances.

Baobab value chains in Kenya and Sudan

The work of the 'Markets & Value Chains' project team included a "baobab commercialisation strategies & livelihood" study in Sudan, which was carried out in two districts of Kordofan. Results show that between 54% and 70% of the rural population collect the fruits of the baobab and 25-56% of the population sell the fruits. The fruits contribute between 5-10% to the annual household income. Various factors contribute to the intensity with which a household commercializes baobab, including a higher level of education and current market prices for baobab fruits.

In Kenya, a much smaller proportion of the rural population uses the fruits commercially. A study of supplier households in baobab market chains is carried out to investigate the intensity of commercial use and its changes over time. First results show that 52% of women decide to harvest baobab for sale and that in 41% of the surveyed households most of the fruits are harvested by children. About 43% of households sell fruits to rural middlemen and 41% sell to wholesalers in the rural region because they pay in cash and buy larger quantities. Further studies examine consumer behaviour, perceptions and preferences in Kenya and Sudan as well as value creation along the chains and interactions between actors in national and regional supply chains.

Improving the nutrition of schoolchildren through baobab

In a study which examines the influence of the consumption of baobab powder on the nutritional and health status in school children, the central question is whether baobab can improve the uptake of iron. The essential trace element iron is important for the formation of the red blood pigment haemoglobin, as well as cytochrome c and DNA. Iron deficiency is one of the most common deficiency symptoms worldwide. A long-term deficiency of iron can lead to anaemia and does negatively influence the general development (e.g. of the nerve cells and the immune system). Iron is found in both animal and plant foods, but iron from animal products is easier to digest. Since vitamin C promotes the uptake of iron from plant foods, it is believed that baobab fruit powder with its high vitamin C content has a positive effect on iron uptake. Thus, baobab could make a direct contribution to lower micronutrient deficiencies.

Two intervention studies were carried out in Kenya to investigate this in more detail. In a primary school in Nairobi, 57 children voluntarily participated in data collection. First, various anthropometric measurements were taken to determine the baseline values. Blood samples were collected for blood mineral analysis and interviews collected socio-economic information. The survey included aspects of eating habits and the extent of food insecurity in the children's families. Subsequently, over a period of twelve weeks, the school children were given a daily drink containing 30g of baobab fruit pulp (intervention group) or a drink without baobab (control group) in addition to their school meal. The measurements were repeated at regular intervals. At the end of the intervention study, data sets of 52 school children were available. The second part of this study is currently being conducted in a school in the project region Kitui in order to adequately reflect the large differences in nutritional and health status between the urban and rural regions in Kenya.

Outlook: Training of small-scale farmers and setting up a pilot processing plant in Kenya

A survey of farmers (256 participants from 24 villages) was carried out in order to ascertain the knowledge and predominant practices of using baobab. It became clear that the nutritional significance of the baobab fruit is only known in a few households and that the trees in this region are rarely used for other purposes. Building on this, training materials were developed and information events were designed to better inform the target group about the production and use of baobab and to train them in the relevant practices. The first of these training events are currently taking place.

In the next step, the project results will be transferred into practice for the construction of a pilot processing plant in Kenya. This shall include the use of processing technologies adapted to local conditions while minimising nutrient losses or the design of the value chain taking into account the interests of small-scale farmers. In cooperation with the local population, the pilot plant will test the production of nutritious baobab products for the local market. In the future, this plant will also be available for demonstration and training purposes in order to provide trainings in processing of baobab. The strategy for the pilot plant developed by the project staff will focus on the production of high quality baobab fruit powder and oil so that other small entrepreneurs in the region can add value to a variety of other baobab products (such as jam, ice cream, juices, soaps, cosmetics). This should create a multitude of new income opportunities for both the baobab producers and for the processors and at the same time ensure a high quality of the raw material used.

Conclusions

After about two years of the project, the first results are available which document and analyse the East African baobab stocks, their nutritional properties and their management. In addition, it becomes clear that the sustainable use and processing of baobab fruits in the study areas can make a significant con-

tribution to improving the food and income situation of the population. The establishment of the pilot plant provides the corresponding proof of concept. At the same time, the project contributes to linking local producers with experts, companies and political decision-makers in other regions. This will contribute to a permanently improved use of this resource. ■

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