

Research Application Summary

Building capacity for sustainable baobab leaves production in Benin

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Abstract

Food and nutritional insecurity are recurrent issues in traditional systems in sub-Saharan Africa and especially in Benin. As part of contribution to efforts against challenges of food and nutritional insecurity, this project focuses on “promoting environmentally friendly practices for sustainable baobab leaves production for food and nutritional security in smallholders farming systems in Benin”. The project is implemented with support from the Regional Universities Forum for capacity Building in Agriculture (RUFORUM) and was designed to train graduate and undergraduate students, faculty as well as communities. This project aims to design cost-effective, environmentally-friendly and sustainable method of baobab leaf production for food and nutritional security in smallholders farming systems in three bio-geographical zones in the Republic of Benin. The team will assess the effect and dose of organic manure (compost versus animal excrement), density of sowing and frequencies of leaves' harvesting on the seedling growth and leaves biomass. This research feeds into earlier research and will particularly contribute to enhanced use of environmentally friendly practices.

Keywords: Baobab, Benin, domestication, experiments, promising doses

Résumé

L'insécurité alimentaire et nutritionnelle est un problème récurrent dans les systèmes traditionnels en Afrique subsaharienne et en particulier au Bénin. Afin de contribuer aux efforts de lutte contre les problèmes d'insécurité alimentaire et nutritionnelle, ce projet se concentre sur la promotion des pratiques respectueuses de l'environnement pour la production durable de feuilles de baobab pour la sécurité alimentaire et nutritionnelle des petits exploitants agricoles au Bénin. Le projet est mis en œuvre avec le soutien du Forum régional des universités pour le renforcement des capacités en agriculture (RUFORUM) et a été conçu pour former des étudiants des cycles supérieurs et du premier cycle, les enseignants ainsi que les communautés. Ce projet vise à concevoir une méthode de production de feuilles de baobab rentable, respectueuse de l'environnement et durable pour la sécurité alimentaire et nutritionnelle des petits exploitants agricoles dans trois zones biogéographiques de la République du Bénin. L'équipe évaluera l'effet et la dose de fumier organique (compost par rapport aux excréments d'animaux), la densité de semis et la

fréquence de récolte des feuilles sur la croissance des plantules et la biomasse des feuilles. Cette recherche s'inscrit dans des recherches antérieures et contribuera en particulier à l'utilisation accrue de pratiques respectueuses de l'environnement.

Mots-clés: Baobab, Bénin, domestication, expériences, doses prometteuses

Background

Wild edible plants have traditionally been used by rural communities in Sub-Saharan Africa for subsistence and trade (Sinha and Baha, 2002). However, the widely available resources from some tree species seem not to be sufficient to sustain the growing demand. As such, it becomes a must to develop and experiment sustainable production methods using ecologically sound agricultural practices that are beneficial to farmers.

One of the most important trees in the region is the multipurpose *Adansonia digitata* L., commonly known as the baobab tree. The species has great economic importance; a three months market investigation showed that commercialisation of baobab pulp generates up to US\$ 30,000 per year for 130 households of Malanville (north of Benin) involved in that business (Codjia *et al.*, 2001). Moreover, chemical analysis of parts contents showed the presence of proteins, amino acids, iron, vitamins C, A, E and F (abundant compared to daily needs) within its organs, especially leaves (Sidibe and Williams, 2002; Assogbadjo, 2006; De Caluwé *et al.*, 2010). All these uses of the species lead to a high level of harvesting of its main organs especially leaves which is used as leafy vegetables. Pruning in baobab is so high that only a few fruits are produced per tree as a result of reduced photosynthesis.

According to the World Agroforestry Centre and Bioversity International, the multipurpose baobab tree is expected to play a major role in future crop diversification programs and in the development of West-African agroforestry systems. This was also expressed by the rural people in semi-arid West Africa, who selected baobab among top species that should deserve more attention in future domestication programs (Eyog Matig *et al.*, 2002; FAO, 2014). The big challenge the species is facing is a high risk of extinction in the wild where it is threatened by bush fire (seedlings), grazing and lack of natural regeneration. Conservation and domestication strategies of baobab genetic resources require management option to obtain sustainable benefits for present and future generations. Consequently, finding a pathway for propagating baobab in rural areas, especially in smallholder farming systems to satisfy the daily demand for baobab leaves will not only allow protecting the species but also help in fighting food insecurity and poverty. The project herein described then meets the goal of African universities which is to help governments find sustainable ways to tackle the development challenges as part of the overall goal of improving livelihoods in the continent and ensuring food and nutrition security.

Previous research documented genetic differentiation between populations of the species in the three bio-geographical zones of Benin (Assogbadjo *et al.*, 2009). Also, organic

manures from domestic breeding or compost from domestic organic waste are hypothesized to provide sustainable manure for sustainable production in smallholder farming systems (Assogba-Komlan, 2001). However, animal rearing in Benin is cow-based in both Sudano-guinean and Sudanian zone whereas it is poultry-based in the Guineo-Congolese zone. This would thus influence the type of dung or droppings available for the propagating tests but also adoption of the options that will be further developed. Any project willing to be close to local contexts should thus take into account this variability. The challenge here, is to develop safe, cost-effective, ecologically sound and sustainable leaf production thus contributing to meeting the needs of local people and contributing to the fight against nutritional and food insecurity in Sub-Saharan Africa. Furthermore, optimization techniques are needed to identify the best agro-ecological practice for sustainable baobab leaves production in smallholders farming system in Benin.

Thus, the overall objective of the project to develop a set of agro-ecological practices to improve the production of the daily used baobab leaves by building capacity of local farmers and NGOs on how to propagate and grow baobab treelets in small garden plots using environmentally friendly practices. The specific objectives of the study are to: a) test the effects of different doses of two source of organic manures (compost of organic waste versus organic manure from animals: cow dung for sudano-guinean and sudanian regions and poultry dropping for guinean region), b) test the effects of leaves harvesting frequencies on baobab leaves production under on-station conditions in the three regions and the effect of the density of sowing on baobab seeds in the plots, and c) assess the relative performance of orthogonal contrast analysis to optimize the best agro-ecological practice for sustainable baobab leaves production.

The project is being implemented by a university-based research team comprising of students working under the supervision of the project team. The composition of the team is shown in Table 1 below.

Table 1: Composition of the baobab research team at University of Abomey -Calavi

Stakeholder category	Role on the project
1 PhD (Principal investigator) in conservation genetics, Ethnobotany, Forests Ecology and Management.	He is in charge of the project coordination, financial management, reporting and supervision of the two MSc. students
1 PhD expert in Biometry and forest modelling.	He provides support in experimental designs and
1 PhD expert in Agricultural socio-economy and extensions.	He provides support in socio-economy and extensions to MSc. students and the research project.
1 PhD expert in Biological and Applied Sciences.	He Provides technical support for experiments, coordination of data collection, and organizing meetings and workshops.
2 MSc Students	They are used for designing, implementation, monitoring of experiments as well data collection and analysis.

2 undergraduate interns	They assist the MSc students during field work.
Non-academic actors (including farmers and other end-users)	The research is based on participatory approaches with farmers involved in on-station experimnation.

There are also other teams also working on baobab

Origin of the work

Babobab tree is one of the most important trees in the sub-Saharan African region. Previous investigation by our research groups revealed high level of harvesting of its main organs especially leaves which is used as leafy vegetables and this is especially high in the Sudanian zone of Benin. Pruning in baobab is so high that only a few fruits are produced per tree as a result of reduced photosynthesis. To thwart the extinction risk being currently faced by the species, a sustainable way is to find an appropriate way to make the leaves largely available. As such, previous research revealed capacity of high germination of the seeds using hot water or scarification. This technique is then proposed and will be used to develop a set of agro-ecological practices to improve the production of the daily used baobab leaves. For sustainability, capacity will be built (both for graduate students, undergraduates, and farmers) for further dissemination of the outputs and on-farm sustainable propagation. At the end of the project the best propagation method and the environmentally friendly techniques will be proposed and implemented on farm.

Progress to date in the Project

Recruitment, status and research works of the students. Two MSc students namely, Hounsou-Dindin Guillaume and Sero Baro Nadejda have been recruited for the project. Both students fulfilled the academic requirements for the 1st year, developed and defended their proposals at department level and are implementing their research project as indicated. Hounsou-Dindin Guillaume, a male student, is conducting research on the development of the best agro-ecological practices to improve the production of the daily used baobab leaves. Specifically, his study aims at assessing (i) the effects of different doses of two source of organic manures (compost of organic waste versus organic manure from animals: cow dung for Sudano-Guinean and Sudanian regions and poultry dropping for Guineo-Congolian region), (ii) the effects of leaves harvesting frequencies on baobab leaves production under on-station conditions in the three regions and (iii) the effect of the density of sowing on baobab seeds in the plots. The female student Sero Baro Nadejda is conducting her research on the relative performance of orthogonal contrast using the three methods of type I error correction on data having different structure depending on the number of levels, levels of non-normality and Heteroscedasticity. Her work will help to identify the best techniques that can be disseminated to local people at the end of the experiments.

Research undertaken to date. Important progress is being made towards achieving the research objective. Seeds have been collected and the experiment has been set (Since February 2016) and is ongoing in all three biogeographical zones. In addition, 10 leaves cutting have already been done, oven-dried, weighted (wet and dry) and stored. Literature review is ongoing. Several workshops and sensitization events have been made in each of the three zones so as to involve local people in the action. Contacts have been made

with extensionists, NGOs and other stakeholders for activities to be implemented. **Envisaged work ahead.** The experiments are currently being conducted in each of the three biogeographical zones in Benin and will yield results in the coming months. Subsequently on-farm trials will be conducted. Thereafter the most promising techniques will be disseminated to stakeholders. For a successful action, linkage need to be established with some NGOs, extensionists and decision makers involved in agricultural channels so as to enhance dissemination and adoption of the selected best practices.

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