



POLICY BRIEF

Value-added processing of underutilised savanna tree seeds for improved food security and income generation in West Africa



Fig 1. Processing of tree seeds by women's cooperative in Nyankpala village, Ghana

Executive summary

The urgency for improving food security and income generation in the savanna region of West Africa is widely recognized and calls for an immediate action with focus on new food raw materials and value added food processing.

The overall objective of the SeedFood project has been to improve food security and to create opportunities for income generation, especially for women's cooperatives, through value-added processing of seeds derived from semi-domesticated and wild tree species that commonly grow in the savanna

ecological region of West Africa. The SeedFood project has applied a fully participatory approach with strong North-South and South-South collaboration. The research findings of SeedFood have provided evidence for use of seeds from native trees to improve food security and provide a strong potential for income generation for women in the savanna region of West Africa. The research outcome has additionally provided evidence for health beneficial effects and quality improvements supported by implementation of new technologies and quality management to ensure food safety.

Based on the lessons learned by the SeedFood project four directions for actions are seen: i) For the entire population in the region and the thousands of women's cooperatives upscaling of the entire food processing chain is needed as a condition for increased income generation and sustainability. ii) For this to happen vocational training programmes reaching out to the entire food chain and financed by governments are urgently needed and seen as a high priority political issue. iii) The results obtained in the SeedFood project have demonstrated the need for research to identify microbial hazards in food chains and a policy change to introduce legal requirements in terms of methods and standards to support food safety. iv) The SeedFood project together with previous projects in the region have created a strong research education and strong interactions between food scientists across borders which should be sustained and expended.

Introduction

It has been the overall objective of the SeedFood project to improve food security and to create opportunities for income generation, especially for women's cooperatives, through value-added processing of seeds derived from semi-domesticated and wild tree species that commonly grow in the savanna ecological region of West Africa.

SeedFood is a Danida financed project headed by University of Copenhagen and conducted in collaboration with DTI, Denmark, DTA in Burkina Faso, UDS/FRI in Ghana and IER in Mali. Guidance on occurrence and collection of seeds three native tree species as food raw materials was made available to local production sites in the region. Technologies and equipment for dehulling and milling of seeds were developed for process optimization by the West African partner institutions with subsequent transfer and implementation at local women's cooperatives. Improved fermentation methods were developed to enhance food quality and health aspects by identification and implementation of multifunctional starter cultures. Advanced molecular and biotechnological methods were transferred to West African partners and networking activities including an extensive program of exchange of scientists and technical staff were carried out. Pilot plants were up-graded at the partner institutions to undertake application studies

and provide training for small-scale food processors, as well as equipment for amino acid analyses at the partner in Burkina Faso (DTA) offering analytical facilities for all partners in the SeedFood project. Quality management, food safety and good hygienic practices were developed and implemented according to international standards with main emphasis on the concept of HACCP (Hazard Analysis and Critical Control Points). Several women's cooperatives in Burkina Faso, Ghana and Mali were equipped with dehulling machines and trained in improved processing including quality assurance and food safety management.

Background

The West African savanna region has a fragile ecological system that is vulnerable to prolonged droughts and food shortages. It is shared by countries with some of the lowest per capita incomes in the world. The urgency of the situation calls for innovative research and development to combat shortage of food, malnutrition and lack of meaningful employments in addition to income generation for the millions of people in the savanna region of Burkina Faso, Ghana and Mali.

The region is well endowed with underutilised wild plants that can be processed to improve food security and poverty alleviation. Of particular interest is value-added processing of seeds from three semi-domesticated native trees, namely, African locust bean (*Parkia biglobosa*), baobab (*Adansonia digitata*) and kapok trees (*Ceiba pentandra*).



Fig 2. Fermented Baobab seeds, Mali

The women producers of the region normally operating in groups or cooperatives constitute the informal private food sector responsible for a major part of the food industry and hence the majority of the employees in the industry. They hold a key position in any attempt to improve food security and income generation. The cooperatives operate according to very old traditions and actual developments and improvements if any are very limited. This needs to be changed not only to the benefit of the women, but to the benefit of the population as such and the overall economy of the region.

Results

From the results obtained by the SeedFood project we learned how to:

- increase utilization of seeds from semi-domesticated and wild trees common to the savanna region as raw material for traditional fermented food,
- optimize processing of seeds by development and implementation of machines for mechanical dehulling and milling of seeds to the benefit of the women producers including improvements of working conditions, reduced consumption of fire wood and faster fermentations,
- develop and implement defined multifunctional starter cultures at local production sites leading to controlled fermentations, improved food quality and enhanced human nutrition,
- adjust processing methods to eliminate flavour being an acquired taste in West Africa but prohibitive for export,
- adapt quality management to women's cooperatives for consistent food quality, including food safety and good hygienic practices based upon the HACCP concept, presented in a written as well as a

pictorial version applicable at smaller production sites and in villages,

- support sustainability of production sites located in villages by training of women based upon pictorial guides designed within the SeedFood project,
- support human capacity building in research based upon upgrading of institutional research laboratories, extensive exchange of scientists and writing of scientific papers.

Conclusions

The approach and methodology applied have provided evidence for use of seeds from native trees to improve food security in the savanna region of West Africa. The research outcome has also provided evidence for health beneficial effect and quality improvements including food safety by implementation of multifunctional starter cultures and implementation of new technologies e.g. mechanical dehulling and milling equipment in production sites. For the entire population in the region and the thousands of women cooperatives to benefit from the SeedFood project upscaling is needed by uptake of the results in the entire region. This is a condition for creating income generation of any measurable impact which in turn is a condition for sustainability.

Apart from the beneficial situation for the informal food sector and for the common consumer of the fermented seeds with the access to larger quantities of healthy and attractive food the population as such could gain from the SeedFood project by spreading out the code of good hygienic practices. These are part of the quality system implemented in women's cooperatives and seen as a substantial support to the much needed hygienic improvement in the region and West Africa as such for containment of epidemics and other contagious diseases.



Fig 3. Illustrations from pictorial books distributed to women's cooperatives showing good manufactural practices

Implications

The people in the savanna region and the women of the food producing cooperatives can benefit substantially from the SeedFood project. The results obtained have shown how production of food can be increased to improve food security and make larger quantities of more healthy and safe food of defined quality and preferred taste available in the region. The overall approach applied for capacity building has been successful and sustainable for the West African research partners.

The research capacity of the West African research institutions has been enhanced significantly with the completion of a number of PhDs, the continued employment of all PhDs and the very substantial exchange of scientists within the SeedFood project. The research group established at DTA, Burkina Faso is now seen as one of the strongest groups in Africa south of Sahara excluding South Africa. The group at UDS, Ghana is reaching an effective size and a solid basis for further development is established. For IER, Mali capacity building has taken place with one PhD student and laboratory upgrading but the fragile political situation in Mali has been prohibitive for the capacity building envisaged in the original project description.

Recommendations

The experience gained from the SeedFood project points at four directions where immediate actions are required in order to improve food security and up-grade the food sector.

Up-scaling and transfer of know-how to women's cooperatives

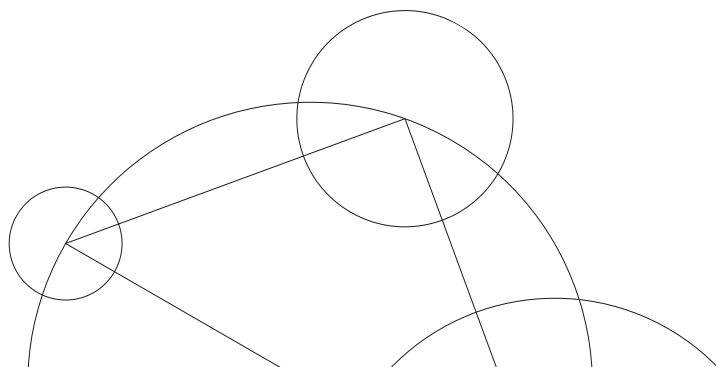
As learned from the SeedFood project the private informal food sector has a great potential to support food security and drive income generation. This potential is not effectively utilized in West Africa. The informal sector with smaller production sites mainly comprising women's cooperatives are practically operating as they have done way back in history. For the entire population in the region and the thousands of women's cooperatives to benefit from the SeedFood project upscaling of the entire food processing chain is needed including installation and up-grading of production equipment as well as technological knowledge sharing.

Vocational training

The recent very significant capability building in food science at universities and research institutions in West Africa has not reached the informal food sector to the extent urgently needed. This gap between the relevant capability available and the informal sector should be closed. As step one a policy change should be instituted. At governmental level priority should be given to formalized vocational training with emphasis on subjects like up-scaling of processing of traditional West African food based upon local raw materials, optimization and development of processing technology, food safety, packaging, marketing and quality management. The professionals trained should include full time members of cooperatives running the production sites. Governmental finances should preferably pay the actual training and provide the resources for specialization to meet the dynamics of the future development of the informal food sector. Formal links between the sector, the professionals created by vocational training and the relevant universities and research institutions should be established.

Measures to prevent microbial food safety hazards and improve hygienic conditions

The hygienic infrastructure is very weak in many parts of West Africa including urban as well as rural areas as shown by the inability to contain contagious diseases. The SeedFood project has demonstrated how GMP (Good Manufacturing Practices) and hygienic practices in food processing can be implemented in women's cooperatives and villages. Practices which include personal hygiene to prevent cross contamination in food production and at the same time prevent transmission of zoonotic agents to food and transmission of pathogens between humans. A policy change should address a food law to implement GMP and HACCP principles as a condition for commercial. To ensure the microbial safety of West African food products and to facilitate the entry of West African food products on global markets, microbial hazards in the food chains should be identified by internationally accepted methods and standards applied for preventing food borne diseases.



Research education and regional interactions

The SeedFood project together with previous projects in the region has created strong research capacity within food science in West Africa. The West African scientists are now recognised internationally through scientific peer reviewed publications and participation in international conferences. This gives a very strong scientific platform within food science and it is of outmost importance that the knowledge is transferred to younger generations of West African scientists. Over the years a very strong network has been established between food scientists within the West African region covering research training, exchange of analytical services and know-how. It is highly recommended that such networks are sustained and expanded to cover new members.

Frederiksberg, 1st June 2015

Authors

Mogens Jakobsen, Professor Emeritus
University of Copenhagen, Department of Food Science
moj@food.ku.dk

Lene Jespersen, Professor
University of Copenhagen, Department of Food Science
lj@food.ku.dk

Further reading

Thorsen, L., Kando, C.K., Sawadogo, H., Larsen, N., Diawara, B., Ouédraogo, G.A., Hendriksen, N.B., Jespersen, L., 2015. Characteristics and phylogeny of *Bacillus cereus* strains isolated from Maari, a traditional West African food condiment. *International Journal of Food Microbiology* 196,70-78. doi:10.1016/j.ijfoodmicro.2014.11.026

Amoa-Awua, W., Awusi, B., Owusu, M., Appiah, V., Ofori, H., Thorsen, L., Jespersen, L., 2014. Reducing the atypical odour of dawadawa: Effect of modification of the fermentation conditions and post-fermentation treatment on the development of the atypical odour of dawadawa. *Food Control*, 41, 335-342. doi:10.1016/j.foodcont.2014.02.016

Kpikpi E.N., Thorsen L., Glover R., Dzogbefia V.P., Jespersen L. 2014. Identification of *Bacillus* species occurring in Kantong, an acid fermented seed condiment produced in Ghana. *International Journal of Food Microbiology*. 180:1-6. doi:10.1016/j.ijfoodmicro.2014.03.028

Thorsen, L., Kpikpi, E.N., Jespersen, L. 2014. Yeasts in Alkaline Fermented Food, Chapter 4 In: Parabir K. Sarkar & M.J. Robert Nout (Eds.), *Handbook of Indigenous Foods Involving Alkaline Fermentation*, 1. ed. pp. 259-314, CRC Press, Taylor and Francis Group. doi:10.1201/b17195-5