

# Upgrading value chains of Bambara groundnut and amaranth in Zimbabwe, Kenya and Benin

Conclusions and recommendations from three national innovation platform workshops, June-July, 2014



Amaranth products on sale in the Kenyan market

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Photos: Per Rudebjer

## Background

Bambara groundnut and amaranth have been identified as priority crops for value chain development among hundreds of neglected and underutilized species (NUS) cultivated across Africa. The potential for such crops to contribute to nutrition, income generation and climate change adaptation is increasingly recognized internationally, such as in the European Union's Horizon 2020 programme: 'Widening the genetic basis of crops, forest trees and animals as well as diversifying production is essential'.

The project '*Strengthening capacities and informing policies for developing value chains of neglected and underutilized crops in Africa*' is contributing to diversifying agriculture beyond the main staple crops and commodities that dominate agricultural research, development and business today. The three-year project, which runs from 2014 to 2016, is supported by the EU-ACP Science & Technology Programme with co-financing by the project partners<sup>1</sup>. The project's vision is 'Enhanced value chains of neglected and underutilized species (NUS) in Africa contributing to improved food and nutritional security, income of smallholder farmers and entrepreneurs and mitigation of, and adaptation to climatic, agronomic and economic risks.'

The target crops – Bambara groundnut and amaranth – are grown locally in the three project countries (Benin, Kenya and Zimbabwe) but have received limited investments in research and value chain development. Some entrepreneurs are starting to develop and market new products based on these crops, and some research projects are in progress, but it is still early days. The value chains are immature. There is need to develop capacity, stimulate consumer demand, strengthen research and create a 'level playing field' in terms of policies and support, among others. Better understanding of how value chains of these crops operate, of the current constraints and future opportunities is needed. Stakeholders also need to agree on priority actions, including research, to focus efforts on where they are most needed. All this aims to contribute to increasing the demand for, and production of Bambara groundnut and amaranth.

An earlier EU-ACP project, '*Building human and institutional capacity for enhancing the conservation and use of neglected and underutilized species of crops in West Africa, Eastern and Southern Africa*' played an important role in conceptualising the current project. It focused on training researchers and on identifying priority underutilised crops in West Africa and East and Southern Africa. The project, implemented from 2009 to 2013 confirmed a high demand for capacity enhancing activities related to NUS research in general, but also revealed that training in value chain upgrading is a novelty for many young scientists. The documented success of the value chain training courses conducted in the previous project was an important inspiration to expanding such capacity development opportunities.

In particular, the project identified a need to go beyond individual capacity and strengthen the institutional level to provide a good enabling environment for value chain upgrading. It was decided that the best approach here would be to focus on two promising underutilised crops, Bambara groundnut and grain/leafy amaranth. The rationale for wishing to promote these two 'model crops' resides in (a) their superior nutritious properties and so, with staples such as maize or rice, would potentially contribute to a more diverse and healthier diet and are therefore important in the fight against malnutrition; (b) the ability of these crops to thrive in marginal environments, a very positive

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<sup>1</sup> The project is implemented by a partnership consisting of Bioversity International (Coordinator); Africa University, Zimbabwe; African Network for Agriculture, Agroforestry and Natural Resources Education (ANAFE), Kenya; International Foundation for Science (IFS), Sweden; Laboratory of Agricultural Biodiversity and Tropical Plant Breeding (LAAPT), Benin, and; University of Nairobi, Kenya. It is co-financed also by the CGIAR Research Programme on Policies, Institutions and Markets.

attribute in predicted climate change scenarios and (c) their potential as niche products which could command a price premium and thus help in wealth creation in resource-poor rural areas.

## National innovation platform workshops

With these two crops in mind, the Project Inception Workshop held in Nairobi, Kenya (12-14 March, 2014), emphasised the importance of an integrated approach to develop their value chains, using a multi-stakeholder platform. This would be the first step towards developing National Action Plans for value chain upgrading of the target crops. Consequently, the project partners organised a National Innovation Platform meeting in each of the three national hubs (Zimbabwe, Kenya and Benin) in June-July 2014, largely based on:

- Participation of relevant value chain operators, service providers, research institutes and governmental organisations at micro, meso and macro level and their respective (current) role within the value chain,
- Development of a functional value chain map analysing basic sequences and functions of each value chain actor,
- Participatory assessment of bottlenecks and constraints along the different stages of the chain starting from seed systems, field cultivation, post-harvest, processing, commercialization up to final consumption,
- Agreeing on actions needed to upgrade value chains of target crops, and setting priorities among those actions, and
- Building of trust and awareness among stakeholders and creating an enabling environment for subsequent collaboration.



*Mr Ringson John Chitsiko, the Permanent Secretary of the Ministry of Agriculture, Mechanization and Irrigation Development, Zimbabwe, addressing the participants at the opening session.*



*Participants in the national innovation platform workshop in Benin, 14-16 June 2014*

## Summaries of innovation platform meetings in Zimbabwe, Kenya and Benin

### Workshop methodology

Three national innovation platform meetings were held in June and July 2014, led by the national project partners:

- Zimbabwe: Africa University (Mutare) organized a meeting in Harare on 23 - 24 June, 2014
- Kenya: University of Nairobi led a meeting in Nairobi on 30 June - 1 July, 2014
- Benin: The Laboratory of Agricultural Biodiversity and Tropical Plant Breeding (LAAPT) coordinated a meeting in Cotonou on 14 - 16 July, 2014.

All three meetings were co-facilitated by Bioversity International and the International Foundation for Science (IFS). External facilitators were also used in Zimbabwe and Benin. The programmes for the three meetings are attached in Appendix 1.

Each workshop included between 20 and 30 participants (Appendix 2), representing a broad range of stakeholders, including private sector representatives, involved in research, production and marketing of Bambara groundnut and amaranth (both the grain and leafy vegetable varieties).

The three workshops focused on mapping out current value chains, assessing bottlenecks and constraints along the different stages of the chain, and on creating an enabling environment for future collaboration, using the following general structure:

1. Presentations gave an update on the national situation with regard to NUS crops in general and the target crops in particular.
2. Group work to analyse the value chains of Bambara groundnut and amaranth, respectively.

3. Exhibitions where private sector entrepreneurs demonstrated products based on the two crops.
4. Final discussion to draw conclusions and agree on priorities and follow-up actions.

The value chains were considered from the standpoint of six topics:

- Market access & consumer demand
- Input supply
- Agronomy/technology/product development
- Organisation & management
- Regulatory policy
- Finance

These topics were analysed for each crop with regard to value chain constraints, opportunities, solutions and actions required. In addition, researchable questions relating to the value chains were identified, to be used for future research proposal training courses under the EU-ACP project, as well as other research programmes.

The results of this analysis will be the basis for developing National Action Plans for upgrading the value chains of Bambara groundnut and amaranth. Importantly, this might require supplementary activities and funding (there are limitations regarding activities eligible under the EU-ACP project). For example, more detailed market research, sensory evaluation of new products derived from the two crops, or policy analysis might be required. In spite of this limitation, the workshops were very useful in giving direction and guidance to stakeholders involved in these value chains. They also contributed to providing visibility for these crops; several newspaper stories were published, and in Benin the national TV covered the workshop. In the months to come, the national project partners will work within their national networks to produce the National Action Plans.

It should be noted that many of the constraints, solutions and possible actions identified are common to both crops, and that many similarities exist among the three countries. This report aims to capture the recommendations and conclusions from a regional perspective, as a complement to the National Action Plans that each country will produce.

[GROUP PICTURE FROM ZIMBABWE TO BE ADDED]



*Innovation platform workshop in Kenya, 20 June – 1 July 2014*

## **Amaranth – constraints and solutions**

Drawing on the results of the value chain analyses in the three countries, this summary focuses on findings that are common to all three countries, but also gives some specific examples that might be of general interest.

The country-specific results are also detailed for each workshop in Appendix 3.

### **1. Market access and Consumer Demand**

The most pressing constraint affecting the marketing of either leafy or grain amaranth was the relative lack of market interest or knowledge. The medicinal and high nutritional values of amaranth are not widely known. So, there are very weak linkages between agriculture, food and health. Grain amaranth is a more amenable product than leafy amaranth regarding transformation, and nutritional stability of products, yet leafy amaranth, with short shelf-life – and therefore highly dependent on infrastructure to reach markets – and with limited possibilities of transformation, is nevertheless the more popular produce in Zimbabwe and Benin. However, in Kenya, the grain amaranth market is probably the most developed of the three countries.

According to the workshop participants, a significant number of actors are working on amaranth and a range of well packaged products are sold in main supermarkets (though one of the workshop facilitators could not find any in a branch of ‘Nakumatt’ in Nairobi). A representative of a farmer group producing grain amaranth in Western Kenya reported that there are demand issues. In Zimbabwe, the grain amaranth market is scarcely developed. There are quality and quantity issues, i.e. standardisation and limited knowledge on the available varieties are lacking, not to mention

knowledge on consumer preferences. There are also price fluctuations especially during dry seasons. Companies are also cautious about taking on new products.

Notwithstanding the above concerns, there are transformed products based on grain amaranth in all three countries (e.g. maize flour fortified with amaranth flour, cereals, popcorn, cakes, biscuits). It was particularly gratifying that one producer of vitamin-fortified biscuits for undernourished children in Benin, as a result of being apprised of the benefits of amaranth, had commenced production of amaranth-fortified biscuits by the end the workshop! Samples which were distributed were met with considerable approval by participants.

**Possible actions:** public awareness of particularly grain amaranth and its derivatives needs to be increased. Information on the nutritional benefits of amaranth products (and nutritional stability) needs to be clearly conveyed to health Ministries and the public. Researchers working in this area need to do more to inform the public and policy makers through e.g. writing popular articles for the press and magazines, reaching out to radio and TV and formulating persuasive policy briefs. Products based on amaranth should be promoted in supermarkets and at, e.g. agricultural/food fairs etc.

Marketing strategies should be developed, possibly learning from existing successes, e.g. baobab in Zimbabwe, green leafy vegetables in Kenya, amaranth, quinoa in Latin America; lessons learned to be compiled - how?



*Products of amaranth and baobab on display in Zimbabwe*

## 2. Inputs (seeds, fertilisers, pesticides, etc.)

Seeds systems are not well developed – there is a lack of certified seeds available. The genetic diversity in grain amaranth varieties grown by farmers is limited. Also, the knowledge and information on existing amaranth varieties is scarce. Also, there is a lack of knowledge and experience on relevant fertiliser regimes as well as pests and diseases of amaranth and their control. There seems to be little information on organic production.

**Possible actions:** in order to improve the diversity and quality of seed supply, the seed sector needs strengthening. Some private seed companies may be in a position to breed and commercialise grain



amaranth seed, but other options such as farmer-produced seeds, and 'seed fairs' may also need attention. Since seed markets are still small, the public sector may be best placed identify and distribute seed of the best varieties probably in conjunction with farmer-led seed-producing groups and NGOs. Extensionists and farmers require training.

Regarding genetic diversity, it was suggested that support should be forthcoming to national gene banks to generate new information on grain amaranth diversity. Research should be undertaken on characterisation of varieties. Collection and exchange of grain amaranth should be encouraged, not only between the African regions but also between Africa and Latin America and Asia where grain amaranth value chains are better developed. Farmer surveys should be performed to document knowledge on the existing varieties.

### **3. Agronomy/Technological/Product Development**

Researchers need to establish economically optimal conditions for growing amaranth both conventionally and organically, interacting with farmers in doing so. In terms of harvesting technologies for grain amaranth, a common issue is losses and/or contamination during harvesting of these small grains, leading to loss of income and higher post-harvest processing costs. There seems to be inadequate knowledge on production (see above), post-harvest handling and processing. In particular, information on the stability of important nutritional factors during processing/storage is lacking. Innovation regarding the development of new attractive products based on grain amaranth needs to be intensified. Documentation of knowledge needs to be organised.

**Possible actions:** developing improved harvesting technologies and training farmers in improving quality standards during harvesting (avoiding sand contamination) are important. Research on nutrient stability during processing and storage is needed. What information exists on (production), post-harvest handling and processing should be incorporated into training manuals. In collaboration with universities and the private sector, new equipment may need to be developed for processing or, where possible, existing equipment should be adapted. Documentation of processing knowledge, including consumers' recipes should be undertaken.

Clearly, linking with other countries within and outside of Africa to learn from existing experience is of great importance.

### **4. Organisation and Management**

Farmers growing amaranth are not well organised; they act independently and so are at a disadvantage regarding negotiation of prices with buyers such as processors. Farmers' knowledge is deficient concerning processing operations they themselves could engage in and profit from. Linkages between farmers and the private sector are extremely limited.

**Possible actions:** increased training and extension support to farmers, especially for group organisation and business skills. The researcher-farmer/researcher-extension- farmer linkage continua should be improved. Field days would encourage farmers to pursue new opportunities for wealth creation through producing NUS such as grain amaranth (within the context of private sector interest).

## 5. Regulatory/Policy

All three countries reported a lack of policies relevant to the promotion of grain amaranth. Benin also mentioned the inexistence of norms for controlling quality of the products derived from amaranth. The second main constraint is the lack of public sector support for research and development, including funding.

**Possible actions:** awareness-raising amongst public sector on grain amaranth opportunities is a priority, in order to inform policy processes. In Kenya, a proposed action was to lobby the Food and Nutrition Council to inform about grain amaranth as a healthy and nutritious cereal, to complement existing grain crops. Benin mentioned that developing norms and standards for quality control of products is important. Secondly, the mobilization of funds, especially via public-private-partnerships is a priority.

## 6. Finance

Once an opportunity has been identified – such as the willingness of the private sector to market a product, farmers require finance in order to adapt and exploit this opportunity. The major problem is that smallholder farmers are not bankable since they may not possess collateral such as land, property, savings etc. Similar constraints may affect other players in the value chain. Where small loans were possible, a gender-related problem in Kenya (and probably other countries also) was reported and related to menfolk taking charge of such funds, even if granted to wives, for other purposes. This kind of problem can apparently be resolved through demonstrating the benefit of such loans to the whole family.

**Possible actions:** the literature describes a number of cases where value chains, suffering from a lack of finance, were strengthened by different approaches to financing. In almost all cases, financing of smallholder farmers, in particular, with a view to becoming established players in value chains was kick-started by various kinds of donors. Such assistance enable groups of farmers to eventually possess 'soft collateral' (e.g. through communal savings, or several years of reliable and profitable operations of a value chain) which permitted access to banking services including loans. In order for this to happen, a value chain must itself be kick-started through sufficient consumer awareness and demand for specific products which would then be 'interesting' for the private sector.

## Bambara groundnut – constraints and solutions

As for amaranth, this summary focuses on findings that are common to all three countries, but also gives some specific examples that might be of general interest.

The country-specific results are also detailed for each workshop in Appendix 3.

### 1. Market Access and Consumer Demand

More so than grain amaranth is the lack of market awareness of Bambara groundnut. There had been serious efforts to popularise Bambara groundnut in Zimbabwe – a tinned product had been available on supermarket shelves but was discontinued because of lack of interest and possibly pricing issues. The latter might have been a result of a problem of economies of scale. In each hub nation, there seemed to be marked differences regarding the value or otherwise of Bambara groundnut. In Zimbabwe, the nutritious properties are not widely appreciated. In Kenya, the same is true but there appeared to be regional claims regarding its usefulness in male fertility. However, stakeholders in Benin were unaware of such a benefit to male consumers. In contrast, aside from the nutritional benefits of Bambara, some anti-nutrient properties were mentioned by workshop

stakeholders – such as digestion problems and even problems affecting specific organs. However, as with other types of beans, anti-nutrient properties are often removed through conventional processing and this, according to the available literature seems to be the case for Bambara. However, the processing of Bambara does seem to be onerous inasmuch as the legume requires a long cooking time—a clear constraint for urban consumers.

Packaging of the products available needs to be made more attractive. In particular, one commercial package in Benin stated on its label that the groundnuts were “pre-cuit” or pre-cooked and cooking time is consequently reduced to 30 minutes. It was suggested that this information be more clearly stated on the package in much larger and bolder font and that “pre-cuit” should be supplemented with “Prêt à manger en 30 minutes”.

**Possible actions:** as for Amaranth (see above). In addition, any question marks regarding anti-nutrient properties should be thoroughly investigated through a comprehensive review of the literature. Any outstanding questions regarding anti-nutrient properties should be the subject of research investigations.

The vexed question of the long time needed for preparing and cooking Bambara groundnut is always raised in any discussion of this legume and is clearly a factor which influences consumer demand. Research on this is necessary to find means of reducing cooking time and could include a study of different varieties some of which may be more amenable in this regard. Given economies of scale, it is possible that the commercial costs of pre-cooking Bambara might comprise a minor proportion of overall marketing costs.

The nutritional value of Bambara is probably under-appreciated by consumers; this also could be made very clear on packaging. Research investigations may be necessary to investigate whether the nutritional properties remain stable during processing operations.



*Entrepreneurs in Benin are marketing biscuits of amaranth and Bambara groundnut*

## **Inputs (seeds, fertilisers, pesticides, etc.)**

The constraints regarding input supply are very similar to those for amaranth (see above). Issues regarding diversity, and access to quality seed in enough quantity are common, and limited information on landraces is available. In Zimbabwe, the indigenous knowledge systems present an unexplored opportunity to improve yields and moderate input requirements.

**Possible actions:** as for amaranth, the seed system for Bambara groundnut needs general attention. Partnering with seed companies for production and distribution is important. Investments in breeding programmes to develop varieties suitable for different agro-ecological zones are needed (e.g. short-cycle varieties), as are investments in research on fertilizer regimes and pest and disease control. Involving farmers in documenting local knowledge and in training programmes would be beneficial.

## **2. Agronomy/Technological/Product Development**

It was reported in Zimbabwe that earthing-up practices were labour intensive. It was also reported that current methods of harvesting of groundnuts can result in a proportion of pods being left under soil. Little information is available on potential maximal yields either using optimised agronomic practices or through selection of high-yielding varieties. Furthermore, yields of Bambara seemed to be viewed in isolation as a single crop whereas it is in fact an ideal intercrop (being a legume, it fixes nitrogen), often grown in combination with other crops. So, yields resulting from intercropping of Bambara plus other crops should enter the economic equation.

Bambara is a nitrogen-fixing legume but very little information is available on the diversity of rhizobia in farmers' fields. Finally, Bambara is susceptible to a number of diseases, though pest problems are less important.

As for technology and product development, what has been said for amaranth also goes for Bambara groundnut. For Bambara, there is also a lack of information on the technology necessary for shelling and peeling.

**Possible actions:** Research into optimising agronomic practices should be undertaken from the point of view of the timing of planting seeds, fertilisers, control of diseases and the influence of rhizobia spp. The need for earthing up of ridges should be investigated; perhaps minimum tillage operations could replace this though this may be influenced by intercropping operations. Research into harvesting should be undertaken to resolve the problem of residual pods left behind in soil. Are there varieties which have stronger peg attachment? Could this be an object of a breeding programme? (Some of these issues are currently being investigated in the BamYield programme at Crops For the Future Research Centre (CFFFRC), Malaysia).

Yields of this drought-resistant crop in arid areas should be investigated in detail in order to make firm recommendations as to the potential of producing Bambara in future climate change scenarios. Such information would be of great value for policy makers.

The lack of technology relating to shelling and peeling and research into appropriate technology should be the subject of research investigations. It is quite possible that existing technology for other crops, e.g. nuts, may be adapted for Bambara. As with grain amaranth, comprehensive documentation of processing knowledge, including recipes should be undertaken. More processing research is required to develop new products which might be appealing for consumers.

### 3. Organisation and Management

As for grain amaranth. In Zimbabwe, it was pointed out that “there is no institutional home for this crop”. In other words, there is no single institute which specialises in Bambara production/research and coordinates research activities in other universities or research institutes as well as interacting with researchers in other countries.

**Possible actions:** as for grain amaranth. In addition, and this goes for grain amaranth also, there should be a core group of researchers – most probably at an institute where most research is taking place on Bambara – who would coordinate research activities throughout e.g. the hub nation and would interact with researchers in other countries. Such a group would be responsible also for feeding new knowledge to extensionists, farmers and, in the case of information regarding e.g. nutritional properties of products to relevant Ministries and policy makers.

### 4. Regulatory/Policy

The regulatory/policy constraints facing actors in the Bambara groundnut value chains are again very similar to those for amaranth. There is limited emphasis on Bambara groundnut in the policy frameworks. Interestingly, Zimbabwe reported that the market for Bambara products is regulated.

**Possible actions:** As for amaranth, sensitization, lobbying and advocacy and capacity building are priority actions for strengthening the institutional environment for Bambara groundnut value chains.

### 5. Finance

As for grain amaranth.



*Group work on analysing value chains of amaranth and Bambara groundnut in Zimbabwe*

## Conclusions

From the foregoing, it is clear that

- (i) There are many researchable questions to be addressed by researchers:
  - a. National inventories with genetic characterisation of varieties cultivated in the hub nations (as well as neighbouring countries are required)
  - b. The ability to produce these crops in situations of abiotic, particularly water, stress should be investigated in depth. Bambara in particular offers such potential and now is the time to ascertain its precise future role and value in climate change scenarios. These varieties should be studied for their ability or otherwise to withstand abiotic (excess water, water stress) and biotic stresses (pests and diseases). Yields of Bambara in particular, well known as a drought-resistant crop should be investigated in arid areas in detail in order to make firm recommendations as to the potential of producing Bambara in future climate change scenarios.
  - c. Regarding pests and diseases, methods of integrated/organic control should be developed.
  - d. Agronomic practices need to be optimised – storage of seeds, planting of seeds, fertiliser treatments, pest control, harvesting methods need to be optimised.
  - e. Can the productivity of Bambara be increased through the use of *Rhizobium* spp.? There is little information on the biodiversity of the rhizobia associated with Bambara groundnut nodulation.
  - f. Research into the technology of producing and harvesting of these crops is required.
  - g. Research is needed on the stability of nutrients during processing of these crops and during storage of products.
  - h. Shelf-life studies on the quality of stored produce are required.
  - i. Any anti-nutritional factors must be studied for their secondary effects. The effects of various types of processing on reducing anti-nutritional factors should be studied.
  - j. Any medical attributes of these crops should be validated – such as the claims made in Kenya for the effect of Bambara groundnut on male fertility.
- (ii) Consumer awareness of the health-giving properties of these crops seems not to be extensive. It is particularly incumbent upon scientific researchers to reach out to the general public through popular articles in the press, and through media such as radio and TV. Policy makers may also be so informed as well as through policy briefs (again usually written by scientists). Policy makers can create the regulatory frameworks for promoting the use of these crops for alleviating malnutrition, for recommendations in future possible climate change scenarios and for wealth creation whereby smallholder farmers can exploit niche, high value markets.
- (iii) Perhaps the most important strategy for promoting grain amaranth and Bambara in all the national hubs is increasing awareness of the health benefits of consuming these crops and taking serious steps to appraise the public and relevant Government Ministries. This can be done through popular science articles for newspapers, magazines and also via radio and TV, as well as supermarket promotions and exhibits at food fairs.
- (iv) Scientists should engage with the private sector to ensure that their research is relevant for private companies. In other words to work on the kinds of products private companies would feel comfortable about investing in.
- (v) Attractive and informative packaging is an important element of marketing.

- (vi) It is clear that there is much to be learned through cross-communication between the three national hubs and beyond. Indeed, it is clearly important that African scientists and other value chain players should learn from the comparatively well-developed value chains for grain amaranth in Latin America and Asia and the intensive research programme on Bambara being undertaken by Crops for the Future in Malaysia. Thus, one of the most important follow-up activities is to develop and promote an effective communication strategy which would enable a flow of information and cross-fertilisation of ideas.
- (vii) Training:
- a. Farmers in production, amenable processing techniques and group organisation and business skills.
  - b. Training of young researchers on project proposal writing, scientific writing and communication. The current ACP-EU project has planned for such training and the first workshops are scheduled to commence in October, 2014.



*Mr Patrick Otieno, BAFAM Co-op Bondo, a farmer group in Western Kenya that produces grain amaranth*

## Appendix 1. Programmes of national innovation platform meetings

### Programme for Zimbabwe national workshop on upgrading value chains for bambara nut and grain amaranth

DAY ONE 23 June 2014

08.30-09.00	Registration	<b>Ms L. Machejera</b>
09.00-09.10	Introductions	<b>Dr W. Manyangarirwa</b>
Session 1	OVERVIEW OF NUS IN ZIMBABWE	
Chairperson	<b>Dr W. Manyangarirwa</b>	
09.10-09.20	Background and Workshop objectives	<b>Dr Z. A. Chiteka</b>
09.20-09.40	Project background and Neglected and Underutilized Crops (NUS)	<b>Mr. Per Rudebjer</b> , Head Knowledge Management and Capacity Development Bioversity International
09.40-10.00	Perspectives on underutilized crops in Zimbabwe	<b>Mr. G. Le Breton</b> Chief Executive. Bio-Innovation Zimbabwe.
10.00 -10.20	Official opening address	<b>Mr. R. J. Chitsiko</b> Permanent Secretary Ministry of Agriculture Mechanization and Irrigation Development
10.20-10.40	Health Break	
10.40-11.00	The role of value chains in the utilization of crops in rural communities	<b>Dr R. Mano</b> Director, International Relief and Development
11.00-11.20	Underutilized crops and the national perspectives	<b>Dr C. Mujaju</b> Head Seed Services, Department of Research and Specialist Services.
Session 2	SITUATION ANALYSIS: GRAIN AMARANTH IN ZIMBABWE	
Chairperson	Dr S. Chakeredza	
11.20-11.40	Food products and utilization of Grain Amaranth.	<b>Ms Maidei Kutambura</b> Ecologist Bio-Innovation Zimbabwe
11.40-12.00	Innovative food products from grain amaranth	Caroline Jacquet and Constance Gumpo Bio-Innovation Zimbabwe
12.00 -12.20	Production and marketing of Grain Amaranth, pilot project in Mutoko and Mudzi Districts.	<b>Ms Lilian Machivenyika</b> Cluster Agricultural Development Services
12.20-12.40	Germplasm conservation and characterization of Bambara nut and grain amaranth	<b>Mr Kudzai Kusena</b> Curator of the National Gene Bank. R. & S. S.
12.40–12.50	Research priorities on grain Grain amaranth and experiences in Chimanimani.	<b>Dr Edmore Gasura</b> Lecturer, Crop Science Department, University of Zimbabwe



- 12.50- 14.00 Lunch break
- Session 3 TOWARDS A NATIONAL STRATEGY ON GRAIN AMARANTH
- Facilitator Mr Gus Le Breton
- 14.00–14.20 Overview of Value Chain Upgrading Strategies  
Mr Gus Le Breton
- 14.20-16.00 Group work on upgrading Grain Amaranth Value Chain in Zimbabwe
- 16.00-17.00 Report back from groups

DAY TWO 24 June 2014

- Session 4 BUILDING CAPACITY IN ZIMBABWE FOR NUS VALUE CHAINS
- Chairperson Mr. Tuarira Abdul Mtaita
- 08.30- 08.50 Recap from Day One  
Mr Gus Le Breton
- 08.50-09.10 Underutilized crops and value chains-perspectives from extension.  
**Mr. Marcus Hakutangwi.** Barefoot Education in Agriculture Trust.
- 09.10-09.30 Opportunities for research on NUS.  
**Dr Richard Hall** International Foundation for Science
- 09.30-09.50 Integration of underutilized crops in tertiary education curricula and the potential benefits, the case for ANAFE.  
Dr Sebastian Chakeredza ANAFE
- 09.50-10.10 Experiences with medicinal plants from underutilized crops  
**Prof. Mazuru Gundidza** Harare Institute of Technology
- Session 5 SITUATION ANALYSIS: BAMBARA NUT IN ZIMBABWE
- Chairperson Dr Claid Mujaju
- 10.10-10.30 Bambara nut research current status and into the future  
**Dr Patrick O'Riley** Crops for the Future Research Centre, Malaysia
- 10.30-10.50 Health Break
- 10.50-11.10 Grain amaranth and Bambara nut research at Africa University  
**Dr Z. A. Chiteka** Africa University
- 11.10-11.30 Experiences with commercialization of Bambara nut food products.  
**Ms Ivy Kapora** Tulimara Foods
- 10.50-11.10 Bambara nut breeding Prince M. Matova & Savemore N. Ngirazi  
Pulse Legume Breeders Bambara nut Breeding, Crop Breeding Institute, DR&SS
- Session 6 TOWARDS A NATIONAL STRATEGY ON BAMBARA NUT
- Facilitator Mr Gus Le Breton
- 11.10-13.00 Group work on upgrading Bambara Nut Value Chain in Zimbabwe

13.00- 14.00	Lunch break
14.00-15.00	Group work continued
15.00-16.00	Report back from groups
16.00-16.50	Plenary Session and Workshop recommendations
16.50- 17.00	Vote of thanks
17.00	End of Workshop

**Programme for Kenya national workshop on upgrading value chains for bambara nut and amaranth**

30 June-2 July, 2014 at Kenyatta University Main Campus, Nairobi, Kenya

Programme

Day 1: Sunday, 29 June, 2014		
Participants arrive at KICC		
Day 2: Monday, 30 June, 2014		
Preliminaries		
08.30-09.00	Registration	Ms Pauline Ndwiga
09.00-09.10	Introductions	Prof. Kiarie Njoroge
Part I: Overview of NUS, situation and value chain constraints analysis of amaranth and Bambara nuts in Kenya		
SESSION 1: OVERVIEW OF NUS IN KENYA Chair-person: <b>Prof. George Chemining'wa</b> (Chairman, Department of Plant Science and Crop Protection, Faculty of Agriculture, University of Nairobi)		
09.10-09.20	Introduction to Workshop objectives (Prof. Kiarie Njoroge, Workshop Co-coordinator)	
09.20-09.40	Project background and Neglected and Underutilized Crops (NUS) Mr. Per Rudebjer (Head, Knowledge Management and Capacity Development Bioversity International)	
09.40-10.10	Official opening address Dr George Ombakho (Director, Research Management and Development, State Department of Science and Technology)	
10.10 – 10.40 Coffee Break		
10.10 - 10.30	Perspectives on underutilized crops in Kenya Dr Lusike Wasilwa (Asst. Director, Horticulture and Industrial Crops, KARI Hqs.)	
10.30 – 10.50	The role of value chains in the utilization of crops in rural communities Dr Victor Wasike (Principal Research Officer & Programme Officer, KARI Hqs.)	
10.50 – 11.10	Underutilized crops in the national perspective Patrick Onchieku (Ministry of Agriculture Hqs, Kilimo House)	
SESSION 2: SITUATION ANALYSIS: AMARANTH AND BAMBARA IN KENYA Chairman: Dr Victor Wasike (Principal Research Officer & Program Officer, KARI Hqs.)		
11.10 – 11.30	Food products and utilization of amaranths Dr Dan Sila (Jomo Kenyatta University of Agriculture and Technology)	
11.30 – 11.50	Production and marketing of amaranths and Bambara Nut in Kenya John Ndung'u ( KARI Thika)	
11.50 – 12.10	Germplasm conservation Bambara nut and the amaranth	

Dr Desterio Nyamongo (The National Gene Bank of Kenya, Muguga)	
12.10 – 12.30	Research priorities on amaranth and the bambara. Ms. Agnes Ndegwa (Coordinator, Vegetable Research, KARI, Thika)
12.30 – 13.00	Perspectives from stakeholders (on research and development of bambara and amaranth (Group work) (A discussion facilitated by Per Rudebjer/Prof. Kiarie Njoroge)
13.00 – 14.00 Lunch Break	
SESSION 3:	VALUE CHAINS: CONSTRAINTS ANALYSIS OF AMARANTH AND BAMBARA (GROUP WORK)
Chairperson:	Violet Kirigua (Program Officer, KARI Hqs)
14.00 -14.20	Underutilized crops and value chains-perspectives from extension. Mr Ngugi Ticha (Value Chain Development Officer, ASDSP, Kilifi County)
14.20-14.40	Overview of Value Chain Upgrading Strategies: Plus group tasking Per Rudebjer (Head, Knowledge Management and Capacity Development Bioversity International)
14.40-16.00	Group work 1. Upgrading amaranth and Bambara value chains in Kenya: constraints and solutions (Note: 2 group parallel sessions). (Facilitator: Dr Richard Hall, Mr. Per Rudebjer)
16.00 -16.30	Tea Break
16.30 – 17.30	Group work continues
17.3 One End of Day One	

Day 3: Tuesday, 1 <sup>st</sup> July, 2014	
8.30 – 8.40	Recap from Day One Dr Richard Hall (International Foundation for Science)
08.40- 09.40	Plenary presentation sessions: Report back from groups /Discussions Facilitator: Mr Per Rudebjer ( <i>Bioversity International</i> )
Part 2: Constraints and opportunities available for Bambara groundnut and amaranth value chains	
SESSION 4:	BUILDING CAPACITY IN KENYA FOR NUS VALUE CHAINS
Chairperson:	Mr. Per Rudebjer (Head, Knowledge Management and Capacity Development Bioversity International)
09.40-10.00	Opportunities for research and development on NUS. Dr Richard Hall (International Foundation for Science)
10.00 10.30 Tea Break	
10.30-11.00	Experiences with medicinal plants from underutilized crops Dr. Jennifer Orwa (Ag. Director, Center for Traditional Medicine and Drug Research, Kenya Medical Research Institute, KEMRI)
11.00-11.20	Integration of underutilized crops into tertiary education curricula and potential benefits – The case for ANAFE

Prof. James Kungu (Dean' School of environmental studies, Kenyatta University)	
11.20 – 11.30	Current status and looking into the future: High lights from bambara amaranth research at the Crops for the Future Center Mr Per Rudebjer (Head, Knowledge Management and Capacity Development Bioversity International)
<b>SESSION 5: SITUATION ANALYSIS OF AMARANTHUS AND BAMBARA NUT IN KENYA: OPPORTUNITIES AND RECOMMENDATIONS (TOWARDS A NATIONAL STRATEGY)</b> <b>Chairperson:</b> Prof. James Kung'u (Dean' School of environmental studies, Kenyatta University)	
11.30 -11.50	Experiences with commercialization of Amaranths Dr. Dan Sila (Jomo Keyatta University of Agriculture & Technology)
11.50 – 13.00	<i>Group work 2.</i> Upgrading value chains of Bambara & amaranths in Kenya: Opportunities and needed action (2 group parallel sessions) (Facilitator: Dr Richard Hall, Mr Per Rudebjer).
13.00 – 14.00 Lunch	
14.00-15.00	Report back from groups/Discussions
15.00-16.00	Conclusions and recommendations (Bambara and amaranths)
16.00 – 16.30	Closure
16.00 Tea Break	
17.00 End	

**National innovation platform workshop on developing value chains of underutilized crops in Benin:  
amaranth and Bambara nut**

14-16 July, 2014, Cotonou, Benin

Programme

DAY ONE 14 July 2014		
Session I – Opening ceremony and General presentation (Chair: Facilitator)		
Time	Activity	Responsible
08.30-09.00	Arrival and Registration of the participants	Mr Azize Orobiyi / Mr Paterne AGRE / Olive KPOMALEGNIN
09.00-09.15	Introductions of the participants and presentation of the workshop program	Facilitator (M. Dominique Hounkonnou)
09.15-09.30	Welcome address and presentation of the objectives of the workshop	Prof. Alexandre DANSI
9.30 -9.45	Official opening address	Ir. Virginie ASSOGBA MIGUEL / National Coordinator of WAPP (West African Agricultural Productivity Program), Ministry of Agriculture
9.45 – 10.15	Group Photo and Coffee / Tea break	Facilitator
10.15 – 10.45	Achievements of, and lessons learned from, the first EU-ACP project on NUS in Benin “Building human and institutional capacity for enhancing the conservation and use of Neglected and Underutilized Species of crops in West Africa, and Eastern and Southern Africa”	<b>Dr ADJATIN Arlette</b> , Assistant Director, Laboratory of Agricultural Biodiversity and Tropical Plant Breeding (LAAPT-BIORAVE); Faculty of Science and Technology of Dassa
10.45-11.15	Strengthening capacities and informing policies for developing value chains of neglected and underutilized crops in Africa: project background	<b>Mr Per Rudebjer</b> , Head, Knowledge Management and Capacity Strengthening, Bioversity International (Italy)
11.15-11.45	Diversity of the Neglected and Underutilized Crop Species of Importance in Benin (Finding of the national scoping study on NUS)	<b>Dr Laura LOKO</b> . Researcher; LAAPT / FAST Dassa
11.45-12.05	Bioversity International and the Neglected and Underutilized Species (NUS)	<b>Dr Raymond VODOUHE</b> ; Bioversity International, Cotonou (Benin)
12.05 – 12.25	IFS and Opportunities for research on NUS	<b>Dr Richard Hall</b> , International Foundation for Science
12.25 - 13.00	General discussion	Facilitator
13.00 – 14.00	Lunch break	Mr Azize Orobiyi / Mr Paterne AGRE (Organizing committee)
Session II. Understanding value chain analysis (Chair: Facilitator)		
14.00-14.30	Concept of value chain in agriculture	<b>Dr Ousmane COULIBALY</b> . International Institute of Tropical Agriculture, Benin
14.30 - 14.50	Value chain of Egussi, a neglected and underutilized seed vegetable in Benin	<b>Dr Adetonan Sounkoura</b> ; International Institute of Tropical Agriculture, Benin
14.50 –	Valorization of Baobab and Moringa in Benin	<b>Dr EWEDJE Ebenezer</b> ; Polytechnic

15.05	and in the sub-region	University of Abomey, Benin
15.05 – 15.20	Model of a strategic action plan for promotion of NUS value chain and Experiences of Zimbabwe and Kenya	<b>Mr Per Rudebjer</b> , Head, Knowledge Management and Capacity Strengthening, Bioversity International (Italy)
15.20 – 15.45	General Discussion	Facilitator
15.45 - 16.00	Coffee / Tea break	Mr Azize Orobiyi / Mr Paterne AGRE (Organizing committee)
16.00 – 17.30	Exhibition of, and discussion on, products developed with Bambara groundnut; Baobab; vegetables Amaranth, Crassocephalum and Moringa	<b>Presenters:</b> Prof Alexandre DANSI; Dr Sènan VODOUHE, Dr Arlette ADJATIN and Ms Faouziath SANOUSSI, Anicet GBAGUIDI

DAY TWO 15 July 2014		
Session I – Bambara groundnut and amaranth value chain (Chair: Facilitator)		
Time	Activity	Responsible
08.30-08.50	Introduction to CFFRC's BamYIELD programme and the multi-location field trials of Bambara groundnut'.	<b>Dr. Aryo Feldman</b> ; Crops for the Future Research Centre (CFFRC), Malaysia
08.50-09.10	Nutritional value, Economic importance, Production constraints and possibilities of valorization of Amaranth and Bambara groundnut in Benin	SANOUSI Faouziath and TOVILOUDJI Pierre
09.10 – 09.30	Current status of Bambara groundnut value chain in Benin and Research priorities	GBAGUIDI Anicet; University of Abomey-Calavi
09.30 - 10.00	<b>General Discussion</b>	Facilitator
10.00 – 10:15	Coffee break	Mr Azize Orobiyi / Mr Paterne AGRE (Organizing committee)
10.00 – 10.15	Research on Amaranth in Benin	Dr ASSOGBA-KOMLAN Françoise; National agricultural research institute
10.30-10.45	Improvement of Amaranth production in the semi-arid zone of northern Benin through optimal management of water	AKPONIKPE Pierre; University of Parakou
10.45-11.05	Amaranth value chain in Benin and Research priorities	Dr Arlette ADJATIN; LAAPT (Faculty of Science and Technology of Dassa)
11.05-11.20	Influence of cultural practices on the nutritional and sanitary qualities of Amaranth in Benin	Dr VODOUHE Sena, University of Abomey-Calavi
12.20 -13.00	<b>General Discussion</b>	Facilitator
13.00 -14.00	Lunch break	Mr Azize Orobiyi / Mr Paterne AGRE (Organizing committee)
Session II. Developing strategic action plan (Chair: Facilitator)		
	<b>Group 1</b>	<b>Group 2</b>
14.00-16.15	Strategies for up scaling Bambara groundnut value chain	Strategies for up scaling Amaranth value chain
16.15-16.30	Coffee break	
16.30 -17.00	Report back from groups 1 and discussion	
17.00 -17.30	Report back from group 2 and discussion	

Day 3: 16 July 2014		
Session I. Developing strategic action plan and research topic for young scientists (Chair: Facilitator)		
	Group 1	Group 2
8.00-10.00	Strategies for up scaling Bambara groundnut value chain (continued)	Strategies for up scaling Amaranth value chain (continued)
10.00 – 10.15	Coffee break	
10.15 – 10.30	Report back from groups 1 and discussion	
10.30 – 11.00	Report back from group 2 and discussion	
11.00 – 13.00	Development of good research topics on Bambara groundnut for young scientists	Development of good research topics on Amaranth for young scientists
13.00 – 14.00	Lunch break	
14.00 – 14.30	Report from group 1: topics identified and discussion	
14.30 – 15.00	Report from group 2: topics identified and discussion	
15.00 – 16.00	Plenary session and workshop recommendations	
16.00 – 16.15	Coffee break	
16.15 – 17.00	Closing ceremony and departure	



## Appendix 2. Lists of participants

### Zimbabwe

Surname	Given names	Country	Gender	Institution
Rudebjer	Per	Italy	M	Bioversity International
Hall	Richard	Sweden	M	INT'I Foundation for Science
Mano	Reneth	Zimbabwe	M	IRD
Machivenyika	Lillian	Zimbabwe	F	C.A.D.S
Hakutangwi	Marcus	Zimbabwe	M	BEAT
Chakeredza	Sedastisn	Kenya	M	ANAFE
Chaitezvi	Allen	Zimbabwe	M	CADS
Kusena	Kudzai	Zimbabwe	M	Genetic Resource & Biotechnology
Kanonge	Newton	Zimbabwe	M	ERU
Kapora	Ivy	Zimbabwe	F	Speciality Foods of Africa
Chisipo	Jabulani	Zimbabwe	M	Media
Mujaju	Claid	Zimbabwe	M	Seed Services
Ngirazi	Savemore N	Zimbabwe	M	Crop Breeding Institute
O'Reilly	Patrick	Malaysia	M	CFRC
Gumpo	Constance	Zimbabwe	F	Bio Innovation Zimbabwe
Madewe	Grace	Zimbabwe	F	University of Zimbabwe
Mutuva	Nyasha Cynthia	Zimbabwe	F	University of Zimbabwe
Munyavhi	Austin	Zimbabwe	M	Utsanzi Product
Jacquet	Caroline	Zimbabwe	F	Bio Innovation Zimbabwe
Kutambura	Maideyi	Zimbabwe	F	Bio Innovation Zimbabwe
Mtaita	Tuarira	Zimbabwe	M	Africa University
Manyangarirwa	Walter	Zimbabwe	M	Africa University
Chiteka	Zwenhamo Albert	Zimbabwe	M	Africa University
Machekera	Laureen	Zimbabwe	F	Africa University

## Appendix 3. National analysis of value chains of Bambara groundnut and amaranth

### Zimbabwe: Amaranth and Bambara groundnut value chains analysis

Table 1. Zimbabwe: Grain Amaranth Value Chain Upgrading Strategy

Type	Value Chain Constraint/Opportunity	Solution
<b>Technological/ Product Development</b>	1. Lack of knowledge on appropriate varieties	a) Networking to look into what's available b) Research/breeding c) Survey with farmers/consumers
	2. Inadequate knowledge on production, post-harvest handling, processing	a) Training b) Exchange visits c) Training manuals d) Collaboration with govt. research institutes
	3. Lack of awareness amongst farmers and consumers	a) Marketing/promotional activities b) Fairs
	4. Lack of appropriate equipment	a) Development of new equipment/technologies in collaboration with universities and private sector b) Exchange visits c) Linking with other countries (seeing what's available) d) Adapting existing equipment
	5. Limited innovation on by-products	a) Link to research institutes (e.g. SIRDC) b) Documenting ideas/recipes from consumers
<b>Market Access</b>	1. Low consumer awareness	a) Awareness campaigns
	2. Limited retail awareness	a) Training b) Product trials c) Trial marketing activities d) Business to business marketing/advertising

	3. Limited market understanding	a) Detailed market analysis and research
<b>Type</b>	<b>Value Chain Constraint/Opportunity</b>	<b>Solution</b>
<b>Market Access (cont.)</b>	4. Lack of defined marketing strategy	a) Development of comprehensive marketing strategy, exploring both existing and new actual and potential market opportunities
	5. Quality and quantity issues (standardization)	a) Training b) Organising farmers
	6. Lack of knowledge on external markets and their requirements (costs etc.)	a) Explore external markets and requirements and potential profitability
	7. Private companies afraid of taking on new products	a) Support to private companies b) Awareness-raising activities amongst potential private sector players c) Test marketing activities (on a risk-sharing basis with private companies) d) Networking e) Govt to promote consumption of Grain Amaranth (through e.g. Ministry of Health)
	8. Inadequate transport networks and infrastructure	a) Decentralise marketing and purchasing from producers
	9. Weak linkages between agriculture, food and health	a) Engage with health care sector on health benefits of product b) Collaborate with medical world (ZDA, CA, MoH)
<b>Organisation and management</b>	1. Farmers unable to organize themselves (or stay organized after project ends)	a) Strengthen linkages between farmers and the private sector b) Make use of existing groups c) Increased training and extension support to farmers, especially around group organization and business skills d) Use of agri-dealers and other existing structures
	2. Lack of consistent management practices.	a) Continue using demonstration approach
	3. Slow uptake by extension services of new crops and new technologies	a) More relevant in-service training b) Curriculum development

		c) Participation in field days and exchange visits at all levels
<b>Type</b>	<b>Value Chain Constraint/Opportunity</b>	<b>Solution</b>
<b>Regulatory and policy issues</b>	1. Limited policies relevant to the promotion of Grain Amaranth	a) awareness-raising amongst public sector on Grain Amaranth opportunities b) Lobby Food and Nutrition Council to acknowledge Grain Amaranth as a healthy and nutritious cereal to complement existing grain crops
	2. Lack of public sector support in research and development (opportunity for private sector investment into Grain Amaranth value chain development)	a) Mobilisation of private sector Grain Amaranth co-ordination and regulation
	3. Lack of genetic diversity in Grain Amaranth	a) Support to national gene bank to generate new information on Grain Amaranth diversity b) Support for detailed studies on genetic diversity of and characterization of GA varieties c) Collection and exchange of GA germplasm
<b>Finance</b>	1. Lack of clarity on who the value chain players are or might be for GA	a) Identify and approach current and potential health food companies with potential interest in GA and other indigenous food crops b) Conduct national assessment of potential value chain players and support organisations.
	2. Lack of available donor/private sector financing mechanisms	a) Undertake systematic awareness-raising campaign around nutrition and health benefits of GA
	3. Capacity-constraints around access to finance	a) Capacity-building to access funds aimed at actual and potential players in the value chain
<b>Input supply</b>	1. Limited availability of certified seed	a) Engage private seed companies to breed and commercialise GA seed
	2. Lack of knowledge and experience on relevant fertilizer regimes for GA on Zimbabwean soils	a) Specific yield trials through relevant research institutions

**Table 2. Zimbabwe: Bambara Groundnut Value Chain Upgrading Strategy**

<b>Type</b>	<b>Value Chain Constraint/Opportunity</b>	<b>Solution</b>
<b>Technology/ Product Development</b>	1. Labour intensive during earthing-up practices	a) Adopt or modify existing ridgers
	2. Problem of gleans (pods that remain under soil during harvesting)	a) Need to breed for strong genetic variability and peg attachment
	3. Vulnerability to diseases	a) Use virgin lands b) Rotations c) Breeding/identifying varieties
	4. Low yields	a) germplasm collection, selection, plant breeding b) training in appropriate agronomic practices c) systems analysis into value of intercropping
	5. Narrow range of products	a) Exchange visits
	6. Limited knowledge of plant physiology restricts our ability to manipulate the breeding	a) Research
	7. Lack co-ordinated efforts	a) Networking b) Effective communication
	8. Lack of technology on shelling and peeling	a) Research into appropriate technology
<b>Market Access</b>	1. Imbalanced volumes, insufficiently standardised product	a) Intensify extension b) buffer-finance until balance reached
	2. Inadequate market intelligence	a) Market analysis b)Intelligence sharing

<b>Type</b>	<b>Value Chain Constraint/Opportunity</b>	<b>Solution</b>
<b>Market Access</b> (cont.)	3. Limited use of product	a) Promotional activities b) Explore product development c) Look into export markets d) Institutional buyers (schools, hospitals)
	4. Lack of knowledge of "what's in Bambara nut"	a) Order adequate available info b) Share info on nutritional value (e.g. video awareness campaigns) c) Involve local leadership
	5. Lack of processing/utilisation ideas	a) In-store promotions b) Recipe cards c) Videos d) Exchange visits e) Gather existing info
	6. Lack of collaboration and partnership between relevant parties.	a) Stakeholder engagement e.g. Bambara nut marketing board
	7. Stigma associated with nuts	a) Exchange visits to diversify the array of options for presentation of the food
	8. Poorly presented products	a) Work on packaging and presentation
<b>Organisation and management</b>	1. Production of breeders seed	a) Proper funding b) Proper networking
	2. There is no institutional home for this crop	a) Caretaker group must be formed
<b>Regulatory</b>	1. No deliberate policies supporting the production	a) Lobbying for them adopted in the existing homes
	2. Closed /regulated market	a) De-regulate market of Bambara
<b>Finance</b>	1. Lack of knowledge on financing institutes	a) Undertake funding inventory (i.e. who does what) b) Information sharing around financing

<b>Type</b>	<b>Value Chain Constraint/Opportunity</b>	<b>Solution</b>
<b>Finance</b> (cont.)	2. Lack of financing options	a) Explore alternatives (e.g. promote Internal Savings and Loans) b) Collaborate and link with micro-finance service-providers
	3. Limited skills on how to communicate good ideas	a) Capacity building
	4. Over-reliance on external support	a) Develop local solutions
<b>Input Supply</b>	1. Inadequate seed supply systems (variable quantity and quality).	a) Partnering with seed companies for production and distribution. b) Investment in breeding programmes. c) Improved sharing of landraces - organising seed fairs d) Strengthening linkages local - external
	2. Unexplored potential of IKS to improve yields and moderate input requirements	a) Involve farmers b) Document IKS c) Involve farmers in self-study materials devt d) Promote study groups
	3. Need for better understanding of different fertiliser regimes	a) Fertiliser research

## Kenya: Amaranth and Bambara groundnut value chains analysis

**Table 3. Constraints, Solutions, Opportunities and Actions in Amaranth in Kenya**

Topic	Value chain constraint	Solutions	Opportunities	Action (order of priority)
<b>1. Market Access/ consumer demand</b>	<ul style="list-style-type: none"> <li>• Nutritional and medicinal value not widely known<sup>1</sup></li> <li>• Low volumes</li> <li>• Sporadic productions</li> <li>• High cost of final product</li> <li>• Consumer preference for the leaves</li> <li>• Grain of low quality</li> <li>• Exploitation by middle men</li> <li>• Transport</li> </ul>	<ul style="list-style-type: none"> <li>• research &amp; dissemination</li> <li>• Training on agronomic practices</li> <li>• production subsidy</li> <li>• market driven varieties</li> <li>• provide quality seeds</li> <li>• Form marketing groups</li> <li>• Construction of better infrastructure</li> </ul>	<ul style="list-style-type: none"> <li>• Untapped market</li> <li>• Income generation</li> <li>• Creation of employment</li> <li>• Food and nutritional security</li> </ul>	<ul style="list-style-type: none"> <li>• Marketing /promotions/ exhibitions (1)</li> <li>• Increased output (2)</li> <li>• Develop cottage industries (3)</li> <li>• Improved storage (4)</li> <li>• Create awareness on the nutritional values and utilization (1)</li> </ul>
<b>2. Input supply: seeds, fertilizers, pesticides, etc</b>	<ul style="list-style-type: none"> <li>• Lack of certified seeds (uncontrolled recycling)</li> <li>• Lack of awareness on usage of fertilizers /pesticides (amount, timing, supplies)/ no wide spectrum</li> <li>• High cost of inputs</li> <li>• Lack of awareness of status soil fertility</li> </ul>	<ul style="list-style-type: none"> <li>• Breeding and bulking of better varieties</li> <li>• Training on usage of inputs</li> <li>• Procurement as a group</li> <li>• Soil analysis</li> </ul>	<ul style="list-style-type: none"> <li>• Production of organic fertilizer/pesticides</li> <li>• Seed breeding and bulking</li> </ul>	<ul style="list-style-type: none"> <li>• Farmers trained to produce organic fertilizer /pesticides using locally available materials</li> <li>• Research institutions to undertake breeding</li> <li>• Farmers and seed companies</li> </ul>



Topic	Value chain constraint	Solutions	Opportunities	Action (order of priority)
<b>3. Agronomy/technology/ product development</b>	<ul style="list-style-type: none"> <li>• Poor agronomic practices</li> <li>• Lack of accurate information by the extension providers</li> <li>• Over-dependence on rain fed agriculture</li> <li>• Lack of labour</li> <li>• Post-harvest handling /losses</li> <li>• Crude threshing methods</li> <li>• Lack of handling equipment/materials</li> <li>• Lack of capacity in product development and analysis</li> <li>• Not a priority crop in research</li> <li>• No product for low end segment</li> </ul>	<ul style="list-style-type: none"> <li>• Training</li> <li>• Retooling of EW</li> <li>• Irrigation</li> <li>• Mechanization</li> <li>• Training</li> <li>• Mechanization</li> <li>• Driers</li> <li>• Training /support</li> <li>• More focus in research &amp; disseminating findings</li> <li>• Reduce overheads</li> </ul>	<ul style="list-style-type: none"> <li>• Research in agronomy and IPM</li> <li>• Mechanized farming</li> <li>• New products development</li> </ul>	<ul style="list-style-type: none"> <li>• Research institutions to develop better practices</li> <li>• Develop tool for planting, harvesting , threshing, cleaning and drying</li> <li>• Developing animal feeds and recipes</li> </ul>
<b>4. Organization/ management</b>	<ul style="list-style-type: none"> <li>• Lack of/poor coordination among groups</li> <li>• Lack of collection centers</li> <li>• Lack of management skills</li> </ul>	<ul style="list-style-type: none"> <li>• Capacity building</li> <li>• Form groups</li> <li>• Training /capacity building</li> <li>• Awareness on reality</li> <li>• Training on agribusiness skills</li> </ul>	<ul style="list-style-type: none"> <li>• Better group organization/management</li> </ul>	<ul style="list-style-type: none"> <li>• Training of groups/cooperatives</li> </ul>

	<ul style="list-style-type: none"> <li>• Some farmers are over ambitious</li> <li>• Expectation to sell at high prices</li> <li>• Agribusiness skills lacking</li> </ul>			
<b>5. Regulatory/policy</b>	<ul style="list-style-type: none"> <li>• Lack of adequate policies</li> <li>• Lack of implementation of policies</li> <li>• Inadequate funding in agricultural sector</li> </ul>	<ul style="list-style-type: none"> <li>• Develop and implement policies</li> <li>• Alternative source of funding</li> </ul>	<ul style="list-style-type: none"> <li>• Development of better policies</li> <li>• Implementation of policies</li> </ul>	<ul style="list-style-type: none"> <li>• Policy formulation and briefs</li> <li>• Source funds through PPP</li> </ul>
<b>6. Finance</b>	<ul style="list-style-type: none"> <li>• Lack of funding for</li> <li>• Research and</li> <li>• Dissemination of findings</li> <li>• Poor access to loans by small scale farmers</li> <li>• Poor access to loans by processors due to lack of safe collateral</li> <li>• High interest rates on loans</li> <li>• Lack of gender inclusiveness in decision making</li> </ul>	<ul style="list-style-type: none"> <li>• Sponsorship</li> <li>• Dissemination of findings</li> <li>• Form groups to access loans</li> <li>• Both gender to be included in training</li> </ul>	<ul style="list-style-type: none"> <li>• Banking services and availability of pro-poor funds/grants</li> </ul>	<ul style="list-style-type: none"> <li>• Sourcing of affordable credit/grants providers</li> </ul>

**Table 4. Kenya. Bambara groundnut Constraints, Opportunities, Solutions and Action**

Topic	Value chain constraint	Solutions	Opportunities	Action (order of priority)
<b>1. Market access/consumer demand</b>	<ul style="list-style-type: none"> <li>Insufficient &amp; non consistent supply</li> </ul>	<ul style="list-style-type: none"> <li>Demand for Bambara products exist</li> </ul>	<ul style="list-style-type: none"> <li>Enhance production &amp; productivity (High-yielding varieties, increase acreage etc.)</li> <li>Intensify/innovative extension</li> </ul>	<ul style="list-style-type: none"> <li>Sensitize farmers on Bambara groundnut growing (2)</li> <li>Link farmers to market (3)</li> <li>Market survey (dd &amp; ss, prices, seasons, sources, outlets etc. (1)</li> </ul>
	<ul style="list-style-type: none"> <li>Limited knowledge on the product &amp; on its utilization</li> </ul>	<ul style="list-style-type: none"> <li>Willingness of Technology uptake high</li> <li>ICT available</li> </ul>	<ul style="list-style-type: none"> <li>Enhance Capacity building of the VC actors</li> </ul>	<ul style="list-style-type: none"> <li>Develop curriculum for various value chain actors (2)</li> <li>Awareness creation (1)</li> <li>Trainings (3)</li> <li>Develop ICT platforms (4)</li> </ul>
	<ul style="list-style-type: none"> <li>Product available only in selected rural market centres</li> </ul>	<ul style="list-style-type: none"> <li>Existence of other rural/urban markets &amp; market segments/channels</li> </ul>	<ul style="list-style-type: none"> <li>Streamline marketing channels</li> <li>Enhance market information systems</li> </ul>	<ul style="list-style-type: none"> <li>Market survey to assess size, type &amp; location (mapping) (1)</li> <li>Awareness creation on nutritional/health benefits (2)</li> </ul>
	<ul style="list-style-type: none"> <li>Quality standards not in place</li> </ul>	<ul style="list-style-type: none"> <li>Institutional capacity exist (e.g KeBs, Kephis, PPB)</li> </ul>	<ul style="list-style-type: none"> <li>Develop standards</li> </ul>	<ul style="list-style-type: none"> <li>Convene value chain forums (1)</li> <li>Create linkages &amp; networks (2)</li> </ul>

Topic	Value chain constraint	Solutions	Opportunities	Action (order of priority)
<b>2. Input supply: seeds, fertilizers, pesticides, etc</b>	<ul style="list-style-type: none"> <li>Limited information on landraces available.</li> <li>Low quality/quantity planting material/seed</li> </ul>	<ul style="list-style-type: none"> <li>Demand for quality seeds exist</li> <li>Stockists' networks exist</li> <li>Strong seed supply systems exist</li> <li>Research capacity exist</li> </ul>	<ul style="list-style-type: none"> <li>characterization of available landraces</li> <li>Develop certified seed</li> <li>Seed bulking with selected, trained growers</li> </ul>	<ul style="list-style-type: none"> <li>Develop improved varieties for different <b>AEZs</b> (2)</li> <li>Seed bulking with growers (3)</li> <li>Entice seed companies (4)</li> <li>Develop competitive research protocols (1)</li> </ul>
	<ul style="list-style-type: none"> <li>Limited access to agro-inputs</li> </ul>	<ul style="list-style-type: none"> <li>Devolved government structures</li> </ul>	<ul style="list-style-type: none"> <li>Introduce subsidy programmes, improve infrastructures etc.</li> </ul>	<ul style="list-style-type: none"> <li>Sensitize county government on Bambara (1)</li> </ul>
<b>3. Agronomy/technology/ product development</b>	<ul style="list-style-type: none"> <li>No agronomic package available, fertilizer regime, planting calendar, seed rate, crop protection, post harvest handling, etc.</li> </ul>	<ul style="list-style-type: none"> <li>Robust research</li> <li>Extension systems in place &amp; well distributed</li> </ul>	<ul style="list-style-type: none"> <li>Develop suitable agronomic package (ITK considered)</li> <li>Capacity building &amp; awareness creation</li> </ul>	<ul style="list-style-type: none"> <li>Conduct adaptive research &amp; recommend (1)</li> <li>Develop training &amp; extension manuals (3)</li> <li>Review &amp; include NUS in school curriculum (4)</li> <li>Package &amp; disseminate technologies (2)</li> </ul>
	<ul style="list-style-type: none"> <li>Rudimentary Processing technologies</li> </ul>	<ul style="list-style-type: none"> <li>Appropriate processing technologies exist</li> </ul>	<ul style="list-style-type: none"> <li>Product development</li> <li>Enhance cottage industries</li> </ul>	<ul style="list-style-type: none"> <li>Validate the processing technologies (1)</li> <li>Fabricate processing equipment (2)</li> </ul>

	<ul style="list-style-type: none"> <li>Limited end products</li> </ul>	<ul style="list-style-type: none"> <li>Diversity of Bambara products exists</li> </ul>	<ul style="list-style-type: none"> <li>Research on product development for product diversification</li> <li>Dissemination on product diversification</li> </ul>	<ul style="list-style-type: none"> <li>Test &amp; validate diversified products for taste &amp; consumer preference (1)</li> <li>Diversify culinary options (2)</li> </ul>
	<ul style="list-style-type: none"> <li>Lack of/ poor packaging technologies</li> </ul>	<ul style="list-style-type: none"> <li>Packaging institutions exist &amp; personnel</li> </ul>	<ul style="list-style-type: none"> <li>Develop/design packages for different markets</li> </ul>	<ul style="list-style-type: none"> <li>Carry market need assessment (1)</li> <li>Feasibility study (2)</li> </ul>

Topic	Value chain constraint	Solutions	Opportunities	Action (order of priority)
<b>4. Organization/ management</b>	<ul style="list-style-type: none"> <li>Farmers not organized in formal/commercial groups</li> <li>Disjointed/uncoordinated value chain actors</li> </ul>	<ul style="list-style-type: none"> <li>Existence of farmer groups, merry go round, CBOs, FBOs</li> <li>Value chain/ stakeholder forum exist</li> </ul>	<ul style="list-style-type: none"> <li>Adopt commercial village model/innovation platforms</li> <li>Form/strengthen farmer groups into commercial entities</li> <li>Enhance Public-Private-Partnerships</li> </ul>	<ul style="list-style-type: none"> <li>Capacity needs assessment (1)</li> <li>Capacity build on gaps (2)</li> <li>Develop upgrading strategy (3)</li> <li>Upgrade/strengthen the value chains (4)</li> </ul>
<b>5. Regulatory/policy</b>	<ul style="list-style-type: none"> <li>Low emphasis on Bambara in the nuts policy</li> </ul>	<ul style="list-style-type: none"> <li>Draft oil &amp; nut policy &amp; other relevant policies in place</li> </ul>	<ul style="list-style-type: none"> <li>Awareness creation</li> <li>Sensitize &amp; seek collaborative activities with county governments on NUS</li> <li>Advocacy for greater emphasis of Bambara in the policy</li> </ul>	<ul style="list-style-type: none"> <li>Capacity building (3)</li> <li>Sensitization (1)</li> <li>Lobbying &amp; advocacy for Bambara inclusion (2)</li> </ul>

	<ul style="list-style-type: none"> <li>• No standards for Bambara products</li> </ul>	<ul style="list-style-type: none"> <li>• Institutions exist</li> </ul>	<ul style="list-style-type: none"> <li>• Create awareness among the chain actors &amp; engage regulators e.g KeBS</li> </ul>	<ul style="list-style-type: none"> <li>• Capacity building (3)</li> <li>• Sensitization (1)</li> <li>• Lobbying &amp; advocacy for Bambara inclusion (2)</li> </ul>
	<ul style="list-style-type: none"> <li>• Seed – no regulation in place</li> </ul>	<ul style="list-style-type: none"> <li>• Stakeholders &amp; institutions exist</li> <li>• Political will exist</li> </ul>	<ul style="list-style-type: none"> <li>• Advocacy on Bambara</li> </ul>	<ul style="list-style-type: none"> <li>• Capacity building (3)</li> <li>• Sensitization (1)</li> <li>• Lobbying &amp; advocacy for Bambara inclusion (2)</li> </ul>
<b>6. Finance</b>	<ul style="list-style-type: none"> <li>• Lack of friendly credit package for Bambara farmers</li> </ul>	<ul style="list-style-type: none"> <li>• Credit institutions exist</li> <li>• Funds &amp; funding agencies exist</li> </ul>	<ul style="list-style-type: none"> <li>• Partner with selected credit institutions &amp; develop a credit package for Bambara production</li> </ul>	<ul style="list-style-type: none"> <li>• Lobby for Bambara-friendly terms (2)</li> <li>• Develop competitive grant protocols (1)</li> </ul>

## Benin: Analysis of Bambara groundnut and amaranth value chains

Table 5. Benin: Bambara groundnut value chain analysis: constraints and solutions

Type	Value chain constraint	Solutions
<b>1. Consumer demand, market access</b>	<ul style="list-style-type: none"> <li>Présence de substances anti nutritionnelles (Indigestion, maux de hanche, Infécondité etc.)</li> </ul>	<ul style="list-style-type: none"> <li>Documentation des perceptions des consommateurs</li> <li>Identification des anti nutriments responsables des différents maux</li> <li>Création des variétés à faible concentration en anti nutriments</li> </ul>
	<ul style="list-style-type: none"> <li>Longue durée de cuisson</li> </ul>	<ul style="list-style-type: none"> <li>Identification des variétés traditionnelles et création de nouvelles variétés à courte durée de cuisson</li> </ul>
	<ul style="list-style-type: none"> <li>Faible valorisation des produits du voandzou (mauvaise qualité, Problème d’emballage)</li> </ul>	<ul style="list-style-type: none"> <li>Création des produits dérivés du voandzou</li> <li>Marketing : mettre sur l’emballage “Voandzou 30mn “</li> </ul>
	<ul style="list-style-type: none"> <li>Accessibilité (Cherté, Zone enclavée des producteurs)</li> </ul>	<ul style="list-style-type: none"> <li>Augmentation de la production</li> </ul>
<b>2. Input supply: seeds, fertilizers, pesticides, etc</b>	<ul style="list-style-type: none"> <li>Attaque des graines par les insectes</li> </ul>	<ul style="list-style-type: none"> <li>Amélioration des méthodes de traitement des semences</li> </ul>
	<ul style="list-style-type: none"> <li>Pourriture des semences</li> </ul>	<ul style="list-style-type: none"> <li>Amélioration des méthodes de séchage</li> </ul>
	<ul style="list-style-type: none"> <li>Manque de formulation d’engrais spécifique</li> </ul>	<ul style="list-style-type: none"> <li>Détermination des formulations d’engrais spécifiques</li> </ul>
	<ul style="list-style-type: none"> <li>Manque de pesticides adéquats</li> </ul>	<ul style="list-style-type: none"> <li>Utilisation des extraits aqueux ou pesticides appropriés</li> </ul>
	<ul style="list-style-type: none"> <li>Manque de semences de qualité</li> </ul>	<ul style="list-style-type: none"> <li>Prospection, collecte et caractérisations des variétés traditionnelles du voandzou</li> <li>Mise en place d’un système de production de semences</li> </ul>
<b>3. Agronomy, technology, product development</b>	<ul style="list-style-type: none"> <li>Forte pression parasitaire des insectes et maladies sur le voandzou en pré et post récolte</li> </ul>	<ul style="list-style-type: none"> <li>Mise au point des techniques de lutte intégrée contre les parasites (luttés agronomiques, biologiques)</li> </ul>
	<ul style="list-style-type: none"> <li>Effets du changement climatique (Excès de pluies, sécheresse)</li> </ul>	<ul style="list-style-type: none"> <li>Identification des stratégies d’atténuation des risques ou impacts.</li> </ul>
	<ul style="list-style-type: none"> <li>Faible maîtrise des pratiques culturales</li> </ul>	<ul style="list-style-type: none"> <li>Documentation des pratiques culturales du voandzou</li> <li>Mise au point de nouvelles méthodes culturales pour l’amélioration de la production</li> </ul>
	<ul style="list-style-type: none"> <li>Difficulté de décorticage</li> </ul>	<ul style="list-style-type: none"> <li>Conception de décortiqueuses spécifiques pour le voandzou (PTA, COBEMAG)</li> </ul>

<b>4. Organization, management</b>	<ul style="list-style-type: none"> <li>Mauvaise organisation des producteurs du voandzou</li> </ul>	<ul style="list-style-type: none"> <li>Mise en place de plateforme d'échange des producteurs du voandzou avec une faitière au niveau national</li> </ul>
	<ul style="list-style-type: none"> <li>Non existence de la chaine de valeur du voandzou</li> </ul>	<ul style="list-style-type: none"> <li>Implication des producteurs, des structures d'états (Carder, SONAPRA, INRAB), les ONGs, les transformateurs et les commerçants</li> </ul>

**Table 6. Benin: Bambara groundnut value chain analysis: opportunities and actions needed**

Type	Value chain opportunity	Actions needed
<b>1. Consumer demand, market access</b>		<ul style="list-style-type: none"> <li>Etude du marché (préférence des consommateurs, qualité des produits)</li> <li>Etude de la chaine de valeur dans les plateformes d'innovation</li> </ul>
<b>2. Input supply: seeds, fertilizers, pesticides, etc</b>	<ul style="list-style-type: none"> <li>Existence des structures de production de semences et de distribution des pesticides et engrais pour les autres cultures</li> <li>Existence des structures de recherche et d'encadrement</li> </ul>	<ul style="list-style-type: none"> <li>Mise à disposition des producteurs des semences de qualité (Cycle court, cuisson rapide)</li> <li>Formulation et distribution des engrais et pesticides</li> </ul>
<b>3. Agronomy, technology, product development</b>	<ul style="list-style-type: none"> <li>Existence des variétés locales</li> <li>Disponibilité de l'encadrement des acteurs</li> <li>Existence des structures de recherches technologiques (PTA, SONGHAÏ) et d'équipementiers spécialisés</li> <li>Existence des structures de transformation</li> </ul>	<ul style="list-style-type: none"> <li>Développement des variétés améliorées adaptées aux facteurs biotiques et abiotiques et répondant aux préférences des producteurs et consommateurs.</li> <li>Renforcement de la capacité des agents d'encadrement et chercheurs</li> <li>Développement des équipements pour la réduction du temps de cuisson</li> <li>Mise au point des produits dérivés compétitifs</li> </ul>
<b>4. Organization, management</b>	<ul style="list-style-type: none"> <li>Existence de plateforme au niveau d'autres cultures (PPAAO, COS, DONATA)</li> </ul>	<ul style="list-style-type: none"> <li>Visite d'échange et de partage d'information vers ces plateformes</li> <li>Formation des acteurs et mise en place d'une plateforme d'innovation dans la chaine de valeur de voandzou</li> </ul>

**Bambara groundnut (Voandzou): Thèmes de recherches:**

- Inventaire et caractérisation génétique des variétés de voandzou cultivées au Bénin
- Evaluation agronomique des variétés locales du Bénin vis.à.vis des stress abiotiques (excès hydrique, stress hydrique) et biotiques (ravageurs et maladies)



- Mise au point d'une méthode de lutte intégrée contre les nuisibles du voandzou au champ et en stock
- Détermination des périodes optimales de semis du voandzou dans les zones productrices du Bénin dans un contexte de changement climatique
- Détermination des formules d'engrais chimiques spécifiques pour la production du voandzou
- Amélioration de la productivité du voandzou par l'utilisation des rhizobiums fixateurs d'azote
- Influence de la fertilisation sur l'incidence et la sévérité de quelques ravageurs et maladies majeurs du voandzou
- Influence des types de labour et de la densité de semis sur la productivité du voandzou dans les zones de production du Bénin
- Critères de préférences, Perceptions sur les effets secondaires de la consommation du voandzou et identification des facteurs antinutritionnels mis en jeu.
- Evaluation des valeurs nutritives de quelques produits dérivés du voandzou
- Evaluation des technologies de transformation sur la teneur en substances anti nutritionnelles du voandzou
- Influence des méthodes de conservation sur la viabilité des semences du voandzou au Bénin
- Evaluation des méthodes endogènes de lutte contre les ravageurs pré et post récolte du voandzou
- Influence des différentes méthodes de stockage et de conservation sur la qualité du voandzou

**Table 7. Benin: Amaranth value chain analysis: constraints and solutions**

Type	Value chain constraint	Solutions
<b>1. Consumer demand/market access</b>	<ul style="list-style-type: none"> <li>• Variétés disponibles ne correspondant pas aux préférences des consommateurs (odeur, périssabilité, présence de chenilles sur les feuilles, etc.)</li> </ul>	<ul style="list-style-type: none"> <li>• identification des critères de préférence des consommateurs</li> <li>• Introduction de variétés améliorées répondant aux préférences des consommateurs</li> </ul>
	<ul style="list-style-type: none"> <li>• Manque de produits de transformation</li> </ul>	<ul style="list-style-type: none"> <li>• Développement de produits dérivés</li> <li>• Approche participative pour la promotion et la distribution des produits finis</li> <li>• Création des relations entre les différents acteurs</li> </ul>
	<ul style="list-style-type: none"> <li>• Non disponibilité et fluctuation des prix sur le marché pendant les périodes de sécheresse</li> </ul>	<ul style="list-style-type: none"> <li>• Mise en place de système d'irrigation (motopompe, retenue d'eau, tourniqué, arrosoir)</li> <li>• Culture hors sol</li> </ul>
<b>2. Input supply: seeds, fertilizers, pesticides, etc.</b>	<ul style="list-style-type: none"> <li>• Manque de semences de qualité</li> </ul>	<ul style="list-style-type: none"> <li>• Mise en place d'un système de production semencier</li> <li>• Création de banques de semence communautaires</li> </ul>
	<ul style="list-style-type: none"> <li>• Manque de pesticides spécifiques</li> </ul>	<ul style="list-style-type: none"> <li>• Approvisionnement en pesticides recommandés</li> <li>• Promotion de la lutte biologique</li> </ul>
	<ul style="list-style-type: none"> <li>• Utilisation abusive des engrais et pesticides chimiques</li> </ul>	<ul style="list-style-type: none"> <li>• Formation et sensibilisation des producteurs aux bonnes pratiques de fertilisation et de traitement</li> </ul>

		phytosanitaire
<b>3. Agronomy, technology, production development</b>	<ul style="list-style-type: none"> <li>Méconnaissance de la diversité variétale</li> </ul>	<ul style="list-style-type: none"> <li>Prospection-collecte des variétés locales</li> <li>Caractérisation et évaluation des variétés locales collectées</li> </ul>
	<ul style="list-style-type: none"> <li>Manque de variétés améliorées</li> </ul>	<ul style="list-style-type: none"> <li>Introduction et création de variétés améliorées répondant aux préférences des producteurs et consommateurs</li> </ul>
	<ul style="list-style-type: none"> <li>Attaque des ravageurs et maladies</li> </ul>	<ul style="list-style-type: none"> <li>Mise au point d'une méthode de lutte intégrée contre les maladies et ravageurs</li> </ul>
	<ul style="list-style-type: none"> <li>Présence de résidus de pesticides, de nitrates et de métaux lourds</li> </ul>	<ul style="list-style-type: none"> <li>Promotion des pratiques de l'agriculture biologique</li> <li>Formation et sensibilisation des producteurs aux bonnes pratiques de fertilisation et de traitement phytosanitaire</li> </ul>
	<ul style="list-style-type: none"> <li>Insuffisance des technologies de transformation</li> </ul>	<ul style="list-style-type: none"> <li>Développement de nouvelles technologies de transformation</li> </ul>
<b>4. Organisation &amp; management</b>	<ul style="list-style-type: none"> <li>Inexistence d'une plateforme des acteurs de la filière amarante</li> </ul>	<ul style="list-style-type: none"> <li>Création d'une plateforme des acteurs de la filière amarante</li> </ul>
	<ul style="list-style-type: none"> <li>Faible utilisation de l'amarante dans les études de cas des programmes scolaires</li> </ul>	<ul style="list-style-type: none"> <li>Renforcement de l'utilisation de l'amarante dans les études de cas des programmes scolaires</li> </ul>
	<ul style="list-style-type: none"> <li>Inexistence d'une chaîne de distribution des intrants</li> </ul>	<ul style="list-style-type: none"> <li>Mise en place d'une chaîne de distribution des intrants</li> </ul>
	<ul style="list-style-type: none"> <li>Problème foncier</li> </ul>	<ul style="list-style-type: none"> <li>Mise à disposition des producteurs des sites de production</li> </ul>
	<ul style="list-style-type: none"> <li>Inexistence de stratégie de promotion et de commercialisation</li> </ul>	<ul style="list-style-type: none"> <li>Développement de stratégie de promotion et de commercialisation</li> </ul>
	<ul style="list-style-type: none"> <li>Enclavement des voies d'accès aux zones de production</li> </ul>	<ul style="list-style-type: none"> <li>Construction et réfection des voies d'accès aux zones de production</li> <li>Ouverture de pistes rurales</li> </ul>
<b>5. Regulatory aspects and policy</b>	<ul style="list-style-type: none"> <li>Inexistence de stratégies et de politiques gouvernementales d'accompagnement du secteur</li> </ul>	<ul style="list-style-type: none"> <li>Développement de stratégies et de politiques gouvernementales d'accompagnement du secteur</li> </ul>
	<ul style="list-style-type: none"> <li>Inexistence de normes pour le contrôle des produits dérivés</li> </ul>	<ul style="list-style-type: none"> <li>Elaboration de normes et législations pour le contrôle des produits dérivés</li> </ul>
	<ul style="list-style-type: none"> <li>Inexistence de stratégies de contrôle de la production vis-à-vis des intrants</li> </ul>	<ul style="list-style-type: none"> <li>Mise en place d'un dispositif de contrôle (Normalisation)</li> <li>Développement de stratégies de contrôle de la production vis-à-vis des intrants</li> </ul>
<b>6. Finance</b>		

**Table 8. Benin: Amaranth value chain analysis: opportunities, actions needed and key research topics**

Type	Value chain opportunity	Actions needed
<b>1. Consumer demand/market access</b>	<ul style="list-style-type: none"> <li>• Existence d'une forte demande</li> </ul>	<ul style="list-style-type: none"> <li>• Augmentation de la production</li> <li>• renforcement de la chaîne de transformation</li> </ul>
	<ul style="list-style-type: none"> <li>• Existence de marché d'écoulement</li> </ul>	<ul style="list-style-type: none"> <li>• Développement et promotion de produits dérivés</li> <li>• Création des relations entre les différents acteurs</li> </ul>
<b>2. Input supply: seeds, fertilizers, pesticides, etc.</b>	<ul style="list-style-type: none"> <li>• Disponibilité des acteurs (producteurs, distributeurs, etc.)</li> </ul>	<ul style="list-style-type: none"> <li>• Mise en place de plateforme</li> <li>• Formation et sensibilisation des producteurs aux bonnes pratiques de fertilisation et de traitement phytosanitaire</li> </ul>
	<ul style="list-style-type: none"> <li>• Existence d'institutions de distribution des intrants</li> </ul>	<ul style="list-style-type: none"> <li>• Distribution d'intrants spécifiques</li> </ul>
	<ul style="list-style-type: none"> <li>• Existence de semences de variétés locales</li> </ul>	<ul style="list-style-type: none"> <li>• Mise en place d'un système de production semencière</li> <li>• Création de banques de semences communautaires</li> <li>• Formation des semenciers</li> </ul>
<b>3. Agronomy, technology, production development</b>	<ul style="list-style-type: none"> <li>• Disponibilité de ressources humaines qualifiées</li> </ul>	<ul style="list-style-type: none"> <li>• Renforcement des capacités des ressources humaines</li> </ul>
	<ul style="list-style-type: none"> <li>• Existence d'une diversité variétale</li> </ul>	<ul style="list-style-type: none"> <li>• Sélection et amélioration de variétés</li> </ul>
	<ul style="list-style-type: none"> <li>• Existence de structures de transformation et possibilité de diversification des produits dérivés</li> </ul>	<ul style="list-style-type: none"> <li>• Innovation technologique dans la transformation</li> <li>• formation aux bonnes pratiques d'hygiène (BPH), de conditionnement (BPC) et de contrôle HACCP (Hazard Analysis and Control Critical Point)</li> </ul>
	<ul style="list-style-type: none"> <li>• Existence de consommateurs bio</li> </ul>	<ul style="list-style-type: none"> <li>• Recherche documentaire sur les techniques de production existantes</li> <li>• Promotion de l'agriculture biologique et durable</li> <li>• Formation aux bonnes pratiques agricoles</li> </ul>
	<ul style="list-style-type: none"> <li>• Existence de structures de recherche</li> </ul>	<ul style="list-style-type: none"> <li>• Formation et recherche</li> </ul>
	<ul style="list-style-type: none"> <li>• Existence de système d'irrigation à faible coût</li> </ul>	<ul style="list-style-type: none"> <li>• Adaptation des systèmes d'irrigation existants à la production d'amarante</li> <li>• formation et sensibilisation des maraîchers à l'utilisation des systèmes d'irrigation</li> <li>• Sensibilisation des maraîchers sur</li> </ul>

		la qualité de l'eau à utiliser <ul style="list-style-type: none"> <li>• Recyclage des eaux usées</li> </ul>
<b>4. Organisation &amp; management</b>	<ul style="list-style-type: none"> <li>• Existence des acteurs de la filière</li> </ul>	<ul style="list-style-type: none"> <li>• Création d'une plateforme des acteurs de la filière amarante</li> <li>• Formation des acteurs</li> </ul>
	<ul style="list-style-type: none"> <li>• Existence et flexibilité des unités d'enseignement en économie familiale et jardins scolaires dans les programmes d'étude</li> </ul>	<ul style="list-style-type: none"> <li>• Renforcement de l'utilisation de l'amarante dans les études de cas des programmes scolaires</li> </ul>
	<ul style="list-style-type: none"> <li>• Existence des agences et canaux de communication</li> </ul>	<ul style="list-style-type: none"> <li>• Promotion et commercialisation des produits dérivés</li> </ul>
<b>5. Regulatory aspects and policy</b>	<ul style="list-style-type: none"> <li>• Possibilité de mise à disposition des terres</li> </ul>	<ul style="list-style-type: none"> <li>• Promotion de la culture</li> </ul>
	<ul style="list-style-type: none"> <li>• Existence de structures de contrôle et de normalisation</li> </ul>	<ul style="list-style-type: none"> <li>• Elaboration de notes d'orientations politiques</li> <li>• Elaboration des normes par rapport aux produits dérivés</li> </ul>

#### **Amaranth: Thèmes de recherches**

- Conduire une étude diagnostique sur les critères de préférence des consommateurs
- Développer un modèle de business pour la promotion et la commercialisation des produits dérivés
- Etudier le marché et l'acceptabilité des produits dérivés
- Etudier le système semencier traditionnel
- Prospector et collecter les accessions d'amarante locales
- Etudier les connaissances endogènes et diversité des variétés cultivées au Bénin
- Caractériser les accessions d'amarante collectées (agro-morphologique et moléculaire, physico-chimique)
- Sélectionner des variétés locales performantes dans le contexte du changement climatiques
- Créer des variétés améliorées répondant aux critères de préférence des producteurs et des consommateurs
- Evaluer les performances des variétés introduite
- Comparer les valeurs nutritives des différentes variétés
- Formuler et évaluer sur le plan nutritionnel les produits dérivés
- Tester l'effet de diverses technologies de séchage sur les produits dérivés
- Concevoir des équipements et techniques de transformation accessible et à moindre coût
- Evaluer la durée de conservation des produits dérivés
- Tester différents types d'emballage sur la qualité nutritionnelle et la durée de conservation des produits dérivés
- Evaluer l'effet de la combinaison de l'amarante avec d'autres produits locaux
- Identifier les ravageurs de l'amarante et leurs ennemies naturelles
- Identifier les maladies de l'amarante et les agents causaux
- Etudier la biologie et l'impact des ennemies naturels des principaux ravageurs
- Identifier les plantes à effets insecticides et leur efficacité sur les principaux ravageurs de l'amarante

- Identifier les plantes à effets nématocides et leur efficacité sur les nématodes de l'amarante
- Identifier les plantes à effets fongicides et leur efficacité sur les champignons de l'amarante
- Développer une méthode de lutte intégrée contre les principaux ravageurs et maladies de l'amarante
- Tester l'effet de différents types d'engrais biologique sur la productivité de l'amarante
- Analyser la rentabilité économique et financière des méthodes de lutte intégrée développées
- Analyser la rentabilité économique et financière des engrais biologiques identifiés