INTERGRATING NEGLECTED AND UNDERUTILISED CROP SPECIES IN FOOD PRODUCT DEVELOPMENT

BY

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Outline of Presentation

• Introduction
  • Neglected and underutilised Species
  • Food product development

• Why Neglected and underutilised species
• Food product development
• NUS and Food product development
• Conclusion and summary
Neglected and underutilised Species

• Plants or animals neglected by mainstream agricultural systems and marginalized by consumers.
• More than 6000 NUS are documented
• Some NUS have gained popularity such as
  • Chia, Quinoa, Baobab
  • Mostly through the Health foods market
# Neglected and Underutilised Crops

<table>
<thead>
<tr>
<th>Cereals *</th>
<th>Roots &amp; Tubers</th>
<th>Pulses</th>
<th>Oil Seeds</th>
<th>Fruits &amp; Vegetables</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sorghum</td>
<td>Taro</td>
<td>Cowpeas</td>
<td>Marama beans</td>
<td>Moringa</td>
</tr>
<tr>
<td>Millets</td>
<td>Cassava</td>
<td>Grain</td>
<td></td>
<td>Amaranth</td>
</tr>
<tr>
<td>Quinoa</td>
<td>Livingstone potato</td>
<td>Lentil</td>
<td></td>
<td>Roselle</td>
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<tr>
<td>Amaranthus</td>
<td>Amaranthus amaranth</td>
<td></td>
<td></td>
<td>Pumpkins</td>
</tr>
<tr>
<td>Chia</td>
<td></td>
<td></td>
<td></td>
<td>Boabab</td>
</tr>
</tbody>
</table>

*DO NOT COPY*
Neglected and underutilised Crops

• NUS are adapted to low input agricultural systems and marginal environments, hence may offer:
  • Resilience against climate change,
  • Enhance food security and reduce malnutrition in food systems
  • Stabilize crop diversity.

• NUS include cultivated and wild species
  • Increased utilization of the wild species requires increased production, which has proved successful in some species e.g. Moringa,
  • While other’s are still gathered from the wild. E.g boabab- Sustainable sourcing is critical
WHY THE INTEREST IN NUS?

• Growing world population and hunger- Zero hunger by 2030
  • Climate change negatively affecting conventional crops
  • Dwindling production resources
  • Need to harness the diversity of edible resources to feed the population
  • Economic inclusion of local communities producing or sourcing NUS
WHY THE INTEREST IN NUS?

• Concerns over declining crop and animal diversity worldwide
  ➢ Overreliance on ‘major crops’ and neglecting of other crops including NUS in research, genetic preservation and domestication

• Emerging urban and environmentally conscious consumer
  ➢ NUS are resilient to climate change
  ➢ Low input requirement
  ➢ Sustainable and ethical sourcing of food
WHY THE INTEREST IN NUS?

• Demand for healthy foods and healthier alternatives
  ➢ Consumers are aware of the link between food and health
  ➢ Rise of functional foods
• Food and nutrition security
  ➢ Major crops failing to provide sustainable nutrition, NUS to contribute to dietary diversity
  ➢ Dietary diversity to meet nutritional gap due to emphasis of selected staples
• Demand of novelty products
WHY THE INTEREST IN NUS?

• Integrating NUS in food product development would be key in driving the commercialisation of these species.

• Commercial food products would create a sustainable demand for the raw materials, which is one of the key factors that local farmers consider on whether to increase production or not.
New Food Product Development

• Designing and developing food products aimed at meeting specific consumer needs.
• The process involves new or alternative ingredients, processes, packaging or product positioning.
• New food products, are described on a spectrum from “new to this world” to “cost reduction” and reformulations.
New Food Products

• About 15 000 new food products are launched on the market annually.
• Of which more than 80% fail.
• Food technologists explore raw materials and ingredients that respond to consumer trends such as:
  • Flexitarian diet (vegan protein drinks, Plant meat Substitutes e.g. Beyond meat)
  • Sustainable and ethical sourcing of ingredients
  • Health
  • Natural ingredients
NUS and New Food Product Development

• Considering the prevailing food trends, NUS seem to be an obvious choice for new product development.

• The internet provides anecdotal claims of health benefits of ingredients from underutilized species.

• The challenge comes when a product developer starts to look for specific information.
NUS and New Food Product Development

• Comprehensive scientific evidence on:
• Production and supply chain
• Raw materials
  • Nutrient composition
  • Functional Properties
  • Sensory Properties
  • Nutraceutical properties
  • Processing methods and parameters
  • Recipes for utilization
• Trade and regulatory requirements
• Consumer Preference
The Case of Bambara groundnuts

- Bambara groundnut (*Vigna subterranea Verdc*) is a legume planted in hot, dry areas where growing other pulses is risky.
- The crop is grown mainly by women farmers for subsistence and sundry sales. It is an important source of income for women and provides essential protein to a carbohydrate-based diet.
- The McKnight foundation has supported Bambara development work in Malawi, Mozambique & Tanzania since 2009 to date.
- The aim of this phase was to develop and grow bambara markets for nutrition in the
Production and Supply Chain of Bambara

- Relative cost of nutrients and functionality in comparison to conventional crops.
- NUS raw materials or ingredients tend to have higher unit cost when compared to alternative conventional raw materials due to:
  - Low productivity attributed to underdeveloped production practices.
  - Value chains for these materials are undeveloped presenting a challenge in consistency of supply and quality of raw materials for innovative processors.
- Variability in supply:
  - Seasonal availability of raw materials
  - Quality and grades
Production and Supply Chain of Bambara

- **Agronomy and breeding**
- Preliminary Variety Trials (8 Entries), On Farm participatory variety selection (6 Entries) and Advanced Variety Trial (6 Entries)
- PVS and Demonstration plots for agronomic practices and released varieties involved 1200, 2500 and 3200 farmers in Mozambique, Malawi and Tanzania Respectively.
- Varieties have been released in Tanzania (6), Malawi(4) and Mozambique (2)
Production and Supply Chain of Bambara

• Markets and postharvest

• Increased production have brought new challenges for the farmers:
  • Harvest practices
  • Postharvest handling – Shelling
  • Storage

• Farmers, extension staff and grain sellers were trained on the use of PICS bags for storage of Bambara groundnuts, so that they can store and sell Bambara at any convenient time.

• Commodity traders are yet to include bambara, affecting the demand
Composition Data for Bambara

• The Malawi Food composition database, currently contain information on nutrient composition of raw Bambara
  • Recipes
  • Micronutrients

• Most NUS are good sources of:
  • micronutrients- Calcium
  • rich in dietary fibre,
  • healthy lipids,
Neutraceutical/Functional properties of some Bambara

• Most NUS are good sources of neutraceutical/functional components that provide health benefits in addition to the energy and nutrients.
• These are the properties that are also driving the health food trends among emerging urban and environmentally conscious consumers.
• Anthocyanins, phenolic acids, Flavonoids
• Resistant and slowly digested starch
Flavonoids and tannin composition of Bambara groundnut (Vigna subterranea) of Mpumalanga, South Africa

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Abstract

Bambara groundnut (Vigna subterranea) an indigenous legume proclaimed to have anti-nutritional properties such as high levels of tannin and flavonoids. Studies have demonstrated the potential of flavonoids and tannin to be effective in ameliorating the anti-nutritional properties of Bambara groundnut. In the study reported here, flavonoids and tannin composition of Bambara groundnut (Vigna subterranea) from Mpumalanga, a province in South Africa, were investigated. Aflatoxin was also measured as a proxy for aflatoxin contamination. Flavonoids were extracted from groundnut flour using methanol and the flavonoids were isolated using preparative thin layer chromatography. The flavonoids were identified using mass spectrometry and confirmed using spectrophotometry. The total flavonoid content of the flour was 195.8 mg 100 g−1. Of these total flavonoids, 93% were identified as myricetin. Tannin extraction was carried out using a mixture of methanol and water. The total tannin content of the flour was 12.4 mg 100 g−1. Aflatoxin levels were determined using HPTLC. The aflatoxin levels in the flour were below the maximum level of 20 µg kg−1 as per the South African food standard. These findings are important as they identify potential anti-nutritional properties and determine the health benefits that this vegetable can offer.
Functional Properties and modifications

• Inclusion of Bambara as an ingredient, requires characterization of the physical and functional properties of the flour, starch and protein fractions.

• In addition, modification for further development is required to suit specific applications.

• Conventional or emerging food processing technologies can also enhance product functionality, stability, safety, appearance and acceptance.
Consumer perspectives of Bambara materials and ingredients

• Consumer education on the NUS, especially on materials, sensory properties and benefits
• Inferior by traditional consumers; in comparison with conventional materials
• Safe due to non intensive production system
• Consumers require NUS ingredients to deliver much more than conventional ingredients.
  • Nutritional value
Recipes & Utilisation

• Traditional recipes are mostly with the Indigenous knowledge domain

• Standardised recipes

• Innovative products, ie non traditional use that would easily appeal to non traditional consumers.

• Most internet blogs discussing NUS/Super foods/Future foods includes recipes

• Bioversity Neglected and Underutilised Species Community: http://www.nuscommunity.org/
Recipes & Utilisation

• Farmer and food service providers were trained on bambara groundnut recipes in Tanzania, Malawi and Mozambique.
• Cooking characteristics of bambara have been determined.
• Consumer preference of bambara dishes in all the 3 countries.
Promoting Bambara Groundnuts in Food Service Units

- This particular study was conducted in 11 local restaurants in Mzimba (5 Units), Ntchisi (4 Units), and Area 13 market in Lilongwe (2 units) district that serve various traditional meals and were willing to participate in the study.
- A total of 210 consumers participated in the study, 75 each in Mzimba and Ntchisi and 60 in Lilongwe.
- The short questionnaire on consumer knowledge of bambara groundnuts, 5 point hedonic scoring on sensory properties and willingness to order that dish if it were available on the menu. Since the questionnaire was administered during lunch hour, care was taken to limit the interview to 20 minutes at most.
Promoting Bambara Groundnuts in Food Service Units

• Bambara groundnut was not featured on the regular menu in all the participating restaurants because it’s not readily available and common beans (*Phaseolus vulgaris*) were the dominant pulse on the menu.

• There is an emerging trend of interest in traditional indigenous foods in the country, with a number of upscale restaurants carrying traditional meals on designated days.
Promoting Bambara Groundnuts in Food Service Units

Restaurant consumer (%) hedonic scoring of bambara groundnut relish in Lilongwe, Mzimba and Ntchisi districts (N=210)

<table>
<thead>
<tr>
<th>Hedonic scale</th>
<th>Colour</th>
<th>Grain size</th>
<th>Broth</th>
<th>Smell</th>
<th>Taste</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dislike alot</td>
<td>0.95</td>
<td>0</td>
<td>4.28</td>
<td>2.38</td>
<td>0.95</td>
</tr>
<tr>
<td>Dislike</td>
<td>4.28</td>
<td>5.71</td>
<td>6.19</td>
<td>3.33</td>
<td>4.28</td>
</tr>
<tr>
<td>Neither like or dislike</td>
<td>5.23</td>
<td>10.00</td>
<td>8.57</td>
<td>6.67</td>
<td>4.28</td>
</tr>
<tr>
<td>Like</td>
<td>20.95</td>
<td>6.19</td>
<td>10.95</td>
<td>15.71</td>
<td>14.76</td>
</tr>
<tr>
<td>Like alot</td>
<td>68.67</td>
<td>73.81</td>
<td>69.52</td>
<td>72.38</td>
<td>75.71</td>
</tr>
</tbody>
</table>
Promoting bambara groundnuts on the retail market

• Growth of the market
  • Retail marketing of Bambara

• TV and radio programs to raise awareness

• Trade and Agricultural fair participation
  - Leaflets of bambara recipes were distributed
Promoting NUS in Non Traditional areas

• In traditionally consuming areas NUS are mainly consumed whole or minimally processed by culinary preparation.

• This traditional forms is not likely to be adapted by western markets and emerging urban consumers

• There is need for innovation to transform such ingredients into familiar products that align with consumer trends
Promoting NUS in Non Traditional areas

• Innovative marketing is required to augment health and novel properties of food containing Bambara.

• The need to engage champions would be instrumental in moving underutilized ingredients from pariah to limelight status.
Trade and regulatory Requirements

• Trade and regulatory requirements for utilization of underutilized ingredients when such products are promoted outside the traditional area of consumption. E.g. EU

• analytical data and methodology;

• intake estimate

• Toxicology & allergenicity

• Safety - Mycotoxins
Conclusions

• Therefore, integrating NUS derived ingredients in food product development will require concerted value chain research including production, processing, marketing, legislation, consumer demands and preferences.

• Linkage of scientific and traditional knowledge systems is necessary to influence consumer preference and demand, which determine food products success on the market.
Thank You

Partners

Malawi

IIAM

Tanzania

Natural Resources Institute

United Kingdom

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Isabel Banda