Promotion of Underutilized Food Plants in Sub-Saharan Africa: Experiences with African Leafy Vegetables

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Sub-Saharan Africa – an introduction

- Sub-Saharan countries are below the Sahara Desert
• Agricultural output has been trailing population growth for most of the last three decades (FAO, 2002).
• World average has been increasing
Vegetable and fruit consumption

- Vegetable and fruit consumption per capita less than that of the rest of the world and declining.
- In 1995, per capita consumption of vegetable was 29 kg (average for the world was 75.3 kg and China had 146 kg).
Low micronutrient intake

- High prevalence (2/3 of population) of Mineral and Vitamin deficiency especially Iron, Zinc, Selenium, Vitamin A
- High prevalence of micronutrient deficiency related diseases – Anaemia, blindness etc.
- An estimated 42.2% of children in SSA at risk of Vitamin A Deficiency (VAD) (Aguayo, V. 2003)
Diseases complicating situation

- Malaria and HIV/AIDS – Major challenges for Sub-Saharan Africa (SSA)
- Region is home to close to two-thirds of all people living with HIV! Yet it has just over 10% of the world's population,
- 90% of all new cases of malaria worldwide (300-500 million) found in SSA (Episcopal 2004)
Eating habits are changing

- High intake of fatty foods and refined carbohydrates
- Result: increased incidences of obesity, diabetes, cardiovascular diseases, high blood pressure and cancer – all previously rare in SSA
- Urban areas most affected
Exotic vegetables are preferred

- Increasing preference for a few exotic vegetables – mainly white cabbage
Can African Leafy Vegetables (ALVs) make a difference?

• Yes!
Good sources of micronutrients

- Pro-vitamin A (β-carotene)
- Vitamin C
- Folate
- Iron
- Calcium
- Fibre
- Protein
Comparison of the nutritional content of amaranth and cabbage
B-carotene in vegetables is bio-available

Bioavailability of β-carotene depends on the species and the processing method

<table>
<thead>
<tr>
<th>Cooked sample</th>
<th>Amount (µg/g d.m.)</th>
<th>(µg/g d.m.)</th>
<th>In vitro accessibility (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cleome gynandra</td>
<td>857</td>
<td>69</td>
<td>8</td>
</tr>
<tr>
<td>+ oil (46%)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Vigna unguiculata</td>
<td>502</td>
<td>43</td>
<td>9</td>
</tr>
<tr>
<td>+ oil (34%)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Amaranthus sp.</td>
<td>415</td>
<td>37</td>
<td>9</td>
</tr>
<tr>
<td>+ oil (25%)</td>
<td>411</td>
<td>72</td>
<td>18</td>
</tr>
</tbody>
</table>

A high diversity of nutritious vegetables

- SSA has a high diversity of leafy vegetables
- About 1000 species are used traditionally
Huge diversity of plant food

• One out of every ten species of Afriaca’s 45,000 higher flora has food value
Leafy vegetables may form as much as 20% of edible plant species in SSA.
African leafy vegetables cont..
African leafy vegetables

Cassava leaves are important in the Congo basin

The spider plant is important in East and Southern Africa
Moringa oleifera
(horse-radish tree)

- Moringa leaves are particularly important in Senegal.
African leafy vegetables

Cowpea

- Bissap (*Hibiscus sabdariffa*) - important in Senegal
Roselle (*Hibiscus sabdariffa*)

- Different types are used in different recipes
Nightshades

- African nightshades are popular vegetables.
African leafy vegetables cont..

Pumpkin

Amaranth

Crotalaria
Why Traditional Vegetables?

Traditional leafy vegetables are accessible!

- locally available,
- affordable
- local knowledge and expertise among local communities exist.
Constraints

- Lack of data (research lagging behind)
- Seed system not developed
- Most grow in the wild – regarded as weeds
- Leaves small hence processing is labour intensive
- Usually bitter, cooking for too long, –Picked from dirty places
- Sold in dirty places
- Attitude – poor mans food, associated with backwardness
- High post harvest losses
Why traditional vegetables cont..

Genetic Diversity is high at the village Level

- Cowpea germplasm - Kyanika Women’s group, Kenya
- 22 landraces
Constraints cont..
Improving handling and processing of ALVs

• Large quantities of vegetables are lost due to poor handling.
African leafy vegetable programme

- Implemented since 1996
- Phase I (1996-1999)
- Phase II (2001-2004)
First phase:

- understanding the species used
- documenting indigenous knowledge
- identifying key constraints in the conservation, production, marketing and consumption
- identifying priority species for conservation and use
Priority species

• 22 priority species were identified
Phase II

- Germplasm collection and ex situ conservation
- Participatory characterization
- Participatory selections
- Seed supply
- Consumption (recipes)
- Marketing
- Agronomy
- Nutritional analysis
- Taxonomy
The partners – 10 countries and over 40 institutions

- Botswana
- Zimbabwe
- Cameroon
- Senegal
- South Africa
- Uganda
- Tanzania
- Zambia
- Ghana
- Togo
- Benin
- Botswana
- Zimbabwe
- South Africa
Enhancing quality of genetic material of priority ALVs

- Germplasm characterization, evaluation and selection

This selected variety of *Solanum scabrum* can yield up to 40 tonnes per ha.
Building capacity:

- Characterization and selection work at - AVRDC, Tanzania
## Opportunities for Higher Nutritional Benefits

Mean Composition per 100 Gram Edible Portion of Selected Traditional Leafy Vegetables Compared with Cabbage

<table>
<thead>
<tr>
<th>Nutrient</th>
<th>Amaranth (Mchicha)</th>
<th>Spiderplant (Mwangani)</th>
<th>African nightshade (Mnavu)</th>
<th>Cabbage (Kabiji)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Moisture (water) (gram)</td>
<td>84</td>
<td>86.6</td>
<td>87.2</td>
<td>91.4</td>
</tr>
<tr>
<td>Iron (milligram)</td>
<td>8.9</td>
<td>6.0</td>
<td>1.0</td>
<td>0.7</td>
</tr>
<tr>
<td>Protein (gram)</td>
<td>4.6</td>
<td>4.8</td>
<td>4.3</td>
<td>1.7</td>
</tr>
<tr>
<td>Calories</td>
<td>42</td>
<td>34</td>
<td>38</td>
<td>26</td>
</tr>
<tr>
<td>Carbohydrates (gram)</td>
<td>8.2</td>
<td>5.2</td>
<td>5.7</td>
<td>6.0</td>
</tr>
<tr>
<td>Fibre (gram)</td>
<td>1.8</td>
<td>1.4</td>
<td>1.3</td>
<td>1.2</td>
</tr>
<tr>
<td>Ascorbic acid (Vit. C) (milligram)</td>
<td>64</td>
<td>13</td>
<td>20</td>
<td>54</td>
</tr>
<tr>
<td>Calcium (milligram)</td>
<td>410</td>
<td>288</td>
<td>442</td>
<td>47</td>
</tr>
<tr>
<td>Phosphorus (milligram)</td>
<td>103</td>
<td>111</td>
<td>75</td>
<td>40</td>
</tr>
<tr>
<td>*B-carotene (microgram)</td>
<td>5716</td>
<td>10452</td>
<td>3660</td>
<td>100</td>
</tr>
<tr>
<td>Thiamine (Vit. B₁) (milligram)</td>
<td>0.05</td>
<td>-</td>
<td>-</td>
<td>0.04</td>
</tr>
<tr>
<td>Riboflavin (Vit. B₂) (milligram)</td>
<td>0.42</td>
<td>-</td>
<td>0.59</td>
<td>0.1</td>
</tr>
</tbody>
</table>

*Note: B-carotene is Vitamin A precursor

Supported by International Plant Genetic Resources Institute (IPGRI). This chart is available at Kenya Resource Centre for Indigenous Knowledge (KENRIK), National Museums of Kenya. P.O Box 48458 Nairobi, Kenya. Tel: 3741673. Email: info@kenrik.org
The taxonomic position of this species is yet to be finalized. It is restricted to the Kenyan highlands and highlands in northern Tanzania.
4. Kenya

1. Characterization work
*Solanum* spp. in Kari-Kisii
*Amaranthus* spp. in Gene Bank
Characterization and selection - Senegal

- Characterization and Selection work
- Output: Farmers’ seeds
Increasing yield through selection

- Production of up to 40 tonnes per hectare has been achieved
Linking farmers with the markets...

- Working in partnership with a local NGO, farmers have been linked to formal markets.
Processing seeds of Vernonia amygdalina
Indigenous Knowledge documentation

IK documentation in Kitui

- Documenting cowpea local knowledge (Kyanika)
Senegal: Characterization and selection of *Hibiscus sabdariffa*

- Dried calyxes
- Leaves

Characterization and selection of *Hibiscus sabdariffa*
Characterization of Amaranths
Outcomes/outputs

1. Attitude changed
2. Consumption increased and demand created
Outcomes cont..

- Eight vegetable species introduced in leading supermarkets
Outcomes
1. The incomes of close to 300 farmers that were monitored increased two to twenty fold.

2. Produce delivered by these farmers increasing from 31 to 400 tons a month. Demand still far from being met.
Products...

- *Species monographs*
- Bibliography (Mnzava *et al*)
- Recipe book
- Extension material
- Public awareness material
Challenges for the Future

• Research on Toxicity of some – determine safe levels of some- *Solanum*, *Crotalaria*, *Erythrococca*

• Research in bioavailability
Challenges cont.:

_We are losing the custodians of Indigenous knowledge_
Conclusion

- African leafy vegetables (ALVs) and underutilized species in general have potential to contribute to poverty alleviation in Africa.

- ALVs are a rich source of micronutrients, and can help ease the current vitamin and mineral deficiencies in SSA.
Conclusion cont...

• Develop irrigation
• Influence policies
Dietary diversity programme
Dietary diversification
Dietary diversification
Dietary diversification

Lye

Fruits
Dietary diversification
Sponsors of this work

Sponsors:

- Directorate General for International Cooperation (DGIS) of the Netherlands
- IDRC
Thank You!