How to maximize useful diversity of rice bean and other UPS for the well-being of people: some inputs for next phase

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Outline

✓ Purpose

✓ How to realize their potential for people’s well being

✓ Emerging reality “Use it or lose it”

✓ Grassroots breeding

✓ New ways of marketing

✓ Take home messages
Species diversity of neglected and underutilized crops in home gardens!
Biodiversity shapes food culture = NUS = dietary diversity = nutrition and health

Vietnam

Thailand

Morocco

India

China

Nepal
Context of the presentation

This asset however is being lost or not used optimally because it is not properly understood, valued and/or managed, either by the rural poor themselves or by other service providers (Bioversity, 2006).

Despite great success in conservation (ex situ and in situ) and modern plant breeding, many poor farmers in marginal areas have not benefited from such interventions (Tripp, 2001; Bellon, 2006).
Emerging Reality

- We will never ever have sufficient resources to do plant breeding in all crops for all conditions! –e.g. NUS

- What are the challenges and opportunities for making underutilized plant species research targeted, relevant and appropriate to those poor farmers?

- How to realize their future potential of NUS for people’s livelihoods?
Key questions of understanding local context of underutilized plant species

1. What do we have?
2. What we value most?
3. How do we manage?
4. How do we use?
5. Who maintains diversity and how?
6. What are factors that influencing our decisions to maintain and use?
7. What are practical interventions that support both livelihood gains and conservation costs?

Strengthening local capacity
Entry point: Farmer seed system function

Germlasm base
  – diversity, flexibility, selection

Seed production and quality
  – germination, vigor, disease problems, quantity

Seed availability and distribution
  – seed sources, networks, markets

Knowledge and information
  – adaptation, growing methods, utilization, knowledge of new materials, traits trade off
Consolidating role of farmers as conservers, promoters of diversity and as dynamic Innovators ??

Basic concerns:(1) ACCESS;(2) IPR;(3) MARKET;(4) BIOSAFETY (Sajise et al., 2007)
Strategic decisions: Empowering community for setting development and conservation agenda

- On-farm conservation
  - Improve access
  - Improve materials
  - Value addition
  - Market links

- Large area; Many HHs
- Large area; Few HHs
- Small area; Many HHs
- Small area; Few HHs

- CBR
  - Ex situ conservation

- Recognition

- Improve materials
- Value addition
- Market links
Case 1: Improved access to unique materials and information to wider groups

*Luffa cylindrica L.* Traits: aroma, taste, delayed net

<table>
<thead>
<tr>
<th>Improved access by community actions; many examples</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>1998</strong> Rare</td>
</tr>
<tr>
<td><strong>2002</strong> Common</td>
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</tbody>
</table>

**Good practices**
- Diversity fairs
- Diversity blocks
- Diversity kits
- CBR
- Community seed bank

<table>
<thead>
<tr>
<th>Year</th>
<th>Action</th>
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<tbody>
<tr>
<td>1998</td>
<td>1 HH Diversity fair</td>
</tr>
<tr>
<td>2000</td>
<td>Diversity block 7HH</td>
</tr>
<tr>
<td>2001</td>
<td>70 Diversity kits</td>
</tr>
<tr>
<td>2002</td>
<td>195 HHs</td>
</tr>
</tbody>
</table>
## Comparative differences in breeding process

<table>
<thead>
<tr>
<th>Typology</th>
<th>GB</th>
<th>PVS</th>
<th>PPB</th>
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</thead>
<tbody>
<tr>
<td>Breeding Strategy</td>
<td>Selection from existing diversity of traditional variety by farmers under target environment</td>
<td>Selection amongst fixed lines by farmers under target environment</td>
<td>Selection from segregating lines by farmers under target environment</td>
</tr>
</tbody>
</table>
| Breeding process | 1. Need assessment  
2. Diversity assessment  
3. Selection of market traits  
4. Multiplication & distribution  
5. Monitoring spread | 1. Need assessment  
2. Search  
3. Experimentation  
4. Wider dissemination | 1. Goal setting  
2. Creating variability  
3. Selection of segregating lines under TPE  
4. Testing varieties  
5. Seed supply  
6. Monitoring spread |
| Institutional role | Grassroots | NGO, DoA, NARS | NGO, NARS, CG |
Selection for preferred traits

Trait differentiation

- Trait differentiation and selection
- Seed maintenance and exchange

- Bold grain
- Taste
Process of Grassroots Breeding

1. Conduct diversity fair
   - Locating diversity
2. Conduct market survey
   - Studying farmer/consumer preferred traits
3. Carry out diversity block
   - Assessing genetic diversity
4. Traits selection
5. Support community based seed production and marketing
6. Register new selection by community and make available

- Conducting simple informal variety selection
Enhance local materials by selection

Diversity assessment

Market survey

Selection of preferred traits

Post harvest trait

On-farm testing & Seed production

Production

Marketing
Comparison of GB with various participatory approaches to plant breeding

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</thead>
<tbody>
<tr>
<td>Selection of Source Germplasm</td>
<td>✔️</td>
<td>✔️</td>
<td>✔️</td>
<td>✔️</td>
<td>✔️</td>
<td>✔️</td>
</tr>
<tr>
<td>Trait Development</td>
<td>✔️</td>
<td>✔️</td>
<td>✔️</td>
<td>✔️</td>
<td>✔️</td>
<td>✔️</td>
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<tr>
<td>Cultivar Development</td>
<td>✔️</td>
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<tr>
<td>Varietal Evaluation</td>
<td>✔️</td>
<td>✔️</td>
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</tbody>
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Note: F=Farmer ; S=Scientist. (Source: Modified from Morris and Bellon, 2004)
Why term “grassroots breeding”?  

Focus on two key elements:  

1. It involves grassroots (basic) type of plant breeding  

2. Activities can be led by farmers and grassroots (rural) institutions  

Reaching to unreachable-benefits of conservation and breeding!!
Intervention Strategy

Improve access
Improve the materials
Improve demand of crops by value addition

- Market information (nutritive value, Brand, GI)
- Consumer awareness
- Product development
- Market development
- Market access as novel food
Market research to explore multiple options

<table>
<thead>
<tr>
<th>Existing Products</th>
<th>New products</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Market Penetration</strong> (e.g. dal)</td>
<td><strong>Product Development</strong> (e.g. qwati)</td>
</tr>
<tr>
<td><strong>New Development</strong> (e.g. Batuk; Bara; market ethnic foods)</td>
<td><strong>Diversification</strong> (eg. Health food; fermented food; sauce etc)</td>
</tr>
</tbody>
</table>
Action 1. Market penetration (dal segment) by cleaning, processing and better packaging
Action 2: Marketing scientific information: Intraspecific variability for the content in micronutrients: example of rice cultivars

### Nutrient Table

<table>
<thead>
<tr>
<th>Nutrient</th>
<th>Range</th>
<th>Average</th>
</tr>
</thead>
<tbody>
<tr>
<td>Protein</td>
<td>5.55 – 14.58 g/100g</td>
<td>8.55</td>
</tr>
<tr>
<td>Iron</td>
<td>0.70 – 6.35 mg/100g</td>
<td>2.28</td>
</tr>
<tr>
<td>Zinc</td>
<td>0.79 – 5.89 mg/100g</td>
<td>3.34</td>
</tr>
</tbody>
</table>

### Rice Variety Table

<table>
<thead>
<tr>
<th>Rice Variety</th>
<th>Iron mg/100g</th>
<th>Zinc mg/100g</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ganjay Roozy</td>
<td>2.64</td>
<td>5.89</td>
</tr>
<tr>
<td>Banjaiman</td>
<td>2.27</td>
<td>5.30</td>
</tr>
<tr>
<td>Tsuyake</td>
<td>2.12</td>
<td>4.25</td>
</tr>
<tr>
<td>IR 10198</td>
<td>1.58</td>
<td>3.79</td>
</tr>
<tr>
<td>IR 36</td>
<td>1.01</td>
<td>3.14</td>
</tr>
</tbody>
</table>

High intraspecific variations for the nutrient content

Example: content in iron and zinc of some rice landraces and improved varieties

Intervention: market nutrition information of Ca, Fe and B9
Action 3: **Diversification**: High-value product differentiation for improving farmer incomes and retaining on-farm crop diversity

**Capitalize colour diversity of potatoes in Peru**

**Grain color and size - Horse gram and ricebean**

**Intervention: Market diversity**
Action 3. Promoting innovative product diversification – blending Amaranthus with rice bean as health food
Action 4. Improve income by use of by-products (skins)

Rural farmers

"Value chain concept"

Valued added local products

Income

Urban consumers
Action 6. Capitalize traditional food for new product development

Traditional dish with ingredients of pork and leaves of *G. cowa*

Product of traditional dish from *G. cowa*
Action 7. Capitalize partnership for Value Chain of *Garcinia*
Edible canna (Andes)

- Ancient Peruvian staple
- Replaced by maize introduced from Mexico (4500 BP)
- Robust relic crop, sporadic use in Andes
- Use constraints: long cooking time, long crop duration

Patate, Ecuador 1994

Action 7: Capitalize the global experience and practice
Oca (Oxalis tuberosa)

Ulluco (Ullucus tuberosus)

Mashua (Tropaeolum tuberosum)

Yacon (Smallanthus sonchifolius)

Arracacha (Arracacia xanthorrhiza)

Edible canna (Canna edulis)

Mauka (Mirabilis expansa)

Maca (Lepidium meyenii)

Ahipa (Pachyrhizus ahipa)
Geographical distribution of Canna and yacon

1983 from Ecuador to New Zealand
1991 Brazil
1985 Japan
1998 S. Korea
2000 Taiwan
2003 Hainan
2003 Philippines
1 propagule!
Use of edible Canna in N-Vietnam, S-China

- Canna rhizomes = traditional pig feed, emergency food
- Canna starch used for high-value transparent noodles
- Now 20-30 thousand ha in marginal environments
- Lesson: Explore new market access
Action 8. Maximize full potential of rice bean and other NUS species – integrated farming system and carbon farming

Ensuring yield stability and reducing risk factors
Action 9. Making agriculture and land use climate-friendly and climate-resilient in shifting cultivation
Take home messages

- Two simple strategy of realise full potential of rice bean:
  - Improve of local materials and improve seed access
  - Strengthen local seed production

- Opportunity for market research: market penetration by value addition, product development, market development and diversification-market access to overseas
- Aggressive promotion in restaurants
- Cultivate collaboration with SE Asian countries for new ideas
- Capitalise as a multipurpose crop to food (Ca rich, protein etc), fodder, green manure, N2 fixation, carbon farming, and market as “gunilo” grain legume crop!
Thank you very much