Contribution of Genetic Resources to Food Security and Nutrition

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CGRFA Special Event
Food security and genetic diversity

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Global nutrition situation

- **Double burden of malnutrition**
  Undernutrition and micronutrient deficiencies are persisting. Obesity is endemic also in developing countries.

- **Increased consumption of animal products** (e.g. China and India) and of processed foods.

- **Simplification of diets** and shift towards westernized diets.

- **Medicalized approach** (fortification and supplementation) instead of a food-based approach using foods.
Astronauts’ diets

NASA (America)
• Foods only
• no supplements except for vitamin D

Is this achievable on earth?
Biodiversity and Nutrition

Genetic resources/biodiversity
1. Nutrition is promoting a **diverse diet**, i.e. eat many different foods = **inter-species biodiversity**

2. **Intra-species biodiversity** is adding a new dimension below species level
   – varieties, cultivars and breeds
   – but also wild, neglected and underutilized foods

Reason for importance:

- differences in nutrient content **between** species are as high as **within** species (up to 1000 times)
- difference between nutritional adequacy and inadequacy
## Differences in food composition

<table>
<thead>
<tr>
<th>Food</th>
<th>Protein (g)</th>
<th>Fibre (g)</th>
<th>Iron (mg)</th>
<th>Vitamin C (mg)</th>
<th>β-carotenes (mcg)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rice</td>
<td>5.6-14.6</td>
<td></td>
<td>0.7-6.4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cassava</td>
<td>0.7-6.4</td>
<td>0.9-1.5</td>
<td>0.9-2.5</td>
<td>25-34</td>
<td>&lt;5-790</td>
</tr>
<tr>
<td>Potato</td>
<td>1.4-2.9</td>
<td>1-2.23</td>
<td>0.3-2.7</td>
<td>6.4-36.9</td>
<td>1-7.7</td>
</tr>
<tr>
<td>Sweet potato</td>
<td>1.3-2.1</td>
<td>0.7-3.9</td>
<td>0.6-14</td>
<td>2.4-35</td>
<td>100-23100</td>
</tr>
<tr>
<td>Taro</td>
<td>1.1-3</td>
<td>2.1-3.8</td>
<td>0.6-3.6</td>
<td>0-15</td>
<td>5-2040</td>
</tr>
<tr>
<td>Eggplant</td>
<td></td>
<td>9-19</td>
<td></td>
<td>50 - 129</td>
<td></td>
</tr>
<tr>
<td>Mango</td>
<td>0.3-1.0</td>
<td>1.3-3.8</td>
<td>0.4-2.8</td>
<td>22-110</td>
<td>20 – 4320</td>
</tr>
<tr>
<td>GAC</td>
<td></td>
<td></td>
<td></td>
<td>6180 – 13720</td>
<td></td>
</tr>
<tr>
<td>Apricot</td>
<td>0.8-1.4</td>
<td>1.7-2.5</td>
<td>0.3-0.9</td>
<td>3.5-16.5</td>
<td>200-6939 (β-carotene equivalent)</td>
</tr>
<tr>
<td>Banana</td>
<td></td>
<td>0.1-1.6</td>
<td>2.5-17.5</td>
<td>&lt;1 – 8500</td>
<td></td>
</tr>
</tbody>
</table>

All nutrients values expressed per 100 g edible portion EP on fresh weight basis (EP).
Impact of food biodiversity on dietary adequacy

<table>
<thead>
<tr>
<th>Protein content</th>
<th>Protein content (g/100 g)</th>
<th>Rice intake (g/d/p)</th>
<th>RDI for protein covered by rice intake (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Average</td>
<td>7</td>
<td>200</td>
<td>31</td>
</tr>
<tr>
<td>Minimum</td>
<td>5.6</td>
<td>200</td>
<td>25</td>
</tr>
<tr>
<td>Maximum</td>
<td>14.6</td>
<td>200</td>
<td>65</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Banana</th>
<th>β-carotene content (mcg/100 g)</th>
<th>Banana intake in Philippines (g/d/p)</th>
<th>Vitamin A intake through banana in (mcg RE/d/p)</th>
<th>RDI for vitamin A covered by banana intake (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>USDA</td>
<td>26</td>
<td>93</td>
<td>4</td>
<td>0.7</td>
</tr>
<tr>
<td><em>Lacatan</em></td>
<td>360</td>
<td>93</td>
<td>56</td>
<td>9</td>
</tr>
<tr>
<td><em>Utin lap</em></td>
<td>8508</td>
<td>93</td>
<td>1319</td>
<td>220</td>
</tr>
</tbody>
</table>

*USDA*: almost no intake

*Lacatan*: adequate intake

*Utin lap*: almost no intake
How to achieve food security

**Objective:** to produce sufficient **nutrients** for a healthy diet for all at all times and ensure that a population is able to acquire foods in sufficient **quantity** and **quality** and to utilize them efficiently.

### Availability
- Agricultural production = foods for humans
- Not only quantity (yield and energy) is important but **quality** (esp. micronutrient content) = shift in paradigm
- Processed foods should contain good nutrient profiles

### Utilization
- Human body is in good health
- Foods and water are safe
- Consumers demand high quality foods
- Adequate intra-household distribution of foods

### Stability
- Economic, political, environmental and GR stability
- Sustainable agriculture conserving and utilizing GR
- Sustainable consumption
Factors influencing nutrient composition of rice

Rice varieties

Agricultural influence
- Environmental conditions: water, light
- Fertilizer
- Soil quality

Genetics

Post harvest influences
- Milling
- Storage
- Cooking

Source: adapted from T. Longvah, NIN, India
Effect of polishing on mineral content in rice varieties

Source: T. Longvah
The Commission **recommended** that:

- Existing biodiversity of rice varieties and their nutritional composition need to be explored before engaging in transgenic research.
- Nutrient content needs to be among the criteria in cultivar promotion.
- Cultivar-specific nutrient analysis and data dissemination should be systematically undertaken.

Optimal food with
• high nutrient content
• high yield and pest resistance
• high acceptance by population
• acceptable price

Better nutrition, food security and income generation

Production and distribution on large scale

Nutrition education, promotion/ads

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• high acceptance by population
• acceptable price

Genetic resources

Nutrition and Food composition

Agricultural research
No mainstreaming of nutrition or GR

Each having own goals, assumptions, policies, programmes, messages – sometimes conflicting

Nutrition  Health  Finance, Trade  Technology  Education  Genetic resources

Agriculture  Environment  Food security  Poverty reduction
Mainstreaming of nutrition and GR

Common and coherent goals, assumptions, policies, programmes, messages to achieve better food-based nutrition through using existing GR, especially for micronutrients.
CGRFA-15/15/6 Biodiversity and Nutrition

Draft Guidelines for Mainstreaming Biodiversity into Policies, Programmes and National and Regional Plans of Action on Nutrition:

• **Rational** – why the guidelines are important
• **Objectives** – assist countries in mainstreaming GF
• **Principles** – including element for planning
• **Three main elements**
  – **Research** – describe knowledge gap and way forward
  – **Implementation** – describe important components
  – **Awareness** – describe how to raise awareness of the general public and of the different stakeholders
Summary

• Biodiversity and genetic resources can improve nutrition, health and food security based on **foods**.

• Biodiversity and genetic resources can make the difference between nutritional adequacy and inadequacy and professionals and consumers need to know more about it.

• Agriculture production and breeding should include nutritional objectives.

• The more biodiversity and diverse diets are consumed the lower the need for fortification and supplementation.

• Many policies and programmes need to include GR and nutritional goals and be coherent across sectors.