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Biofortification in LAC countries

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Outline

• Introduction
• Experiences so far
• Plans for the future
• Key messages
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• Key messages
Introduction

Micronutrient deficiency is a public health problem in many developing countries.

**Biochemical vitamin A deficiency (retinol) in preschool age**


**National risk of zinc deficiency by country**

IZINCG, 2004. Assessment of the risk of zinc deficiency in populations and options for its control.
If poor people in developing countries face a 50% increase in all food prices across the board and no rise in income, iron intake will fall by 30%.

If iron consumption declined by 30% in the Philippines, only 5% of Filipino women would consume adequate levels of iron.
Supplementation

Commercial Fortification

Dietary Diversity

Biofortification
Biofortification-breeding food crops that are more nutritious
Cost-effective: one time investment in research
Targeted: poor people eat staples
Complementary:
‘Grow’ your own nutrients

Photo: IRRI
Sustainable for farmers

Photo: A.M. Ball
Biofortification: Improves Status for Those Less Deficient and Maintains Status for All
3 fundamental questions:

1) Can **breeding** increase nutrient levels enough to improve human nutrition?
   - positive results from various crop/micronutrient combinations (we have reached full target levels for beans and cassava for Africa)

2) Will extra nutrients be **bioavailable** at sufficient levels to improve micronutrient status?
   - efficacy studies for beans, rice and cassava are all positive

3) Will farmers **adopt** crops and will consumers **buy & eat** enough?
   - from Uganda and Mozambique for orange sweet potato - we have positive results
   - We are, however still learning/working crop/micronutrient/country combinations and we still have a lot of work to do for LAC
• Some food basket elements:
  – **Beans** as a source of **Fe** in the diet;
  – **Rice** as source of **Zn** in the diet;
  – **Cassava** as source of **pro-vitamin A**;
  – **Maize** as a possibility for **pro-vitamin A** and / or **Zn**; and
  – **Sweet potato** as source of **pro-vitamin A**.

• We want these crops to be **biofortified** to become a source of these micronutrients.
• In LAC several people are reached via supplementation and fortification;
• We want to reach rural poor with biofortified versions of these crops, since rural poor may not have access to supplements and fortified food;
• Processed products made of these crops that could claim that they are source of Fe, Zn or pro-Vitamin A, according to the labeling guidelines of the target countries.
Outline

• Introduction
• Experiences so far
• Plans for the future
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## Experiences so far

<table>
<thead>
<tr>
<th>Country</th>
<th>Crop</th>
<th>Variety</th>
<th>Content (ppm)</th>
<th>H+ 50% target (ppm)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>Fe</td>
<td>Zn</td>
</tr>
<tr>
<td>El Salvador</td>
<td>Beans</td>
<td>CENTA FERROMÁS</td>
<td>75-80</td>
<td>35</td>
</tr>
<tr>
<td>Panamá</td>
<td>Rice</td>
<td>IDIAP GAB</td>
<td>3.5-4.1</td>
<td>13.2-15.5</td>
</tr>
<tr>
<td>Panamá</td>
<td>Beans</td>
<td>NUA</td>
<td>83-93</td>
<td>32-33</td>
</tr>
<tr>
<td>Nicaragua</td>
<td>Rice</td>
<td>INTA Nutritivo</td>
<td>80</td>
<td>37</td>
</tr>
<tr>
<td>Guatemala</td>
<td>Beans</td>
<td>ICTA Petén</td>
<td>76</td>
<td>?</td>
</tr>
<tr>
<td>Bolivia</td>
<td>Beans</td>
<td>Fortaleza</td>
<td>83-90</td>
<td>40</td>
</tr>
</tbody>
</table>
Biofortification in Brazil

Biofortification Projects in Brazil: BioFORT, HarvestPlus and AgroSalud, coordinated by Embrapa, since 2003, aims to develop micronutrient dense staple crops to achieve provitamin A, iron, and zinc concentrations that can have measurable effects on nutritional status.

<table>
<thead>
<tr>
<th>Cultivars</th>
<th>Conventional</th>
<th>Cultivars developed by the Biofortification Network in Brazil projects</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maize</td>
<td>On average, 4.5 µg of pro-vitamin A per gram of maize on a dry basis</td>
<td>Up to 9 µg of pro-vitamin A per gram of corn on a dry basis</td>
</tr>
<tr>
<td>Sweet potato</td>
<td>In white-fleshed cultivars, up to 10 µg of beta carotene per gram of fresh roots</td>
<td>In the Beauregard cultivar, 115 µg of beta carotene per gram of fresh roots on average</td>
</tr>
<tr>
<td>Pumpkin</td>
<td>Under evaluation</td>
<td>Average of 186 µg of carotenoids per gram of fresh produce</td>
</tr>
<tr>
<td>Wheat</td>
<td>On average, 30 mg of iron and 30 mg of zinc per kg of whole wheat</td>
<td>Average of more than 40 mg of iron and 40 mg of zinc per kg of whole wheat, in the best cultivars</td>
</tr>
<tr>
<td>Cowpea</td>
<td>Average of 50 mg of iron and 40 mg of zinc per kg of product</td>
<td>In the BRS Xiquexique, average of 77 mg of iron and 53 mg of zinc per kg of product</td>
</tr>
<tr>
<td>Cassava</td>
<td>No significant content of beta-carotene in white-fleshed varieties</td>
<td>Up to 9 µg of beta-carotene per gram of fresh roots</td>
</tr>
<tr>
<td>Common Beans</td>
<td>On average, 50 mg of iron and 30 mg of zinc per kg of Carioca beans</td>
<td>On average, 90 mg of iron and 50 mg of zinc per kg of the BRS Pontal cultivar</td>
</tr>
<tr>
<td>Rice</td>
<td>On average, 12 mg of zinc and 2 mg of iron per kg of polished white rice</td>
<td>On average, 18 mg of zinc and 4 mg of iron per kg of polished white rice. Research challenge is to find cultivars with good yield, and higher iron content</td>
</tr>
</tbody>
</table>
Beans – 3 varieties
Cowpeas – 3 varieties
Cassava – 3 varieties
Sweet-potato – 1 variety
Maize – 1 variety
Rice – 1 variety (2013)
Cassava – 1 variety (2013)

Released varieties in Brazil
• Video 1: A short video of inclusion of biofortified crops in a school feeding program (Jornal Nacional – important news in Brazil - audience of 80 million people);
  – Source: local file

• Video 2: If time allows (perhaps during the break?) ... a 6’13” video on biofortification in Brazil, produced during Biofortification Meeting in Teresina-PI, in July 2011.
  – 2 possible sources:
    • http://www.youtube.com/watch?v=t9NcoNoMDHo
    • Local file
Outline

• Introduction
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• Key messages
How are countries prioritized?

To be a H+ priority, a country must:

1. **Produce the crop** - a significant proportion of production must be used for domestic consumption;

2. **Consume** much of the crop on a per-capita basis; and

3. Have a high level of **micronutrient deficiency** (vitamin A, Iron or zinc).

→ Saltzman et al. (2013)
Plans for the future in LAC

- Country priority setting using a Biofortification Priority Index (BPI) developed by HarvestPlus team.
- Source: HarvestPlus planning meeting between HarvestPlus breeders, nutritionists, economists etc. at CIAT (Cali, Colombia, Feb 25 – 28, 2013)
BPI for Beans and Rice in LAC

Biofortification Priority Index (BPI) for Iron Beans: Latin America and the Caribbean

Biofortification Priority Index (BPI) for Zinc Rice: Latin America and the Caribbean

Legend
- No data
- Little/no priority
- Low priority
- Medium priority
- High priority
- Top priority
Biofortification Priority Index (BPI) for Vitamin A Cassava: Latin America and the Caribbean

Biofortification Priority Index (BPI) for Vitamin A Sweet Potato: Latin America and the Caribbean

Legend
- No data
- Little/no priority
- Low priority
- Medium priority
- High priority
- Top priority
## Potential country/crop/micronutrient combinations for investment

<table>
<thead>
<tr>
<th>Countries</th>
<th>Rice (zinc)</th>
<th>Beans (zinc-iron)</th>
<th>Maize (zinc)</th>
<th>Maize (Vit A)</th>
<th>Cassava (Vit A)</th>
<th>Sweet Pot (Vit A)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Nicaragua (1)</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. Guatemala – Mex. (South) (1)</td>
<td></td>
<td>`x</td>
<td>x</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. Honduras &gt;more inform</td>
<td></td>
<td></td>
<td>x</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4. Bolivia ??</td>
<td>x</td>
<td></td>
<td>x</td>
<td>x??</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Countries that requested technical assistance in all topics

<table>
<thead>
<tr>
<th>Countries</th>
<th>Rice (zinc)</th>
<th>Beans (zinc-iron)</th>
<th>Maize (zinc)</th>
<th>Maize (Vit A)</th>
<th>Cassava (Vit A)</th>
<th>Sweet Pot (Vit A)</th>
</tr>
</thead>
<tbody>
<tr>
<td>A. Panama</td>
<td>X (Rural)</td>
<td>X (indigenous)</td>
<td>x</td>
<td>X (indigen.)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>B. Colombia</td>
<td>X (North Coast)</td>
<td>X (North Coast)</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
</tr>
</tbody>
</table>
According to BPI, these countries could be candidates for a H+ program;
However, H+ nutritionists have some doubts about the data of micronutrient deficiency in those countries (=>more information needed to take a decision).
Considering the country’s situation, a special project is needed for Haiti.

<table>
<thead>
<tr>
<th>Countries</th>
<th>Rice (zinc)</th>
<th>Beans (zinc-iron)</th>
<th>Maize (zinc)</th>
<th>Maize (Vit A)</th>
<th>Cassava (Vit A)</th>
<th>Sweet Pot (Vit A)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Haiti</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
</tbody>
</table>
## Indirect benefiting countries

Some potential countries that are not targets (low BPI), but could be beneficiaries of the HarvestPlus technologies (spillovers).

<table>
<thead>
<tr>
<th>Countries</th>
<th>Rice (zinc)</th>
<th>Beans (zinc-iron)</th>
<th>Maize (zinc)</th>
<th>Maize (Vit A)</th>
<th>Cassava (Vit A)</th>
<th>Sweet Pot (Vit A)</th>
</tr>
</thead>
<tbody>
<tr>
<td>El Salvador</td>
<td></td>
<td>x</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Peru (Amazonia)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>x</td>
</tr>
</tbody>
</table>
Brazil - a special case

• In the BPI exercise, Brazil has a high score, but it was not included in HarvestPlus LAC since the Brazilian team has local government funding for several years already (since 2003).
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• **Introduction**
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5 takeover messages

1) Biofortification is a promising strategy for combatting micronutrient deficiency in LAC, especially in rural areas;

2) We have been functioning in LAC for a while, with great successes in breeding and also in raising awareness and building partnerships in research, public and private fora;

3) In phase III of H+ (2014-2018) we want to increase our investments in LAC;

4) Due to the diverse diets in LAC we are advocating "food basket" approach - we want to biofortify all the staples people consume; and

5) Efforts in Brazil and Panama are funded by local governments, other LAC countries are funded by H+. 
Thank you!

Muchas gracias!

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