Biofortification: achievements and challenges

Erick Boy-Gallego
Ascona, Switzerland (May 24, 2015)
Vitamin & Mineral deficiencies: 2 billion persons affected
Supplementation: tablets, pills, etc.

Fortification

Agriculture: Biofortification
The process of increasing vitamin & mineral densities of edible parts of staple food crops (Jeong and Guerinot, 2008)

Dietary Diversity

BREAST FEEDING & COMPLEMENTARY FEEDING

SAFE WATER

INFECTION CONTROL & PREVENTION

DEWORMING

Complementary Strategies
What is biofortification?

- Increases staple crop nutrient concentration without sacrificing agronomic traits (i.e. yield, pest resistance, drought resistance)
- Plant transformation (selective breeding, bioengineering), agronomic management.
- HP focuses on iron, provitamin-A carotenoids, zinc
Letting nature do the work
Cost-effective: single up-front investment in R&D (social good)
“If you had $75 billion for worthwhile causes, where should you start?”

Among the top 16 priority solutions, “Fighting malnourishment should be the top priority for policy-makers and philanthropists…”

1. Bundled micronutrient interventions to fight hunger and improve education
2. Expanding the Subsidy for Malaria Combination Treatment
3. Expanded Childhood Immunization Coverage
4. Deworming of Schoolchildren, to improve educational and health outcomes
5. Expanding Tuberculosis Treatment
6. R&D to Increase Yield Enhancements, to decrease hunger, fight biodiversity destruction, and lessen the effects of climate change


“One of the most compelling investments is to get nutrients to the world’s undernourished. The benefits from doing so—in terms of increased health, schooling, and productivity—are tremendous.”
Niche target: rural subsistence farming families, particularly women and children
Sustainable for producers
DOES BIOFORTIFICATION WORK?
Nutrition Research to Date (April 2015)

Intake & nutritional status
Retention
Absorption
Efficacy
Effectiveness

VA
OFSP ✓
MAIZE ✓
CASSAVA ✓
BEANS ✓
PEARL MILLET ✓
RICE ✓

Fe
WHEAT ✓

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Complete: ✓
## Nutrition Research to Date (April 2015)

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- Intake & nutritional status
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- **Complete:** ✓
- **Active:** ➔
Nutritional Impact: RCTs

- High Iron Beans: increased hemoglobin and total body iron
- High Iron Pearl millet: prevalence of iron deficiency reduced; cognitive improvement in schoolers
- Orange sweet potato: increased vitamin A intake, improved status, reduced prevalence and duration of diarrhea
- Orange Maize: increased vitamin A stores; visual adaption to darkness
- pVAC Cassava: improved vitamin A status
- High Zn Wheat: nearly 70% more absorbed zinc than control wheat
More than 2 million farming households reached by HarvestPlus. Crops released are high-yielding with climate smart traits.
Varieties released in Africa and South Asia

2007
Sweet Potato
Vitamin A
Uganda

2011
Cassava
Vitamin A
Nigeria & DRC

2012
Beans
Iron
Ruanda & DRC

Maize
Vitamin A
Zambia

2012
Pearl Millet
Iron
India

2013
Rice
Zinc
Bangladesh

2013
Wheat
Zinc
India | Pakistan 2015
Released varieties in 27 countries
18 in Africa, 4 in Asia, 5 in LAC
Under development in 43 countries
26 in Africa, 8 in Asia, 9 in LAC
4 Vit-A, 5 Iron, 4 Zinc
High-Level Support - Policymakers
Smile Africa Network
In Partnership with
Harvestplus
Presents
A Zeb Ejiro Production

THE YELLOW CASSAVA

World Premiere
24th September 2014
Silverbird Cinema, Abuja
Empowering women farmers
Uganda OSP scaling up: Start up process

• Choosing areas of implementation – able to support both crops

• Choosing implementing partners with food and/or nutrition security projects

• Select farmer groups (FGs)

• Sensitization process on the nutritional benefits of the crops
• Mostly introduce nutrition into Agric extension system
• Use both paid and voluntary extension agents
• Training conducted down that structure to the farmers
Using government structures

Agric extension system

- District
- Sub/county
- Farmers

Health extension system

- Health centre
- VHTs
- Patients
Dissemination through Schools

- Schools targeted have land and agriculture programs
- Pupils sensitized on nutritional importance of crops
- Pupils given planting material to take home
- Biofortified crops prepared for school meals
Activities

Seed systems

• Agronomy training:
  – Planting,
  – Pest and disease management
  – Post harvest handling
Activities cont’d

Demand Creation

• Nutrition training
• Drama
• Radio
• Field days
Activities cont’d

Marketing and Product development

• Training in marketing
• Linking farmers to traders
• Product development
WHERE ARE THE BEST PLACES TO INVEST IN BIOFORTIFIED NUTRITIOUS CROPS???
Scaling Biofortified Nutritious Crops: the biofortification priority index (BPI)

http://www.ifpri.org/tools/bpimappingtool
The road ahead for a common good

Maize (Zambia) and **pearl millet** (India) trials with CU2Y

Multiple biofortified crops (food basket) approach for the life cycle (Complementary feeding, Mumbai)
The road ahead for a common good

• Lower phytate crops (*lpa* beans) and high minerals GM rice: further breeding and bioavailability testing (ETH, IRRI)

• Zinc biomarkers development: validation of intracellular biomarkers of Zn status (CHORI/ETH/St. Johns Research Center)

• Post harvest food processing: product quality through value chains in target countries

• Information translation and sharing across HP, CG centers, country and international stakeholders...
Purple tomatoes high in anthocyanins

http://news.bbc.co.uk/2/hi/health/7688310.stm

Tearless Onion

Dr Eady
Crop & Food Research in New Zealand and his collaborators in Japan
Context-specific sustainable, effective mix of options addressing immediate and underlying causes with a life cycle approach

- Empowering women
- Education
- Income generation
- Delivery platforms

- Behavior Modification
- Industrial Food Fortification
- Nutrition-sensitive agriculture: Biofortified Crops, Homestead FP
- Supplements
- Dietary Diversity
- Public Health Interventions
"We are guilty of many errors and many faults, but our worst crime is abandoning the children, neglecting the foundation of life. **Many of the things we need can wait. The child cannot.** Right now is the time his bones are being formed, his blood is being made and his senses are being developed. To him we cannot answer "Tomorrow". His name is "Today".

*Gabriela Mistral, 1948*
Thank You!