Practical approaches to address Nutrition Security through Smarter Food Production

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The physical and economic access to sufficient, safe and nutritious food and water to fulfill dietary and cultural needs to enable an active and healthy lifestyle without compromising the ability of future generations to meet these needs.
We can do much with current knowledge...
Biofortifying staple crops to help combat nutritional deficiencies

- Development of naturally rich crop varieties
  - Iron rich millet
  - Iron rich rice
  - Provitamin A maize
  - Provitamin A rich cassava
  - Provitamin A rich sweet potato

- Testing under different climatic conditions, for disease resistance and validate micronutrient content

- Government release and establishing stable seed supply

- Training farmers and providing agronomy support

- Developing products for local consumption
  - Improves nutritional profile of products
  - Addresses deficiencies in local communities

- Identifying methods to measure the dietary impact
Tackling food safety for Nutrition Security

- 30% of cereal crops in Central and West Africa are lost to contamination

- The Grains Quality Improvement Project reduced mycotoxin contamination levels in Ghana and Nigeria by 60%.

- > 50'000 farmers trained in Western Africa with 150 villages in the projects.

- Farmers achieve a price premium for quality.

- Factory rejection rate decreased from 50 to 2% between 2007 and 2012.

- Market access created for locally produced grains in West Africa with a farm base value of > US$ 20 million.
Developing protein-rich plant source foods

<table>
<thead>
<tr>
<th>Today</th>
<th>Tomorrow</th>
<th>Future</th>
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<tbody>
<tr>
<td><img src="image1.png" alt="soybeans" /> <img src="image2.png" alt="peas" /></td>
<td><img src="image3.png" alt="wheat" /> <img src="image4.png" alt="barley" /></td>
<td><img src="image5.png" alt="microalgae" /> <img src="image6.png" alt="biosynthetic_protein" /></td>
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Accelerate usage of available protein ingredients
Optimize functionality of newly available solutions
Develop novel protein sources and technologies

Aim to **broaden the portfolio of solutions** based on protein sources to meet the challenges of growing population’s nutritional need with **reduced environmental impact**, good **sensorial properties** and at **commercially viable costs**.
Valorising water from milk

From...

- The factory uses the water vapour from cow’s milk evaporation
- Water is recycled for use as potable process water, then again for cooling and cleaning
- Saving ~1.6 mio L of water/day, enough to meet the average daily consumption of 6400 people

to....
Valorising spent coffee grains as fuel

- A state-of-the-art system was designed to efficiently valorise discarded coffee grounds
- The heat is used for the steam requirements of the factory
- Benefit also of reduced landfill requirements.

The Cagayan de Oro factory in the Philippines is one of our largest soluble coffee factories
Tackling Food Waste at all points in the value chain

- 72 (15%) factories with zero waste for disposal
- Donations to food banks
- Portion size
- QR codes to share info
- Apps and websites with recipes for leftovers
- Breed new strains that are more drought and disease resistant
- Milk cooling facilities
- Grain Quality Improvement Project
- Transform perishable raw materials into shelf stable food
- Recovery and use of by-products
- Improvement of capacity and demand planning
- Product protection from spoilage or damage
We need new knowledge to take bigger steps...

**KNOWLEDGE**

- **AGRICULTURE**
- **NUTRITION & HEALTH**
- **ENVIRONMENT**

**TOOLS**

- **CROP MODELLING**
- **PROFILING**
- **ECODESIGN SOFTWARE**

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*Image credits*: cimsans
Evaluating the environmental performance of our products

**Scope:**
The entire life cycle product

**Representative set of environmental impact indicators**
- Climate change [kg CO$_2$-eq]
- Freshwater consumption [m$^3$]
- Non-renewable fuels and minerals [kg Sb-eq]
- Impacts on ecosphere [PDF x m$^2$ x year]
- Land use [m$^2$ x year]

**Simplified tool for non-expert users with quick results generation**

Harmonized LCA methodology
Aligned with developments on ISO 14044, EU Food Sustainable Consumption and Production Roundtable
Modelling Nutrition Balance

Fern et al. 2015 PLOS ONE
Example: I want to assess meals and diets for both nutrition and environment.

![Diagram showing relative environmental and nutritional impacts of various foods with a combined meal example.]

Fern et al. 2015 PLOS ONE

MyPlate Sample Menus

All Meals Day 1 – Nutrition and Environmental Impact

Relative Environmental Impact

- Breakfast
- Lunch
- Dinner
- Snack

Relative Nutritional Impact

- Day 1

Breakfast: Brown Sugar, Orange, Fat-free Milk
Lunch: Corn & Canola Oil, Cheddar Cheese, Salsa
Dinner: Turkey, Tortilla Chips
Snack: Lime Juice, Kidney Beans

Combined Meal: Margarine, Tomato Sauce, Spinach

Combined Meals + Snacks: Snack, Lunch, Dinner

Fern et al. 2015 PLOS ONE

Nutritional Balance vs Greenhouse Gas Emissions
MyPlate Sample Menus

**Day 1**
**Breakfast**
Creamy oatmeal (cooked in milk):
- ½ cup uncooked oatmeal
- 1 cup fat-free milk
- 2 Tbsp raisins
- 2 tsp brown sugar
Beverage: 1 cup orange juice

**Lunch**
Taco salad:
- 2 ounces tortilla chips
- 2 ounces cooked ground turkey
- 2 tsp corn/canola oil (to cook turkey)
- ½ cup kidney beans*
- ½ ounce low-fat cheddar cheese
- ½ cup chopped lettuce
- ½ cup avocado
- 1 tsp lime juice (on avocado)
- 2 Tbsp salsa
Beverage: 1 cup water, coffee, or tea**

**Dinner**
Spinach lasagna roll-ups:
- 1 cup lasagna noodles (2 oz dry)
- ½ cup cooked spinach
- ½ cup ricotta cheese
- 1 ounce part-skim mozzarella cheese
- ½ cup tomato sauce*
- 1 ounce whole wheat roll
- 1 tsp tub margarine
Beverage: 1 cup water, coffee, or tea**

**Snacks**
- 2 Tbsp raisins
- 1 ounce unsalted almonds

**Day 3**
**Breakfast**
Cold cereal:
- 1 cup ready-to-eat oat cereal
- 1 medium banana
- ½ cup fat-free milk
- 1 slice whole wheat toast
- 1 tsp tub margarine
Beverage: 1 cup prune juice

**Lunch**
Tuna salad sandwich:
- 2 slices rye bread
- 2 ounces tuna
- 1 Tbsp mayonnaise
- 1 Tbsp chopped celery
- ½ cup shredded lettuce
- 1 medium peach
Beverage: 1 cup fat-free milk

**Dinner**
Roasted chicken:
- 3 ounces cooked chicken breast
- 1 large sweet potato, roasted
- ½ cup succotash (limas & corn)
- 1 tsp tub margarine
- 1 ounce whole wheat roll
- 1 tsp tub margarine
Beverage: 1 cup water, coffee, or tea**

**Snacks**
- ⅛ cup dried apricots
- 1 cup flavored yogurt (chocolate)
Applying these tools for food products

Comparing beef and vegetarian alternate products
By working collaboratively along the entire value chain, and by applying modelling techniques for nutrition and sustainability, we can make tangible and practical advances in nutrition security.