Feed the Future Innovation Lab for Food Processing and Post-harvest Handling (Food Processing Lab)

Betty Bugusu, Ph.D., Project Director

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Summary Program Information

- 5 year: May 2014 to May 2019
- Focus countries: Kenya and Senegal (humid tropics)
- Value chains:
  - Cereal grains
  - Grain legumes
  - Nutrient-rich plants
- Focus areas:
  - Grain drying
  - Grain storage
  - Food Processing
  - Nutrition
Food Processing Lab Components

- Drying and storage of cereals and grain legumes in the humid
- Processing of high quality and nutritious food products to drive value chains
- Institutional and human capacity
- Establish and strengthen public-private partnerships to promote technology innovation and adoption
- Cross cutting issues
  - Gender
  - Environment
Food Processing Lab – Key Messages

• Vision: Produce technologies that are replicable, cost-effective, scalable, and commercially viable
  – Drying, storage, food processing, nutrition

• Technology adoption and commercialization focus
  – Technical choices made to enhance commercialization

• Supply chain development: engage businesses early in the process
  – African businesses
  – Multinational Companies
Drying and Storage Partners

- North Carolina A&T State University, USA
- Cooperative University College of Kenya
- CIMMYT, Kenya
- Kenya Agricultural and Livestock Research Organization (KALRO)
- A to Z Textiles, Tanzania
- Institut de Technologie Alimentaire (ITA), Senegal
- Institut Sénégalais de Recherches Agricoles (ISRA) Senegal
Post-harvest Handling & Storage

• Affordable grain drying technologies
  • Drying stove/Solar dryer
• Affordable and efficient moisture sensing technologies
• Reliable grain storage technologies
  • Hermetic storage: PICS, A to Z Textiles bags, GrainPro.
  • Optimize drying & storage for mycotoxins control
• Training on improved post-harvest handling and storage
• Development of supply chain for improved technologies
Improved Drying Holistic Concept

Target drying entire corn harvested within one week

Dry with biomass agricultural residues (target 80% of fuel needs)

Store dry grain using PICS technology

Use rice husk ash as grain protectant from insects
Moisture Sensing Technologies

Objective measure of Moisture Content

Subjective measure of Moisture Content
Evaluate moisture with inexpensive humidity & temperature devices

Desiccant (Salt) Method (pass/fail)

Analog Hygrometer  Digital Hygrometer  Moisture Strips
What are PICS bags?

Cowpea storage in triple layer plastic bags was developed by a team of Purdue and Cameroonian researchers led by Larry Murdock in the late 1990s.
**Approach to Extension/Outreach**

**In each village**
- Select 5 households
- Project pays for the bags
- Farmers volunteer their cowpea (at least 50 kg)
- Farmers agree to store for at least 4 months

**Four steps involved in the process**
- Awareness building
- Demonstration
- Follow-up
- Open-the-bag event

Radio offers direct contact with listeners.
PICS Bags Supply Chain Development: Project to Private Sector

PICS is a registered trademark in the US and:

- OAPI countries
- Madrid International Trademark System African countries
- Nigeria
- Ethiopia
- Uganda
- Tanzania
- Malawi

Plans are to register in additional African and South Asian countries as needed.
Manufacturing of PICS Bags

6 manufacturers in 5 countries in West Africa

COFISAC Senegal
Embalmali Mali
Emballage Miankala Mali
Fasoplast, Burkina
Lela Agro, Nigeria
Polytank Ghana
Drying and Storage Timeline

• Baseline data collection in Year 1-2
• Development activities in Year 2-3
• Full-scale field trials in communities in Year 3 & 4
• Economic analyses and impact assessment in Year 5
Year 1 Activities

• Baseline data collection - Identify methods used by farmers for drying, storage used and determine moisture content of grain stored by farmers

• Develop a low-cost moisture determination method

• Determine the optimum grain moisture for safe storage in hermetic bags to reduce losses due to mold and insects damage

• Assess potential for aflatoxin development in hermetic bags
Food Processing & Nutrition Partners

- University of Eldoret, Kenya
- CIMMYT, Kenya
- University of Pretoria, South Africa
- *Institut de Technologie Alimentaire, Sénégal*
- *Institut Sénégalais de Recherches Agricoles, Sénégal*
- *Cheikh Antadiop University, Senegal*
Food Processing & Nutrition

Expanding market opportunities through diversified processed and nutritious food products

• Create systems of using food and food and nutrition-related technologies to expand markets and improve nutrition
• Link farmers to markets
• Replicate developed systems in other places
Food Processing & Nutrition: Approach

- Product development, marketing, and promotion
  - Develop high-quality, safe, competitive food products
  - Disseminated through Incubation Training Centers
- Processing technology innovation
  - Appropriate, cost-effective technology
- Improvement of nutritional quality of products
  - Fortified products using local nutrient-rich plant sources
- Impact assessment: product and nutritional
Innovations: Upgrade Traditional Processes

- Agglomerator
- Decorticator
- Packaging
Technology Adoption and Entrepreneurship

Incubation Center Model
- Process demonstration
- Continuous research and development
- Processing and market testing
- Technical support
- Link to farmer organizations
- Leverage capital for businesses

Training: technical & business
• Questions for consideration
  – What are drivers for cereal products in the marketplace
    • Fortification?
    • Instantized flours?
    • Whole grain products?
    • Natural products?
  – On fortification:
    • History of fortification process
    • Current fortification practices?
    • Fortified products and fortificants used (sources)
    • Fortification opportunities and markets
    • Role of government in fortification
    • Fortification challenges
    • Potential contribution of natural fortificants from FPL project
  – What about awareness, education and promotion?
Nutrition: Activities and End-points

**Activities**
- Market-driven fortification (micronutrients and protein)
  - Fortification using local nutrient-rich plant sources
  - Promotion and marketing strategies using nutritional attributes
- Optimizing delivery amount (bioaccessibility) and bioavailability of target micronutrients
  - Iron, zinc, pro-vitamin A/beta carotene
- Nutritional assessment in semi-urban communities

**End-points**
- Increased fortification through markets
  - Using nutritional attributes
- Improvement in nutritional indicators in a population (micronutrient markers and height/weight [z-scores] for stunting)
Year 1 Activities

- Assess market demand and drivers for processed food products, with and without nutritional enhancement
- Conduct analysis of micronutrients from local plant materials collected in Kenya and Senegal
- Screening of micronutrient bioaccessibility (optimizing delivery) from model products - using both *in vitro* and *in vivo*
- Product development - prototype food products for consumer preference testing
- Establish standard procedures (SOPs) for material procurement and handling related to micronutrient screening and product development
- Design of nutritional intervention studies and baseline nutritional assessment of target community in Senegal
- Initiate development of Incubation Center for Kenya
- Collaborative product development efforts for nutrient dense cereal-based products
Local Nutrient-rich Plant Sources and Characterization

• Inventory of and chemical characterization of ingredients: **fortificants for making enriched cereal foods were identified** and are being screened at Purdue for Pro-vitamin A, iron, and zinc (bioaccessibility), antioxidant content
  – cowpea, peanut, moringa, tigernut, sesame, orange-fleshed sweet potato, baobab, local fruits, bambaranut
Extrusion Technology for Instant Products
Partnerships within IL

- Reduction of Post-Harvest Loss Innovation Lab (K-State)
  - Drying and storage of cereal grains and grain legumes
- Sorghum and Millet Innovation Lab
  - Sorghum- and millet-based production systems and value chains
- Nutrition Innovation Lab
- Others: commodity IL and CGIARs
Betty Bugusu, Ph.D.
Department of Food Science
Purdue University

bbugusu@purdue.edu
www.purdue.edu/iftc
https://ag.purdue.edu/ipia/fpl