



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

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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



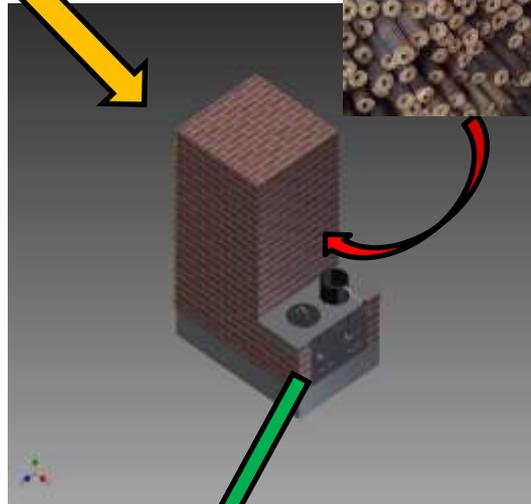
Target drying entire corn harvested within one week



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

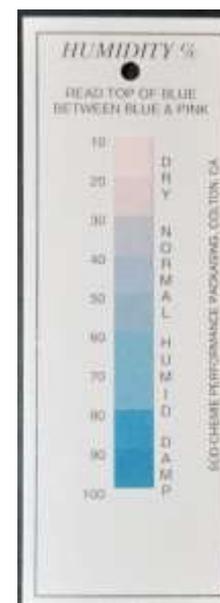
## Desiccant (Salt) Method (pass/fail)



**Analog Hygrometer**

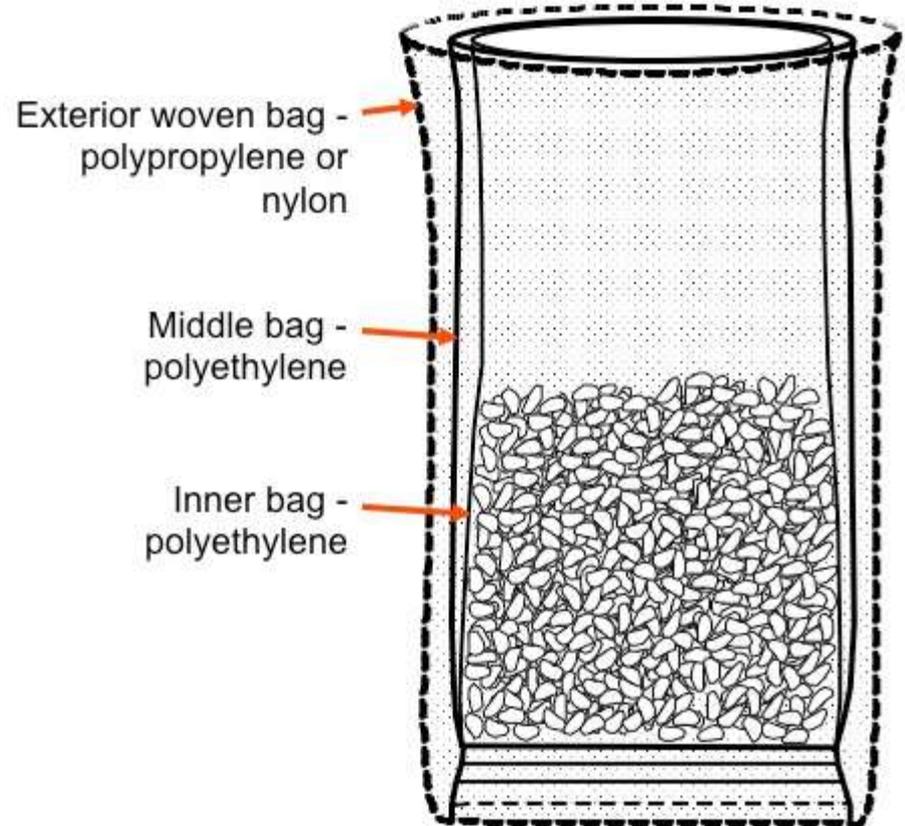


**Digital Hygrometer**



**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.

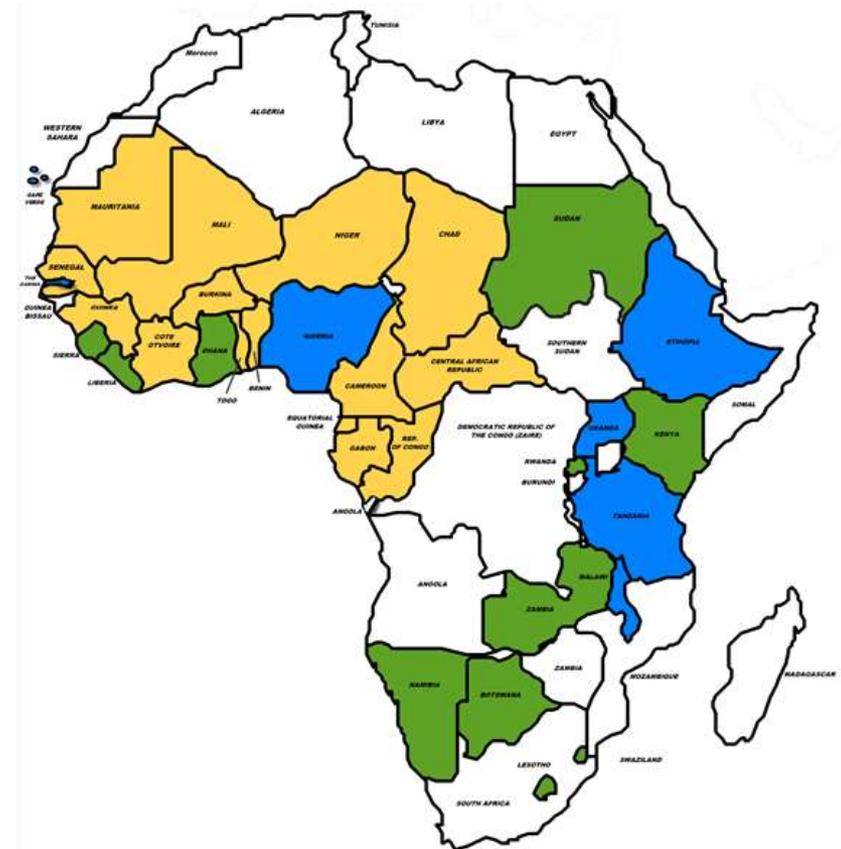
# PICS Bags Supply Chain Development: Project to Private Sector

*PICS TRADEMARK COUNTRIES*

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.



LEGEND	
Property Management Affiliation	
Madrid	Green
OAPI (African Organization for Intellectual Property)	Yellow
NA	Blue

# Manufacturing of PICS Bags

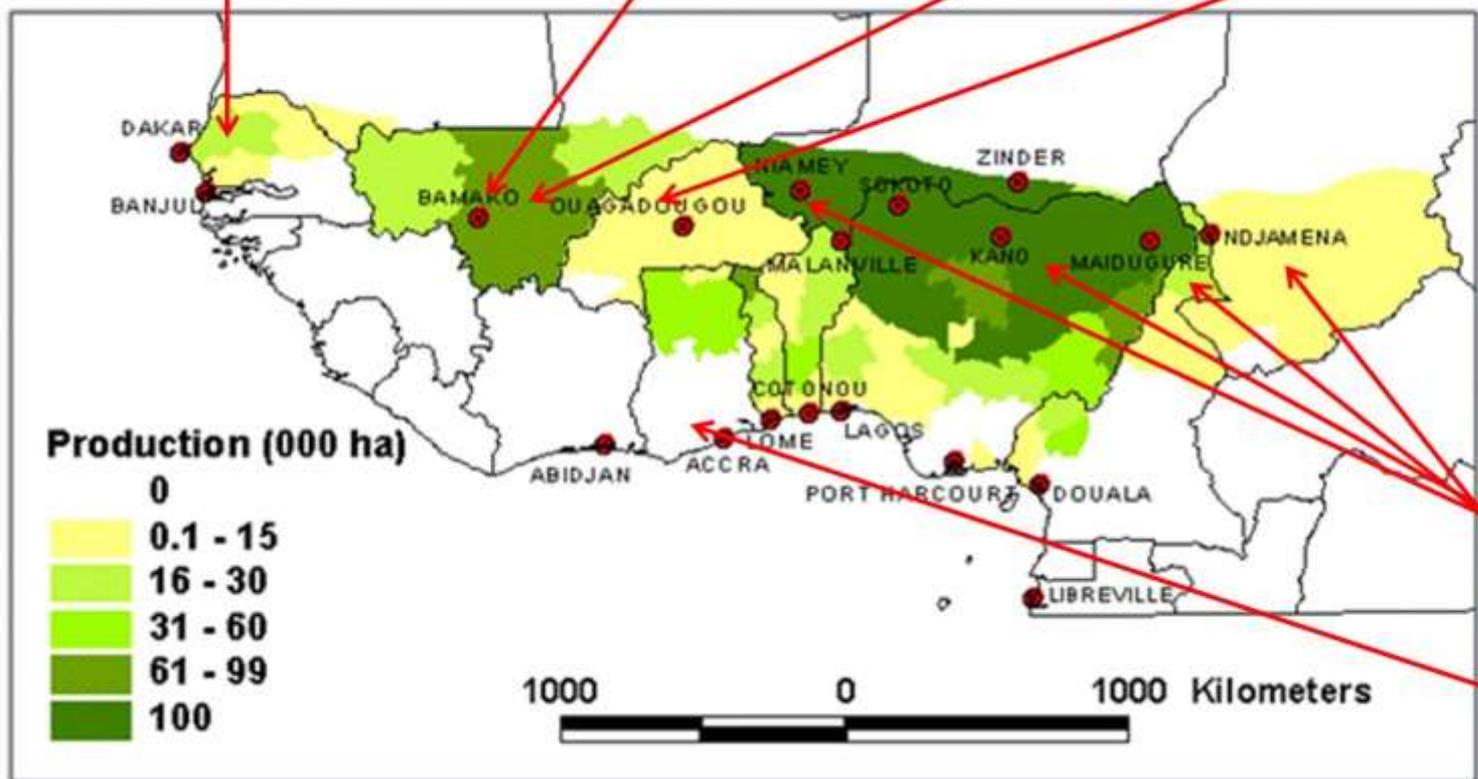
6 manufacturers in 5 countries in West Africa

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**
- **Univeristy 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

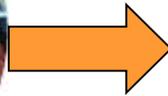
- Create systems of using food and food and nutrition-related technologies to expand markets and improve nutrition
- Link farmers to markets
- Replicate developed systems in other places



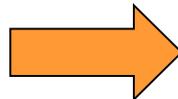
## Food Processing & Nutrition: Approach

- 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

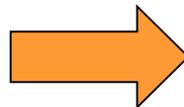
# Innovations: Upgrade Traditional Processes



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?



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## 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



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