

FEED THE FUTURE INNOVATION LAB FOR FOOD PROCESSING AND POST-HARVEST

HANDLING ANNUAL REPORT

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Technical and Advisory Committee Information

Technical Committee

1. Betty Bugusu, Ph.D., Project Director.
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3. Heather Fabries, Project Manager.
4. Jess Lowenberg-DeBoer, Ph.D., Team Leader, Drying and Storage. Tel: 765 494-6876; Email: lowenbej@purdue.edu
5. Bruce R. Hamaker, Ph.D., Team Leader, Processing and Nutrition. Tel: 765 494-5668; Email: hamakerb@purdue.edu

Advisory Committee

1. Tahirou Abdoulaye, Ph.D., Outcome/Impact Economist, International Institute of Tropical Agriculture, Headquarters & West Africa Hub, PMB 5320, Oyo Road, Ibadan 200001, Oyo State, Nigeria.
2. John Bustle, Ph.D., Retired Head, John Deere Foundation, Geneseo, IL.
3. Bruce Maunder, Ph.D., Retired, DEKALB Genetics Corp, Lubbock, TX.
4. Joseph Mpagalile, Ph.D., Agro-Industries Officer, Food Processing and Nutrition, Food and Agriculture Organization of the United Nations, Viale delle Terme di Caracalla, 00153 Rome, Italy.
5. Angela Records, Ph.D., Agreement Officer Representative, International Agricultural Research Advisor, Research Division, Office of Agriculture, Research and Policy, Bureau for Food Security, U.S. Agency for International Development, Washington, DC.

List of Countries Where Work

Kenya and Senegal

List of Program Partners¹

USA: North Carolina A&T State University

Kenya: University of Eldoret; The Cooperative University College of Kenya; and CIMMYT, Kenya

Senegal: Institut de Technologie Alimentaire and Institut Senegalais de Recherches Agricoles.

Others: University of Pretoria, South Africa and A to Z Textiles, Tanzania.

¹ U.S. universities and international partners by country.

Acronyms

AC	Advisory Council
CUCK	The Cooperative University College of Kenya
DV	Dietary value
FPL	Innovation Lab for Food Processing and Post-harvest Handling
ISRA	L'Institut Sénégalais de Recherches Agricoles
ITA	Institut de Technologie Alimentaire
NC A&T	North Carolina A&T State University
PMP	Performance Management Plan
SC	Steering Committee

I) **Executive Summary**

The Food Processing Innovation Lab was awarded in May 2014. The goal of the project is to increase access to safe and nutritious foods along the value chains by improving the drying and storage capacity of smallholder farmers and expanding market opportunities through diversified processed products that address quality in the market and nutritional needs. The program will focus on cereal grain value chains in Kenya and Senegal. Locally available nutrient-rich value chains will also be targeted for enhancing the nutrition of products. The program's inaugural meeting was held in Dakar, Senegal in August 2014 where program partners discussed the proposed work including deliberations on research methodologies and linkages among various project components. Work plans, performance management plan (PMP) and statements of work for each collaborator were finalized. Gender training was conducted for all project participants.

II) **Program Activities and Highlights²**

- Project launch.
- Gender training for all project participants.
- Development of moisture content determination methods for dried grain.
- Identification of nutrient-rich value chains for nutritional enhancement of staple food products.
- Graduate student identification and recruitment.

III) **Key Accomplishments³**

FPL project was launched in August 2014 in Dakar, Senegal.

Gender training conducted for all project participants.

10 graduate students recruited: 7 male and 3 female; 6 Ph.D and 3 Masters. The students are from Ecuador, Ethiopia, Kenya, Lesotho, Nigeria, USA, and Zimbabwe.

IV) **Research Program Overview and Structure**

The project has two core research components: 1) Grain drying and storage involving development and dissemination of affordable and efficient drying and storage technologies for use by smallholder farmer, and 2) Food processing and nutrition involving development of high quality, market-competitive food products, including products with improved nutrition and dissemination through incubation training centers. Building of local capacities (human and institutional) and partnerships

² Summary of program activities for the year, no more than one page in length.

³ Concise statement of achievements, limited to one page in length that focuses on outputs, not process, such as Feed the Future indicators and distillation of program achievements across all program activities. Reporting on numbers of project meetings is not an output.

among public and private sector are also major components of the project. Gender and environment are taken into account at all stages of the project cycle.

V) **Research Project Reports⁴**

a) Theme A: Drying & Storage (Improve drying and storage of cereals and grain legumes in the humid tropics of Africa)

i) Project 1

(1) Name: Grain drying

(2) Description: Drying methods in Senegal and Kenya – Development of moisture content determination methods for dried grain.

(3) Collaborators⁵: Klein Ileleji (lead), Charles Woloshuk, Jess Lowenberg-DeBoer, Corinne Alexander & Jake Ricker-Gilbert (Purdue, USA); Douglas Shitanda (CUCK, Kenya); Hugo DeGroot (CIMMYT, Kenya); Makhtar Samb (ITA, Senegal); Ibrahim Sarr & Katim Toure (ISRA, Senegal); Guibing Chen (NC A&T, USA); Cheryl O'Brien (San Diego State University, USA)

(4) Achievements: Completed work plans, PMP and statements of work for collaborators. Purdue (Ileleji) provided portable moisture meters (two each per country for Senegal & Kenya) to our collaborators that will be used in field studies.

(5) Capacity Building: A PhD student has been admitted in Agriculture Economics. Another PhD student has been identified to begin in January 2015 in Agriculture and Biological Engineering.

(6) Lessons Learned: N/A

(7) Presentations and Publications: None

ii) Project 2

(1) Name: Grain storage

(2) Description: Storage methods in Senegal and Kenya – Begin to identify storage methods used and assess potential for aflatoxin development in hermetic bags

(3) Collaborators⁵: Jess Lowenberg-DeBoer (Purdue, USA) (lead), Charles Woloshuk (Purdue, USA); Douglas Shitanda (JKUAT, Kenya); Hugo DeGroot (CIMMYT, Kenya); Makhtar Samb (ITA, Senegal); Ibrahim Sarr (ISRA, Senegal)

(4) Achievements: Completed work plans, PMP and statements of work for collaborators. The major focus of the research identified as 1) testing the efficacy of the hermetic storage devices to maintain quality during high humidity storage conditions, 2) Effects of periodic opening/closing of the storage devices to grain moisture, mold growth, and aflatoxin accumulation. A quantitative methodology for moisture determination using the salt-jar method is being developed. Two hygroscopic materials are being tested: calcium sulfate (Drierite) and non-iodized salt. Preliminary results indicate that it is possible to develop a quantitative measure of the salt-jar method.

(5) Capacity Building: A Masters student has been admitted in Botany and Plant Pathology.

(6) Lessons Learned: N/A

(7) Presentations and Publications: None

⁴ Summaries of project activities, highlights and outcomes, not scientific reports or long detailed research papers, no more than one page per project.

⁵ Provide institutional affiliation and country.

- b) Theme B: Processing & Nutrition (Drive the value chain through processing to increase commercialization and improve nutrition)

i) Project I

- (1) Name: Food processing Nutrition
- (2) Description: Establish protocols for selection and initial screening of nutrient-rich plant materials from Senegal and Kenya for use at household level and in product development
- (3) Collaborators⁵: Mario Ferruzzi (Purdue, USA) (lead); Violet Mugalavai & Augustino Onkware (Eldoret Univ., Kenya); Djibril Traore (ITA, Senegal); Johanita Kruger (Univ. Pretoria, South Africa)
- (4) Achievements: Standard Operating Procedures are being generated to provide uniformity in sampling and transfer of materials between labs. This includes import permit request for plant material transfer. Formulations with millet/sorghum and dried fruits/vegetables have been developed leveraging mango and carrot powders generated at Purdue University. A database is being established to document all potential African plant materials for use in fortification.
- (5) Capacity Building: Two PhD students have been admitted: one in the Interdepartmental Nutrition/Food Science Program and the other in Food Science.
- (6) Lessons Learned: Achievement of greater than 25% dietary value (DV) for vitamin A may require leveraging of cereals including high provitamin A cereals. Iron and Zinc levels will need additional strategies for plant sources.
- (7) Presentations and Publications: None

VI) Associate Award Research Project Reports: N/A

- a) Name of Mission and Award Number
 - i) Project Description
 - ii) Collaborators
 - iii) Achievements
 - iv) Capacity Building
 - v) Lessons Learned
- b) Name of Mission and Award Number

VII) Human and Institutional Capacity Development⁶

- a) Training by Country
 - i) Short-Term: N/A
 - (1) Number (by gender)
 - (2) Purpose
 - (3) Home institution, if applicable
 - (4) Training institution or mechanism

⁶ This section is to serve as a compilation of all program training activities and not meant to duplicate the Capacity Building section under individual Research Project Reports. It can be in chart format.

ii) Long-Term – see table below

Name	Gender	University	Degree	Major	Grad Date	Home Country	Institutional Home
Florence Gatwiri Kiburi	Female	Jomo Kenyatta Univ. of Agric. & Technology	PhD	Processing Engineering	2017	Kenya	Kenya
Michael I. Mukolwe	Male	Jomo Kenyatta Univ. of Agric. & Technology	PhD	Processing Engineering	2017	Kenya	Kenya
Tim Tubbs	Male	Purdue University	MS	Plant Science	2016	USA	USA
Daniel Burgess	Male	Purdue University	MS	Plant Science	2016	USA	USA
Stacy McCoy	Female	Purdue University	PhD	Agricultural Economics	May-19	USA	USA
Pablo Cesar Torres-Aguilar	Male	Purdue University	PhD	Food Science	Aug-18	Ecuador	USA
Hawi Debelo	Female	Purdue University	PhD	Nutrition	Aug-19	Ethiopia	USA
Peter Meki	Male	University of Pretoria	MS	Food Science	2016	Zimbabwe	South Africa
Ayodeji Falade	Male	University of Pretoria	PhD	Food Science	2017	Nigeria	South Africa
Moeketsi Peter Ntakatsane	Male	University of Pretoria	PhD	Food Science	2017	Lesotho	South Africa

b) Institutional Development

i) Description

ii) Partners

VIII) Technology Transfer and Scaling Partnerships

a) Plan of Action

i) Steps taken

ii) Partnerships made

iii) Technologies transferred

iv) Technologies scaled

v) Technologies ready to scale

IX) Governance and Management Entity Activity

The FPL Steering Committee (SC) meets once a month to discuss the strategic direction of the project and to review and approve potential funding initiatives. The SC also advise on the development, implementation, and monitoring & evaluation of the project, including strategic linkages and partnerships. The Advisory Council (AC) provides strategic guidance to the project and to support development of collaborative, efficient, effective science and management. The AC also helps FPL identify future trends and opportunities in post-harvest research and development. The first AC meeting is scheduled for December 12, 2014,

X) Other Topics⁷

⁷ Such as Regional Centers of Excellence, impact assessment, gender initiatives

XI) Issues⁸

XII) Future Directions: The FPL looks to be effective and relevant in the 2 focus countries of Kenya and Senegal through development of practical and cost-effective solutions for grain drying, storage, and processing in the humid tropics. The solutions will be profitable for the manufacturers who make the technology; help create non-farm jobs; be profitable for the end users including farmers and processors and enable consumers to benefit from the nutritionally-enhanced grain-based products. The FPL is also working to identify trends and opportunities for post-harvest grain research and engagement over the next 5 to 10 years to expand the program and keep it relevant to the stakeholder needs.

⁸ Such as financial, management, regulatory