# Feed the Future Food Processing and Post-Harvest Handling Innovation Lab Annual Meeting

## August 12, 2015

## Year 1 Review  Year 2 Plan

# Roll Call of Participants

**PURDUE**
Betty Bugusu
Suzanne Nielsen
Bruce Hamaker
Jess Lowenberg-DeBoer
Corinne Alexander
Jake Ricker-Gilbert
Mario Ferruzzi
Klein Ileleji
Charles Woloshuk
Heather Fabries

**NC A&T**
Guibing Chen

**PRETORIA - S.A.**
John Taylor
Johanita Kruger
Kwaku Duodu

**CIMMYT-KENYA**
Hugo DeGroote

**U. ELDORET – Kenya**
Violet Mugalavai
Augostino Onkware

**ITA – Senegal**
Djibril Traore
Fallou Sarr
Makhtar Samb

**ISRA – Senegal**
Ibrahima Sarr
Tanaor Ndao
Moussa Sall

**CUCK - Kenya**
Douglas Shitanda

**SDSU – USA- GENDER**
Cheryl O'Brien

**A TO Z TEXTILES- Tanzania**
Johnson Odera

# Advisory Council Members

- Angela Records, USAID
- John Bustle, Retired Engineer, John Deere Foundation
- Joseph Mpagalile, FAO, Rome, Italy
- Bruce Maunder, Retired Breeder, DEKALB Genetics
- Tahriou Abdoulaye, Impact Economist, IITA-Nigeria
- Dirk Maier, Agr. Engineer, Iowa State University

# FPL: Management Team Updates

- FPL is working with USAID to complete a rebudget of the project to better support activities and efforts on the ground.
  - This rebudget will also connect the programmatic and fiscal years.

- Subrecipients: All Year 2 rebudget requests are due to Betty, Heather, and Laura no later than **September 1, 2015**.

- Subrecipients will be receiving updated financial reporting documents this week (via e-mail) from Laura.

# (Purdue-Ileleji: Drying Effort) Year 1 Summary

- **Activity 1.1:** Survey drying grain post-harvest practices in target region in Senegal and Kenya:
  - Finalized scope of work, met with in-country collaborators: August 2015
  - Conduct survey in Kenya (August 30-Sept. 11)
  - Conduct survey in Senegal (Oct. 10 – 23)

- **Activity 1.2:** Develop low-cost moisture determination method.
  - Began research to develop an objective salt-in-jar moisture determination method
  - Worked with Purdue undergraduate students to develop low-cost moisture meter
  - Worked with U of Los Andes, Colombia on a low-cost moisture meter (with Dr. A. Bernal and student M. Otero)

# (Purdue-Ileleji: Drying Effort) Year 1 Plan

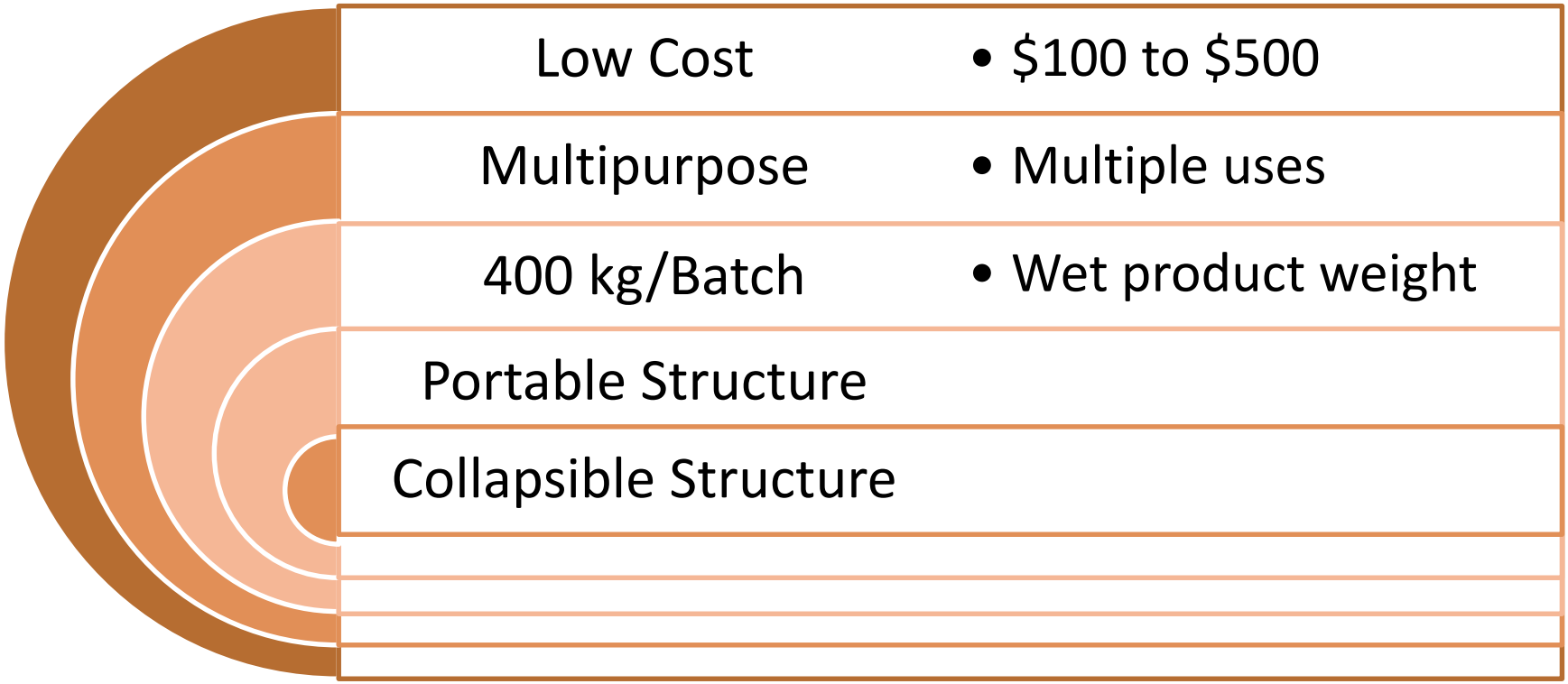
- **Activity 1.3: Develop low-cost drying technology:**
  - Compiled literature on drying technologies (*in progress still*)
  - Installed weather station in Kenya (February 2015) and Senegal (in June 2015).
  - Developed a Modular Collapsible Solar Dryer and refined the design of the Purdue Improved Drying Stove
  - Build and test dryer prototypes at Purdue and refined designs as needed (August to November)

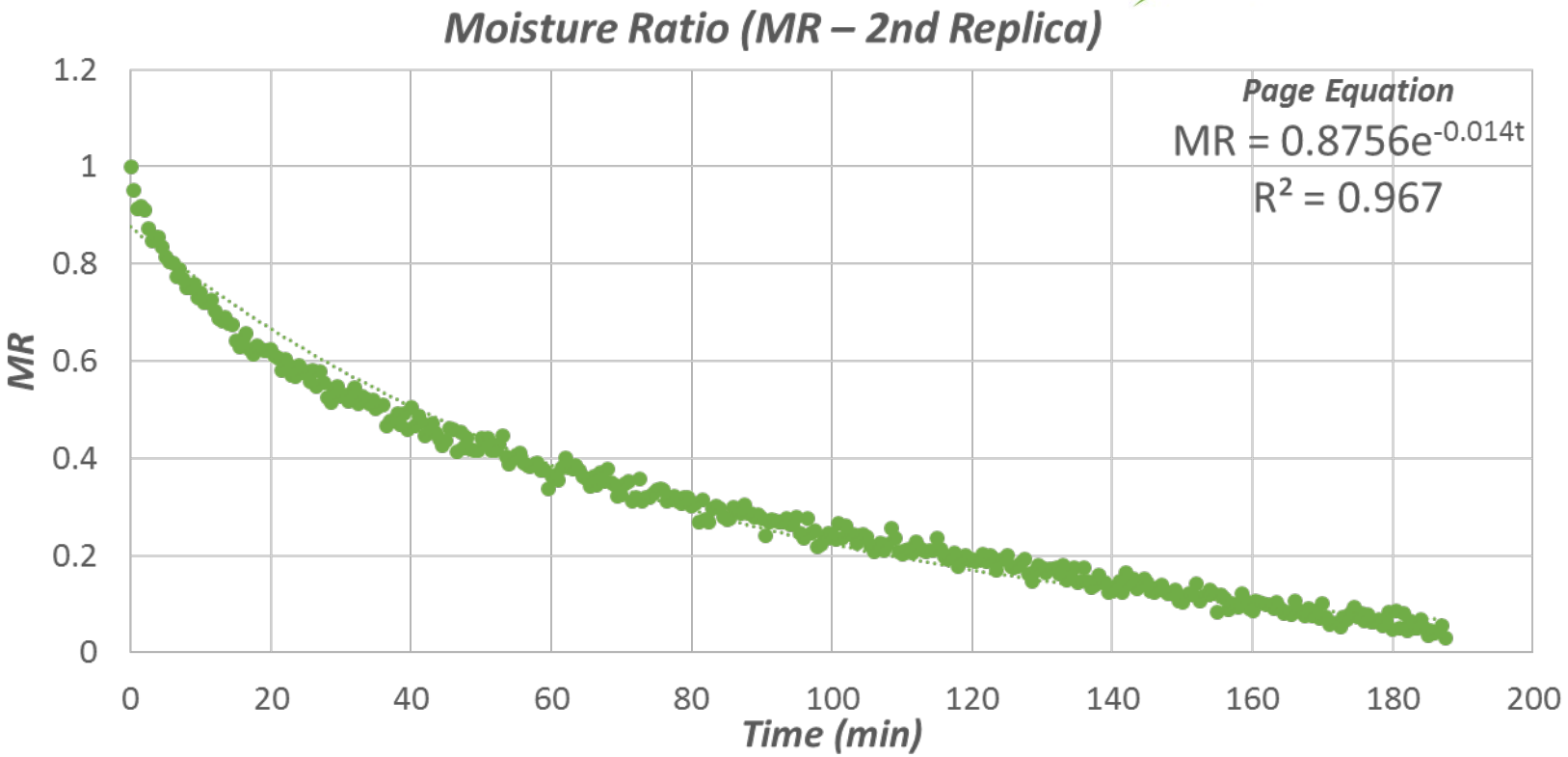
- **Activity 3.1: Train graduate students from US and focus countries:**
  - Recruited 1 PhD student from Nepal
  - Recruited 1 research engineer, a recent Purdue ME graduate from Nigeria
  - Mentored 5-6 undergraduate students from Purdue (US and India nationalities)
  - Mentored 2 undergraduate interns from Colombia

# (Purdue-Ileleji: Drying Effort) Year 2 Plan

- **Build and deploy low-cost drying technologies for testing on the field:**
  - Finalize engineering drawings and manufacturing protocols for fabricating units of the dryers for in-field deployments in January 2016
  - Test the solar dryer and drying stove technologies deployed on the field in comparison with the local technologies at field stations in Kenya and Senegal.
  - Work in collaboration with FtF PHL and other groups to test technologies in other countries.
- **Partnerships and Commercialization Plan:**
  - Continue to work on commercialization plan with private industry (*JT Inc., a new start-up at Purdue Research Park*) toward commercializing new drying technologies.
  - Develop partnerships on commercialization and technology transfer.

# *Design Criteria for Drying Technologies*






**Thin-Layer Drying Experiments (500g) in ABE, Air Temperature is 43°C**
**Product: Shelled yellow corn**
**Drying layer thickness: 0.4 inches**
**Time for 17 percent point moisture removal (30% to 13%): 2 h 23 min.**

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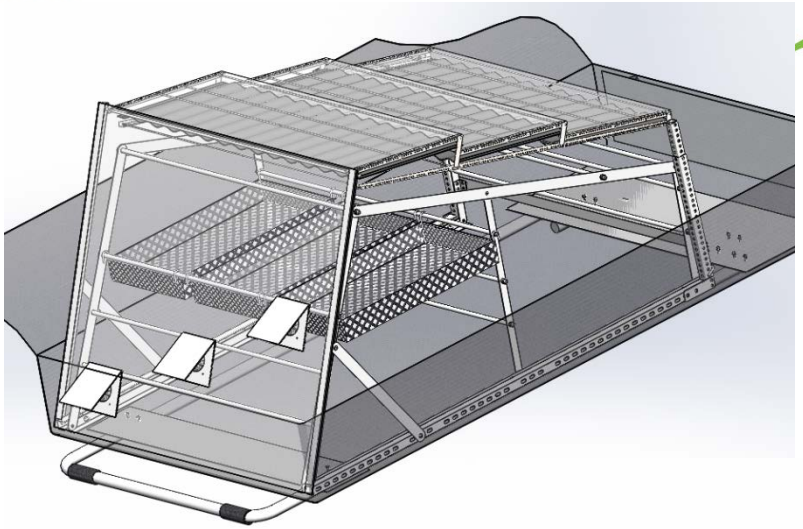
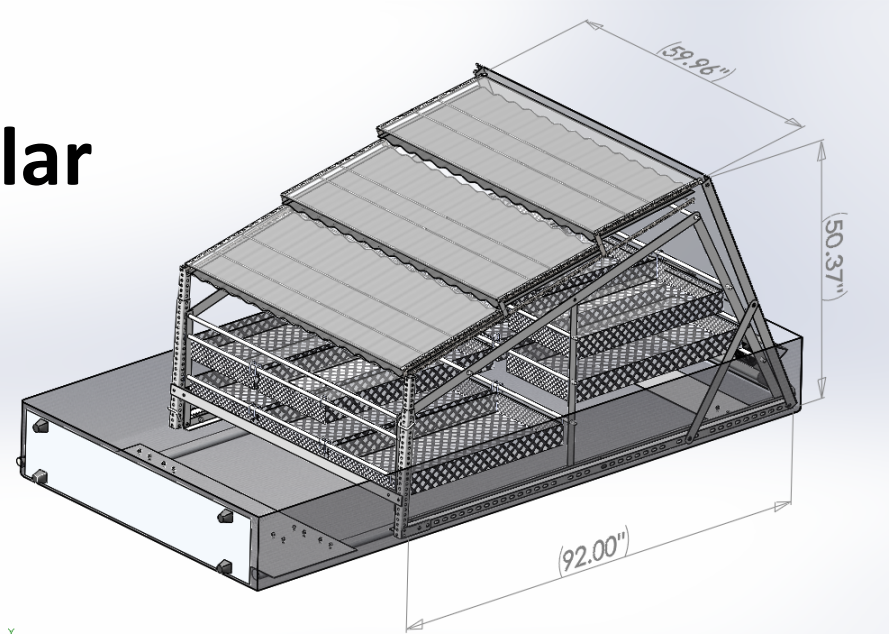
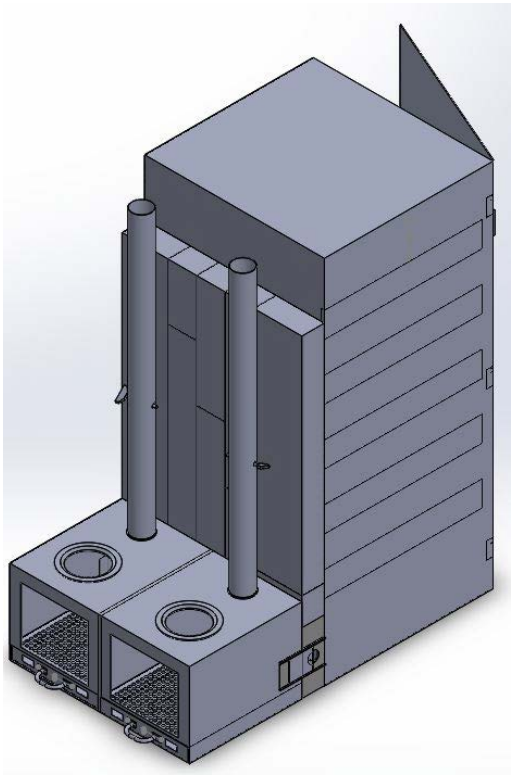
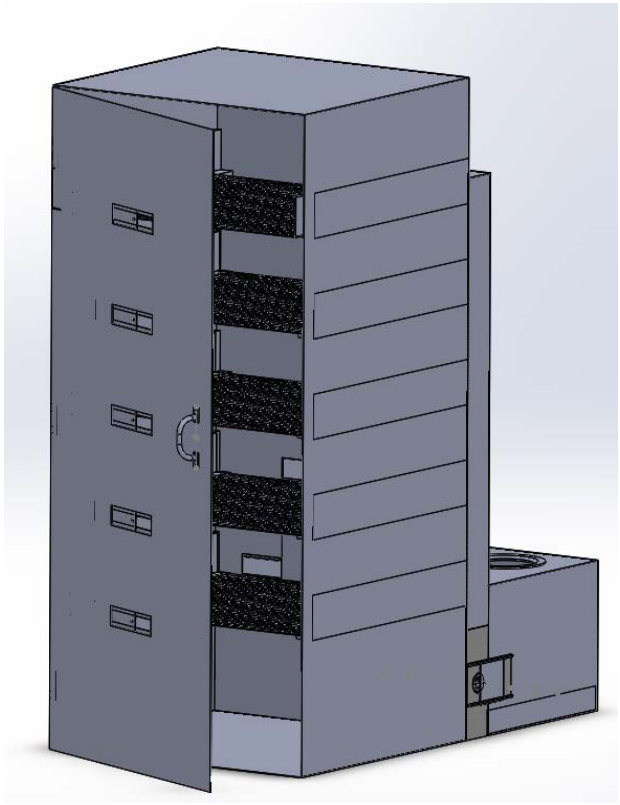


# Modular-C Solar Dryer





# Purdue Improved Drying Stove (PIDS)

*New Look!*

# Purdue Drying Technology Team

- Dr. Klein Ileleji (Leader)
- Ravindra Shrestha, PhD Student
- Jesumayomikun (Mayo) Olasubulumi, Research Assistant Engineer

**Collaborators**

- Diana Milena Ramirez Gutierrez, Visiting Undergraduate Student, National University of Colombia.
- Marisol Pantoja Otero, Visiting Undergraduate Student, University of Los Andes, Colombia.
- Dr. Alba G. A. Bernal, University of Los Andes, Colombia.

# (Purdue – Woloshuk) Year 1 Summary

- 1.2.2 Develop and evaluate moisture content testing protocols that use inexpensive humidity/temperature devices
- Graduate Student Tim Tubbs presented poster at the annual meeting of the American Phytopathological Society

# (Purdue – Woloshuk) Year 1 Summary

- 1.5.3 Determine impact of grain moisture on aflatoxin accumulation in hermetic storage
- Tim Tubbs started 6-month experiment to determine the effect of routine opening of PICS bags on stored maize at various moisture contents (16%, 18%, 20%).

# (Purdue – Woloshuk) Year 1 Summary

- 1.5.1 Prioritize research questions to assess potential for aflatoxin development in hermetic storage
- Graduate student Brett Lane has experiment set up in IN and AR determine the effect of storage environments on aflatoxin accumulation

# (Purdue – Woloshuk) Year 2 Plan

- Discuss with PIs in Kenya (September) and in Senegal (October) about ways to replicate and expand on the US experiments. Include A to Z bags
- Complete US experiments and write manuscripts

# (North Carolina A&T) Year 1 Summary

- Based on definition of moisture content (d.b.), Eq. (1) was obtained:

$$\text{Weight of 1000 kernels (g)} = \text{Dry mass of 1000 kernels (g)} \times (1 + 0.01 \times MC\%) \quad (1)$$

- 1000 kernels (yellow dent corn, NCAT farm) were 264.74±2.24 g (n=3) (102 °C for 8 h). Using this data and Eq. (1), Table 1 was generated. **Accuracy ± 0.85%**

**Each hybrid corn needs to be calibrated.**

**Table 1** The relationship between moisture content (dry basis) and weight of 1000 kernels.

| Weight (g) | MC % | Weight (g) | MC % | Weight (g) | MC % |
|---|---|---|---|---|---|
| 288.57 | 9 | 303.13 | 14.5 | 317.69 | 20 |
| 289.89 | 9.5 | 304.45 | 15 | 319.01 | 20.5 |
| 291.21 | 10 | 305.77 | 15.5 | 320.34 | 21 |
| 292.54 | 10.5 | 307.10 | 16 | 321.66 | 21.5 |
| 293.86 | 11 | 308.42 | 16.5 | 322.98 | 22 |
| 295.19 | 11.5 | 309.75 | 17 | 324.31 | 22.5 |
| 296.51 | 12 | 311.07 | 17.5 | 325.63 | 23 |
| 297.83 | 12.5 | 312.39 | 18 | 326.95 | 23.5 |
| **299.16** | **13** | 313.72 | 18.5 | 328.28 | 24 |
| 300.48 | 13.5 | 315.04 | 19 | 329.60 | 24.5 |
| 301.80 | 14 | 316.36 | 19.5 | 330.93 | 25 |

# (North Carolina A&T) Year 1 Summary

- True density of 10 corn kernels (yellow dent corn, NCAT farm) was measured using a pycnometer (Quantachrome Instruments, Boynton Beach, FL). The obtained results are shown in **Table 2**.

**Conclusion:**

In the experimental range, constant true density indicated weight (g) and volume ($cm^3$) of a corn kernel change at the same ratio.

**Table 2** Corn kernel true densities at different MC

| MC% (dry basis) | True Density ($g/cm^3$) |
|---|---|
| 10.3 | 1.3274 |
| 6.86 | 1.3223 |
| 4.87 | 1.3238 |
| 0 | 1.3252 |

**Moisture content can be correlated with kernel volume.**

# (North Carolina A&T) Year 2 Plan

- To develop a simple device for accurately and quickly withdrawing 1000 kernels from a large quantity of corn in a random manner.
- To develop a moisture determination protocol based on relationship between moisture content and volume of corn kernels.
- To help calibrate moisture determination methods developed by Dr. Klein's lab at Purdue University.

# ISRA Year 1 Summary

**Team:** **Dr Ibrahima Sarr, PI, Dr Moussa Sall & Papa madiama Diop, coPIs**

## Administrative issues

- **Sub-recipient commitment:** signed 27/04/042015
- **Sub-agreement ISRA-Purdue:** signed 10-15/07/2015

## Research activities

**Objective1**: **improve drying & storage storage of cereals & legumes in humid tropics of Africa**

**Activity1.1**: **identify drying and storage methods used by farmers and determine mosture content of grain stored by farmers**

**Subactivity1.1.1: Establishment of in country activities in Senegal/Kenya by meeting with collaborators online/in person**

-The weather station is deployed and installed at Vélingara (Kolda) and data are being shared on a fortnight basis with Moussa Kande an ISRA technician monitoring it.

**Subactivity1.1.2: Plan exploratory appraisal of grain handling, drying and storage in Senegal & Kenya**.

It was not conducted due availability of funds (We've been doing only what was possible with our own funds).

**Subactivity1.1.3**: **Review literature/local on post harvest issues in Senegal & Kenya**.

A Literature review of grain storage (millet, sorghum, maize and groundnut) in Senegal has been completed with my students and some surveys in central Senegal being analyzed.

It appeared,

- Grain borers, weevils and storage moths are the main insects here.
- The loss in maize here is 18% for shelled maize, 20 % for stored cobs and 27% for stored and shelled cobs.
- The use of ordinary bags treated with pesticides in the storage of grain & legume is the most common method but some other farmers use traditional granaries, solarization, hermethic methods etc. Others protectants against insects included diatomous earth (inert products), plant essential oils to control insect. Very few documents on mycotoxins with groundnut and maize being more of concern compared to millet, sorghum and rice for Senegal main rainfed crops. There are very information on drying methods.
- Metadata on Senegal and agriculture in the province of Kolda and the county of Velingara agriculture are gathered including a long term agricultural statistic time series
- Beetles, weevils and storge moths are the main insect here.

# ISRA Year 1 Summary

**Subactivity1.1.4 Draft baseline household survey for Senegal/apply for IRB approvals**

-ISRA has contributed in developping the draft through Katim replaced now by Moussa Sall.

**Subactivity1.1.5 Conduct baseline survey of grain handling, drying and storage in Senegal & Kenya**

-ISRA is contributing in developping and finalizing the sampling plan in relation with local agricultural authority in Kolda and Velingara

**Activity 1.3**: **Develop low-cost grain drying technologies for smallholders**

**Subactivity1.3.1 Review literature on the two drying approaches outlined in the proposal**

(see Subactivity1.1.1 & 1.1.3)

**Subactivity1.3.2 Determine the critical criteria for grain drying by small holders in Kenya/Senegal**

(see Subactivity1.1.1)

**Activity 1.3**: **Develop low-cost grain drying technologies for smallholders** (see Subactivity1.1.1)

# ISRA Year 2 Plan

**Objective1:** improve drying & storage storage of cereals & legumes in humid tropics of Africa

**Subactivity1.1.5** Conduct baseline survey of grain handling, drying and storage in Senegal & Kenya

-The sampling plan will be finalized in relation with the research team

-The survey is planned for october 2015

**Activity 1.4**: Determine the optimum moisture for safe storage of grains and oilseeds in hermetic storage systems

- Protocoles will be finalized in relation with the research team

-The tests are planned from november 2015

**Subactivity1.4.2** Determine impact of grain moisture on mold growth and development during hermetic storage in-country in Senegal and Kenya

- Protocoles will be finalized in relation with the research team

-The tests are planned from november 2015

**Activity 1.5:** Assess potential for aflatoxin development in hermetic bags

**Subactivity1.5.1** Determine research activities to be conducted in-country in Senegal and Kenya

**Subactivity1.5.2** Determine impact of grain moisture on aflatoxin accumulation in hermetic storage conducted in-country in Senegal and Kenya

- To develop a protocole and conduct tests on PICS bags, grain Pro and A to Z bag on aflatoxin accumulation at farmer level

-The tests are planned from november 2015

# (THE CO-OPERATIVE UNIVERSITY) Year 1 Summary

**USAID Feed the Future Food Processing and Post-harvest Handling Innovation Lab (Food Processing Lab, FPL)**

**Objective 1**: Improve drying and storage of cereals and grain legumes in the humid tropics of Africa

**Activity 1:** Funding

- Funds were release late due to the difficult of obtaining the Duns Number in May 2015

**Activity 2:** Field Survey - 1

- Survey carried out in Eldoret and Kakamega in February 2015,
- Traditional open sun drying commonly used,
- Challenge of rain, insects and dust during drying,
- Adoption of PICS bags very low,
- Large scale storage in silos or gunny bags,
- Farmers store maize in granaries and gunny or sisal bags in houses,
- Farmers not able to determine actual moisture content in the field.

# (THE CO-OPERATIVE UNIVERSITY) Year 1 Summary

Clean maize in PICS bags

Infested maize from gunny bags

Traditional granary

Mobile mechanical grain drier

# (THE CO-OPERATIVE UNIVERSITY) Year 1 Summary

**Activity 3:** Research Students

- Three PhD students have been identified. Expected to register by September 2015.

**Activity 4:** Weather Station

- The weather station was installed on the 26th and 27th of June 2015,
- Data retrieve currently ongoing.

**Activity 5:** Field Survey – 2

- Survey to be carried out from 28th August 2015 on harvesting, drying, moisture measurement and storage.

Installed weather station

**Activity 6:** Drying and Storage Tests

- To evaluate natural, solar and mechanical drying of grain
- To evaluate effect of different storage methods on grain quality,
- Promote use of PICS bags.

# (THE CO-OPERATIVE UNIVERSITY) Year 2 Summary

**Objective 1**:

**Activity 1:** Drying and Storage

- Modification and testing of mechanical drier
- Installation and testing of solar driers,
- Testing and analysis of stored grain.

**Objective 3:**

- Training of 3 PhD students,
- Training on local fabrication of grain driers,
- Local fabrication of grain driers,
- Training of extension officers on use of driers and moisture meters,
- Training of farmers on the use of driers and moisture meters,
- Promote use of PICS bags,
- Knowledge enhancement in the USA on grain drying and storage,
- Benchmarking visit to Senegal.

**Objective 4:**Private Partnerships

- Initiate adoption of the grain drier manufacturing by private partners,
- Initiate funding options to support grain drier manufacturers.

# Processing/Nutrition Team

- Senegal – Institut de Technologie Alimentaire (ITA)
  - Djibril Traore, Fallou Sarr
- Kenya – University of Eldoret
  - Violet Mugalavai, Augostino Ongware
- University of Pretoria
  - John Taylor, Gyebi Duodu, Johanita Kruger
- CIMMYT
  - Hugo DeGroote
- Purdue University
  - Bruce Hamaker (PI), Mario Ferruzzi (co-PI)

# Processing/Nutrition Sites in FtF Countries



## Value Chains

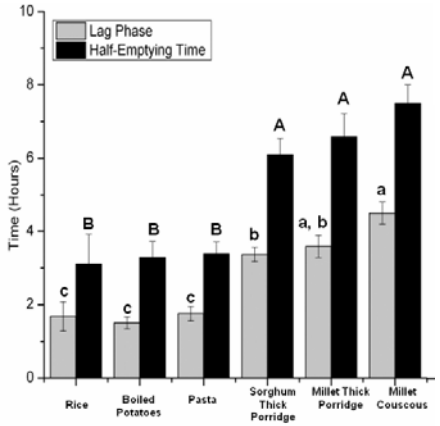
Millet (pearl/Senegal, finger/Kenya, sorghum, maize, grain legumes, and nutrient-rich plants

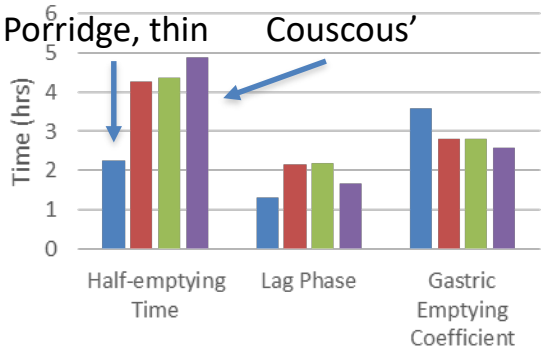
# Food Processing/Nutrition: Approach

- Product development, marketing, and promotion
  - Develop high-quality, safe, competitive food products
  - Disseminated through Incubation Training Centers; processing enterprises
- Processing technology innovation
  - Appropriate, cost-effective technologies
  - Development/refinement
- Improvement of nutritional quality of products
  - Fortified products using local nutrient-rich plant sources
  - Maximized micronutrient (iron, zinc, pro-vitamin A) delivery to the body
  - Cereal processed foods providing fullness and satiety feeling
- Impact assessment: product and nutritional

# Processing/Nutrition - Year 1 Summary

- Activities – to address broad aims
  - Micronutrient assessment of millets, local nutrient rich plants; bioaccessibility and processing to improve it
  - Market analysis – consumer studies, Kenya and Senegal
  - Starting whole grain millet processing and storage study
  - Extrusion instantized flour studies, other processes (fermentation, agglomeration)
  - Delivery of extruders to Senegal/ITA and Kenya/UoE
  - Gastric emptying/fullness preliminary work



# Processing/Nutrition Year 1 (Purdue Detailed Summary)

- **Identify local agriculture commodities to develop nutritionally-enhanced food products**
  - *Collected and characterized 50+ specimens and identified promising candidates for vitamin A (mango, carrot), iron (Hibiscus, Bouye and Morenga) and zinc (Hibiscus)*
  - *Identified local suppliers of strategic materials and have begun validating quality*
  - *Initiated evaluation of local and biofortified millet varieties for iron and zinc with ITA and Univ. Pretoria*

- **Evaluate composition, micronutrient retention and bioaccessibility in prototypes to guide product development**
  - *Developed prototype thin and thick porridges to screen for provitamin A retention and delivery (bioaccessibility) in vitro*
  - *Applied models to identify interactions that can modify provitamin A delivery including impact of key modifiers and interactions between plant based fortifying agents*
  - *Initiated collaboration with Univ Pretoria on iron and zinc assessments*

## *Mineral Analysis of local plant foods/ingredients*

| | Mean Analyte Name | |
|---|---|---|
| | Fe | Zn |
| Sample Name | Concentration (mg/g) | Concentration (mg/g) |
| Baobab | 0.120 | 0.000 |
| Bouy (10) | 0.117 | 0.000 |
| Bouy (11) | 0.020 | -0.010 |
| Ipomoea b. | 0.010 | -0.007 |
| Lam | 0.240 | 0.003 |
| Mango | 0.010 | -0.010 |
| Nere | 0.263 | 0.000 |
| Oule | 0.113 | 0.000 |
| Peach Palm flesh | 0.010 | -0.010 |
| Peach Palm peel | 0.020 | 0.000 |
| Roselle | 0.073 | 0.048 |

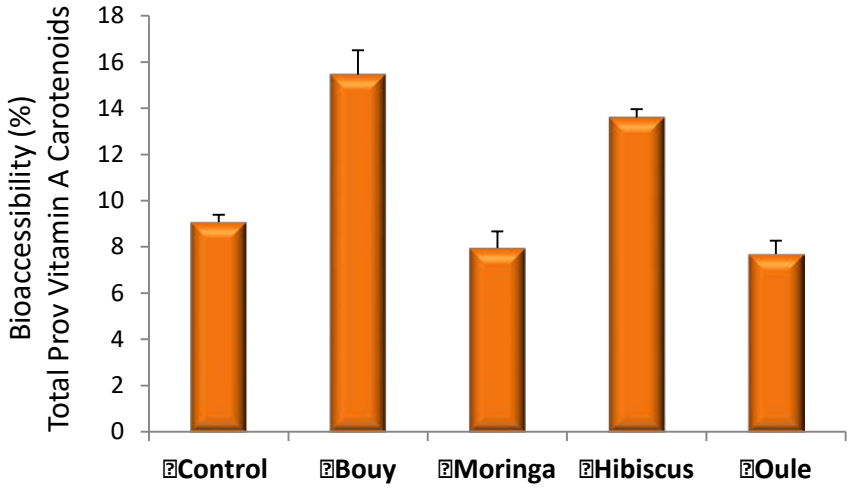
## *Co-Extrusion of vitamin A juices with MIllet*

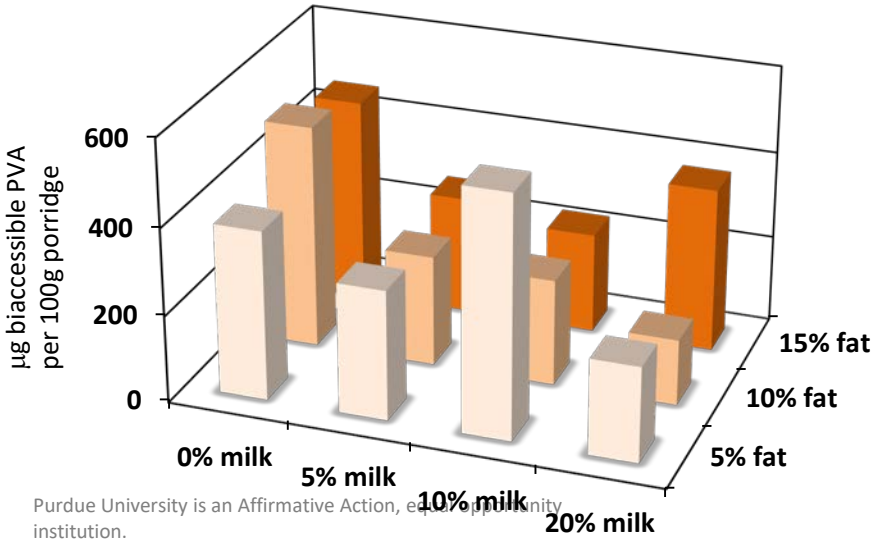
*Co-extruded Millet & Carrot Juice*

*Dry Blended Millet & Carrot Powder*

*Carrot Powder*

## *Vitamin A Bioaccessibility can be influenced by formulation with Ingredients as well as preparation*



# Processing/Nutrition Year 1 (Purdue Detailed Summary)

- **Initiate discussions and planning of nutritional baseline and assessment study in Senegal**
  - *Set objectives of nutritional assessment study and product targets for micronutrient prioritization (iron and zinc as priority with Vitamin A as secondary target)*
  - *Contract with consultant (S. Wade) to aid in design and local implementation of study*

- **Create a sustainable market-led fortified processed grain foods approach in Senegal and Kenya**
  - *Completed initial consumer focus groups with partners in Senegal and Kenya to determine key characteristics and interest in naturally fortified cereal products*
  - *Established connections with processors and ingredient suppliers in Touba and Dakar, Senegal*
  - *Identify gaps in capacity or technology required to produced instant cereal porridges*

# Processing/Nutrition Project Overall Year 2 Plan

- **Identify/develop commercially relevant local plant materials for manufacture of nutritionally-enhanced food products**
  - *Finalize identification and validation commercial suppliers and materials*
  - *Develop drying capacity for generation of materials as required*
- **Source and experiment with local (Souna) and biofortified millet varieties for optimal product quality and nutritional composition**
  - *Explore impact of decortication (whole grain versus decorticated grain) on processing and product quality – interest is in using whole grains for maximized micronutrients*
  - *Explore impact of grain background on micronutrient content and bioaccessibility*
  - *Explore impact of juice/millet co-extrusion on stability and bioaccessibility of micronutrients*
  - *Finish study on satiety and fullness of millet-based products*
- **Initiate technology transfer to local partners for manufacture of nutrient fortified products**
- **Finalize formulation of product prototypes and plan/execute quantitative consumer testing and nutritional baseline study**

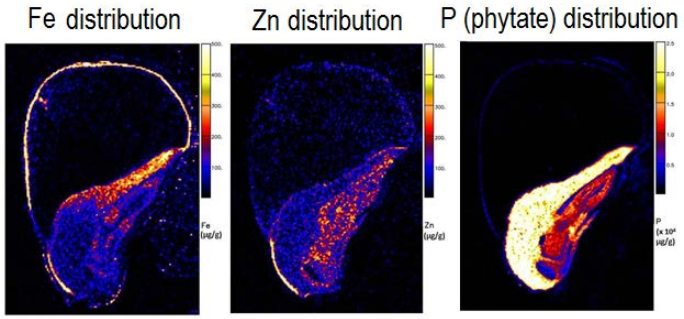
# (University of Pretoria) Year 1 Summary

## Concept Ready-To-Eat Cereal-based Complementary Food

- Extrusion cooked sorghum and micronized cowpea instant porridge
- Similar contribution to protein and lysine RDA as commercial fortified corn-soy blend
- With a cowpea leaf relish, the meal's iron and zinc bioaccessibility similar or better than the fortified commercial product

## Characterization of Pearl Millet Grains to Optimize Product Essential Minerals

- Grains differ greatly in size and hardness (milling quality)
- Iron, zinc and phytate concentrated in pericarp and/or germ
- Debranning effects on mineral content and bioaccessibility being investigated
- Investigation of soaking and parboiling as simple technologies to improve levels of iron and zinc in flours
- Biofortified high iron and zinc obtained from ICRISAT



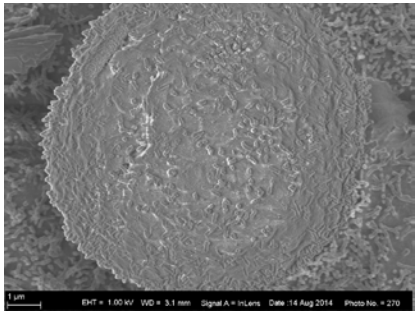

## Souring to Improve Mineral and Protein Quality

- Traditional lactic acid bacteria (LAB) fermentation widely used in Africa to process cereals
- Improves mineral bioavailability and protein quality
- - but slow and difficult to control – mechanisms incompletely understood
- Project developed to evaluate technologies, mechanisms and effects of simple acidification versus LAB fermentation

# (University of Pretoria) Year 2 Plan

## Training and Application of Sensory Science Methodologies

- Training in Consumer and Descriptive Panel Sensory Evaluation
- Evaluation of the shelf-life of concept pearl millet-based products
  - likely problem of rancidity and bleaching – resulting from lipid oxidation



## Inhibitors and Promoters of Mineral Bioaccessibility in the Foods Project

- The products will contain mineral bioavailability Inhibitors
  e.g. phytate and phenolics and also Promoters e.g. ascorbic acid
- Using model systems, including Caco-2 assay their relative effects will be evaluated to optimize mineral bioavailability


## Grain End-use Quality Assessment and Processing Technology Training

- Training manuals developed and hands-on training workshop in simple methods to evaluate pearl millet and maize end-use quality
- Training manual developed and hands-on training workshop in science and technology of soured cereal beverage processing

## (Institut de Technologie Alimentaire, Dakar) Year 1 Summary

- Development of extruded Products from sorghum, millet and maize
- Sensorial analyses of extruded products
- Contact with Prof Wade, Nutrition Consultant
- Establishment with private sector partners for products dissemination:

Touba Darou Salam (Mme Mbacké

Maria Production (Mme Diouf)

FreeWork Services (Mme Dème)

- Training:

Mme Maty Diop Ndiaye: completed her MS at UCAD

Cheikh Ndiaye, PhD student at Purdue

## (Institut de Technologie Alimentaire, Dakar) Year 2 Plan

- Optimization of extruded food products
- Development of new products in collaboration with private partners
- Nutrition survey
- Contact with private partners for new products dissemination at St Louis and Ziguinchor

- Training:

Mr Cheikh Ndiaye, PhD student at Purdue

Mrs Maty Diop, PhD student at UCAD (Food Science & Nutrition)

Mr Eliasse Diémé, PhD student at UCAD (Food Science)

# (University of Eldoret) Year 1 Summary

**Activities covered:**

- Made sorghum/maize/wheat composite product prototypes.
- Survey of types of cereals/products and other flours on the Kenyan market (Eldoret).
- Social experiment on buying patterns of various composites(Urban).
- Microflora Diversity of Traditional Fermented Porridges of Western Kenya .
- Carried out FGD on cereal consumption and processing patterns (Urban)
- Training two postgraduate students. Proposed research topics:
  - Gender issues along the PHAP sorghum value chain (P
  - Nutritional enhancement of Commonly consumed cereal based products using natural fortificants (Mas)
- One week Training at ITA for familiarization of incubation center set up and management.
- Renovation of Incubation center.

**Outputs:**

- The fermented prototypes scored higher than the non-fermented; Acceptability range above 6 on Likert 1-9, for both.
- Most composites using finger millet. Thus important to introduce sorghum. To complete survey and include pricing of preferred composites.
- Sorghum/finger millet favorite, with small additions of other; packaging an issue. Some preferred instant.
- There was a mix of microorganisms; both fungi and bacteria for all the fermented bases.
- FGDs preferred nutritionally enhanced flours, convenience, affordable, accessible products.
- Students will share their research concepts soon and embark on research in year two.
- Renovation to be completed by end of September 2015.

# (University of Eldoret) Year 2 Plan

**ACTIVITIES**

- Students to do a comprehensive survey in Urban and Rural cereal processors and consumers, with viable samples.
- Characterize the main cereals (sorghum, maize, amaranth).
- Undergo training on sensory evaluation in Pretoria and train the students and technicians.
- Standardize products; fortify products (fermented ; non-fermented, do sensory analysis. Include weaning , instant products, baked, fried.
- Complete training manual on cereal processing; complete training manual on value addition and hold a stakeholders meeting.
- Finish the renovation and commission the training center.
- Recruit facilitators (on secondment) for the incubation center and hold a sensitization workshop.
- Identify and Plan for training of 4 women groups in cereal processing and value addition; one group per quarter, or depending on demand.
- Also plan for 4$^{th}$ year students for internship.

# (CIMMYT, Economics) Year 1 Summary

- FGD - Kenya
  - Women from both income groups interested in instant food, for time and fuel savings
  - Both groups are interested in natural fortification, but only medium/higher income groups would pay a premium
- Processors (Kenya & Senegal)
  - Nairobi:
    - Few participated
    - Those presented interested in help with fortification
  - Eldoret and Dakar/Touba
    - Many produce cakes, not formal marketing
    - Interest in instant food,
    - Interest in health food (with millet, natural fortification, for diabetes patients)
- Market survey (Nairobi)
  - Maize and wheat are the most important cereals
  - New law on fortification only partially followed (55% of products), no quality control,
  - Apart from breakfast cereals (98% imported), cereal products are locally produced (wheat grain imported)
  - There is a premium for fortification
  - Most products to be cooked (44%), ready to eat (31%) or instant (25%)
  - Most products not for specified age group, some for children (10%) some for infants (10%)

## (CIMMYT, Economics) Year 2 Plan

- Kenya
  - Further analysis and write-up of market survey
  - Economic analysis of new products
- Senegal
  - Estimating cost of instant food production
  - Consumer acceptance of the new products

# (Purdue University—M&E) Year 1 Summary

- Exploratory visit to Kenya to understand local post-harvest practices
- Findings from the visit being used to:
  - Develop baseline survey questions
  - Develop a proposal for a gender-differentiated focus group study to understand gender dynamics in decision-making
- Review of literature on local post-harvest practices and issues in Senegal

# (Purdue University—M&E) Year 2 Plan

- Finalize baseline household survey for Senegal/ apply for IRB approvals
- Conduct baseline survey of grain in Senegal after the fall 2015 harvest
- Prepare summary report of baseline drying, moisture measurement and storage practices in Senegal
- Prepare summary report of how men and women access information to inform development of gender sensitive Extension efforts

# (O'Brien, Gender Specialist, SDSU) Year 1 Summary

- FPL Gender Training, Aug. 2014
- O'Brien, Alexander, and Woloshuk's trip to Kenya, Feb. 2015 included gender-focused: discussions with the team; site visits; informal interviews with farmers; informal focus group discussions with a) ag extension workers and farmers (mixed-sex group), and b) women farmers; and planning.
- Provide gender feedback.
- O'Brien, Alexander, and Bugusu drafted a Concept Note & Script to hold focus groups in Senegal and Kenya to collect gender-relevant baseline data. USAID Staff provided feedback. We began seeking funding for the focus groups.
- Research gender & ag, share literature, and work toward gender analysis publications.

# (O'Brien, Gender Specialist, SDSU) Year 2 Plan

- Continue seeking funding for focus groups (i.e. Concept Note & Script by O'Brien, Alexander, and Bugusu), and if funded in Year 2, plan and hold focus groups in both countries and begin analyzing the focus group data. This focus group data will support a gender analysis of the study.
- Summer 2015: O'Brien site visits (Kenya and Senegal).
- O'Brien will continue providing gender feedback, researching gender & ag, sharing literature, and working toward gender analysis publications.
- Team continues giving quality control / research design info to O'Brien for gender review & gender integration.



# Questions, Input?