



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

August 17, 2016

Year 2 Review Year 3 Plan



Roll Call – Collaborators by Institution

- **CIMMYT – Kenya**
- Hugo De Groote
- Sarah Kariuki

- **KALRO – Kenya**
- Patrick Ketiem

- **University of Eldoret**
- Violet Mugalavai
- Augustino Onkware

- **ITA - Senegal**
- Djibril Traore
- Fallow Sarr

- **ISRA - Senegal**
- Ibrahima Sarr
- Moussa Sall

- **University of Pretoria – South Africa**
- John Taylor
- Johanita Kruger
- Gyebi Duodu
- Riette DeKock



- **North Carolina A&T**
- Guibing Chen
- **North Carolina State**
- Mario Ferruzzi
- **San Diego State**
- Cheryl O'Brien
- **A to Z Textiles**
- Hubert Kofi
- Johnson Odera
- **Kansas State**
- Jagger Harvey

- **Purdue**
- Betty Bugusu
- Jess Lowenberg-DeBoer
- Suzanne Nielsen
- Bruce Hamaker
- Klein Ileleji
- Charles Woloshuk
- Jake Rickert-Gilbert
- Heather Fabries
- Arvind Raman
- Richard Stroshine



- **Advisory Council**
- Bruce Maunder (Retired Dekalb Genetics)
- Angela Records (USAID-Washington)
- Tahirou Abdoulaye (IITA-Nigeria)
- John Bustle (Retired – John Deere Foundation)
- Dirk Maier (Iowa State)
- Joseph Mpagalile (FAO-Rome)



FPL Management Changes/ Y3 Expectations

- The Cooperative University College of Kenya (CUCK) - removed
- Kenya Agriculture and Livestock Research Organization (KALRO)- added
- Dr. Mario Ferruzzi has moved to North Carolina State University:
 - NCSU to be added in Year 3
- Year 3 funding is contingent upon year 2 progress
- Face-to-face Year 3 annual meeting – preferably in Dakar, Senegal
 - FPL to raise half the funds; request other half from USAID
 - Timing: combine with summer in-country travel
- USAID Mid-term Performance Review anticipated soon



FPL Management Updates

Challenges

- Visits to Mission offices
- Obtaining tax exemption on capital equipment
- Communication memo
 - Sent to all via email and is on PURR website

Opportunities

- Showcasing results/outcomes
 - Newsletters:
 - Feed the Future
 - FPL
 - Conferences
 - Publications



Year 2 Summary



Activities accomplished under Objectives 1, 3 and 4: Drying technology development, capacity building and public/private partnerships

- **Activity 1.1.1 – Conduct baseline post-harvest survey.** Completed baseline survey in Senegal (Oct. 2015)
- **Activity 1.3: Develop low-cost grain drying technologies for smallholders.** Conducted both lab and field tests on maize, carrots and mangoes. Deployed one solar dryer unit in Senegal & Kenya (Oct.2015 to date)
- **Activity 3.1: Train graduate/undergraduate students from US and focus countries.** Trained 7 students (from Nepal, Senegal, Nigeria, Colombia, Haiti, USA & China)
- **Activity 3.2: Conducting workshops for farmers and processors on developed technologies.** Conducted workshops in Senegal & Kenya, developed 6 training materials in rack card format in English, French & Kiswahili (June/July 2016)
- **Activity 4.1: Strengthen established public-private partnerships.** IP filed by OTC for multipurpose solar dryer and licensed to start-up Jua Technologies International LLC. (JTI) to pursue commercialization





Year 3 Plan



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

Activity: Implement field testing of drying options in collaboration with ISRA, KALRO and Purdue working with selected partners (Enterprises & Coops).

Solar Dryer

- Determine the operational performance of the solar dryer with selected crops: **Senegal** (maize, processed cereals, carrots and mangoes) and **Kenya** (Maize, vegetables, mangoes and sweet potatoes)
- Complete modeling effort of solar dryer and validate with field data
- Explore deployment of more solar dryers to enterprises and coops for field testing through partnership with Jua Technologies Int. LLC and other entities

Drying Stove R & D

- Complete design, fabricate and test drying stove prototype at Purdue
- Deploy drying stove prototype to Senegal and Kenya for field testing

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

- Activity 1.2: Develop a low-cost moisture determination method
- Completed development of protocol for hygrometer-based moisture measurement
- Deployed device at train-the-trainer workshops in Senegal and Kenya.





Year 2 Summary



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

- Activity 1.4: Determine the optimum moisture for safe storage of grains and oilseeds in hermetic storage systems
- Activity 1.5: Assess potential for aflatoxin development in hermetic bags
- Completed study on the impact of opening hermetic storage bags on grain quality, fungal growth and aflatoxin accumulation.
- Completed study on the assessment of hermetic storage of maize under different environmental conditions.



Year 3 Plan



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

- Activity 1.5.4: Determine impact of grain moisture on aflatoxin accumulation in hermetic storage conducted in-country in Senegal and Kenya.

Objective: Compare efficacy of PICS bags, A to Z bags (impregnated pesticide and without insecticide), GrainPro bags and woven bags on aflatoxin accumulation.

Maize will be obtained from 2016 fall harvest and dried.

Senegal: 3 replicates; moisture, insect damage, and aflatoxin measured at 0, 3 months, 6 months, and 9 months. (whole bag sampling)

Kenya: 4 replicates; moisture, insect damage, and aflatoxin measured at 0, 3 months, 6 months, and 9 months. (spear-probe sampling)

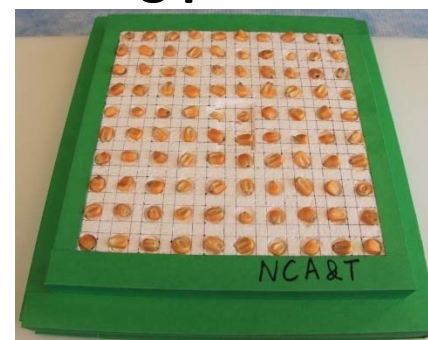
North Carolina A&T Year 2 Summary

- **Estimating MC of corn from 1000-kernel weight**

$$MC = \frac{\text{Total mass} - \text{Dry mass}}{\text{Total mass}} \quad (1)$$

- ✓ The dry mass of 1000 kernels (yellow dent corn, NCAT farm) were 264.74 ± 2.24 g ($n=3$).
- ✓ Absolute error in MC is within $\pm 0.7\%$ when MC = 13% (w.b.)
- ✓ When 1000-kernel weight = 304.30 g, MC = 13% (w.b.)

- **Counting plate**



$$AE = \left(\frac{\pm n}{\pm n + 1000} \right) (1 - MC) \quad (2)$$

When MC = 13% and $n = \pm 4$, $AE = \pm 0.35\%$

- **Major advantages:** Easy calibration and high accuracy.



North Carolina A&T Year 3 Plan

- Determine the effect of hysteresis caused by wetting and drying cycles on errors in moisture determination of maize using the hygrometer method.
- Conduct an evaluation on measurement of maize moisture content using the hygrometer and USDA probe meter (provided by Purdue University) in comparison with a hand-held John Deere grain moisture meter (e.g., Model SW5300).
- Use results from Objective 1 and 2 to determine the error sources and factors of correction using a simple hygrometer.



ISRA Year 2 Summary

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

Conducted activities

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

Activity 1.1: Identify drying and storage methods used by farmers and determine moisture content of grain stored by farmers

Activity 1.1.3: Conduct baseline survey of grain handling, drying and storage in Senegal & Kenya – completed with US collaborators in October 2015. **Overall, 308 households from 31 villages in 9 communities** of Velingara were interviewed. Average household acreage was **1 ha of which 34.10%** (maxi of 49%) was planted in maize.

Most farmers **dry immediately after harvest** (95-100%) and few households are homestead drying (0-6%) or dry a bit before storing (0-8%). Harvest is **manual (100%)** with various drying places including bare soil & roofs .

64-100% have **damage at fields and storage**. The maize is mostly dried in cobs outside. Most farmers are not aware of aflatoxin without nearly any training.

Objective 3: Building capacity in research and information dissemination

Activity 3.3: Incorporate data from baseline survey into capacity building efforts in training extension agents in Senegal, Kenya and other countries in SSA –

- 17 Trainers trained on simple, low cost and environmentally friendly methods of drying and storing maize in Velingara in October 2015 including USAID Yaajeende and Naatal Mbaay as well as the Kolda Directorate for Rural Development (DRDR), Peace Corps, ISRA technicians, ISRA PhD students in crop protection and the National Agency for Extension and Rural Counselling of Kolda (ANCAR Kolda).



ISRA Year 3 Plan

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

Activity 1.5: Assess potential for aflatoxin development in hermetic bags

Subactivity 1.5.2 Determine impact of grain moisture on aflatoxin accumulation in hermetic storage conducted in-country in Senegal and Kenya

- [To conduct tests](#) with PICS bags, grain Pro and A to Z bag for aflatoxin development
- [Testing the Solar Dryer](#) at Maria distribution Dakar and Velingara fields dryer with processed cereals and maize

Objective 3: Building capacity in research and information dissemination

Activity 3.3: Incorporate data from baseline survey into capacity building efforts in training extension agents in Senegal, Kenya and other countries in SSA

- [Training of farmers](#) on drying and storage of maize and demonstration with PICS bags in Velingara



FPL Activities CIMMYT Sept 2015-August 2016 Annual Report

Hugo De Groote, Sarah Kariuki and Michael
Ndegwa

Presentation prepared for the Annual Meeting
– August 17, 2016



Background/objectives

- The goal of the FPL project is a sustainable reduction of post-harvest losses in Feed the Future countries through technologies that link farmers to markets
- The project has two components: drying and processing
- Role and responsibilities of CIMMYT:
 - Participatory evaluation
 - Economic analysis
 - Facilitating field work in Kenya



Component 1: Drying - Activities

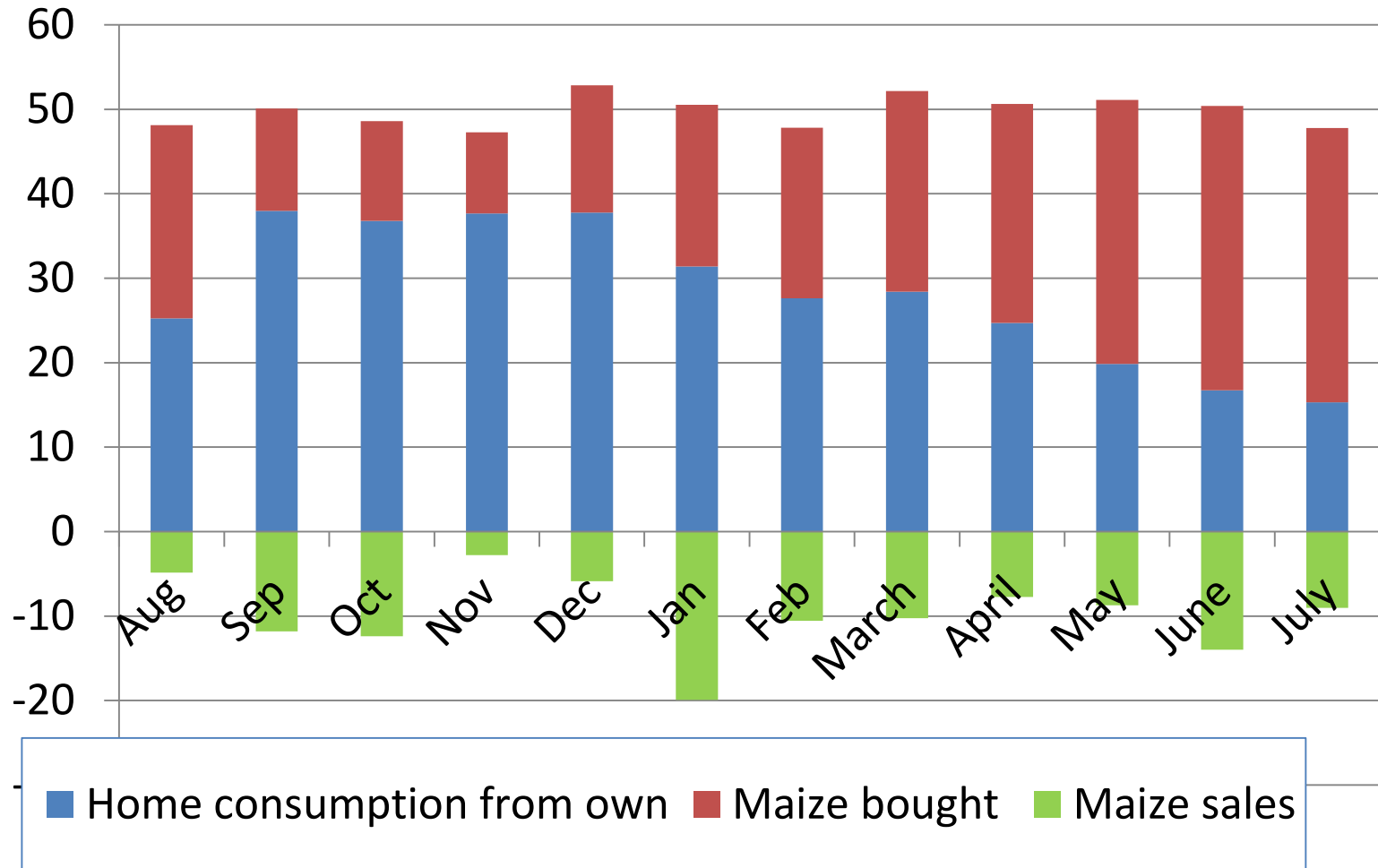
- Activities Year 2 - Sept 2015 – Aug. 2016
 - Household sampling and selection (September 2015)
 - Assistance to the drying and aflatoxins survey (September 2015) (Reported by Klein and Charles)
 - Household storage survey (December 2015):
 - Paper to be presented in Addis Ababa at the 5th AAEA conference
 - Participation in training of extension officers on drying and storing, Kakamega, July 2016 (see Charles and Klein)



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HH survey results: maize consumption and sales





Main results Kakamega Household Survey

- Maize post harvest practices take 1 month; drying 2 weeks
- Most maize is dried in open air on tarp, no driers used
- Main drying challenges are rains and labor
- Moisture was mainly determined by biting or listening, no meters used
- Most maize stored in polypropylene bags in main house, insecticides used as needed
- Most stored maize for home consumption (60%), some sold (20 %)
- 40% of the maize consumed is purchased, mostly as grain, at much higher prices than maize sold.
- 54 % of farmers have some knowledge of aflatoxin, mainly from the media.
- Over 70 % did not know hermetic bags, or how they work.



Component 1: Drying – Planned activities

- Activities Year 3 - Sept 2016 – Aug. 2017
 - Inventory of dryers currently on the market or being tested in Kenya, estimate their cost and efficiency
 - Testing the dryers:
 - have a standard efficiency test: taking 90 kg maize from 30% (or study result) to 13.5%: time needed, labor needed, cost of equipment (amortized over life span, or 2 months per year) in Kakamega and Katumani standard weather.
 - economics of alternative uses of the dryers (vegetables, ...)
 - Test the different storage bags and their effect on aflatoxins (with Charlie and Bruce Anani)



Processing/Nutrition Team

- Senegal – Institut de Technologie Alimentaire (ITA)
 - Djibril Traore, Fallou Sarr
- Kenya – University of Eldoret
 - Violet Mugalavai, Augustino 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
 - Identify consumer drivers, make nutritious products to meet them
- 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 2 Workplan achievements

- **Drive the value chain through processing to increase commercialization and improve nutrition**
 - **Cost analysis of extruded, instant products; further quantitative assessment of market demand and drivers for processed food products, with and without nutritional enhancement**
 - *Conducted “willingness-to-pay” and sensory studies in Senegal and Kenya on instant flours, whole grain instant flours, artificial and natural fortified instant flours (200 participants in each study)*
 - *Cost analysis of extruded, instant products – currently being done in Kenya (process and ingredient costs)*
 - **Develop and/or refine products and processes to drive Senegal and Kenya markets**
 - *Built new Incubation Center at University of Eldoret, conducted consumer preference study*
 - *Shipped and installed two extruders (Touba, Senegal and U Eldoret, Kenya)*
 - *Instant thin and thick millet and maize/sorghum blend flours successfully developed – consumer tests positive*
 - *Transfer of extruder to entrepreneur in Touba, Senegal (Mme. Mbacke); training of processors (and through collaboration with USAID-ERA)*
 - *Worked on prototypes of fermented products (U Pretoria); blended products (U Eldoret); sensory analysis*
 - *Study comparing decorticated and whole grain millet products – currently being done at Purdue U and U Pretoria*



Processing/Nutrition Year 2 Workplan achievements

- **Leverage local agriculture commodities to produce nutritionally-enhanced food products and to create a sustainable market-led fortified processed**
 - *Finished screening of nutrient dense plant materials for iron, zinc, pro-vitamin A (U Pretoria, Purdue U)*
 - *Biofortified millet varieties evaluated (high Fe and Zn), process to reduce phytate/increase bioaccessibility (U Pretoria)*
 - *Pro-vitamin A stability testing using solar drier developed by K. Ileleji (Purdue U)*
 - *Experiments to maximize micronutrient content and availability (U Pretoria, Purdue U)*
 - *Sensory testing of nutrient fortified instant flours done, though not optimized*
- **Evaluate nutritional composition, micronutrient retention/bioaccessibility and ultimate nutritional impact of the program**
 - *Bioaccessibility studies of micronutrients ongoing*
 - *Nutritional assessment delayed to year 4, consultant arranged*
- **Strengthening institutional and human capacities among the actors along the value chains, with emphasis on gender sensitive approaches**
 - *PhD student Emmanuel Ayua, Kenya, started in Spring semester; continued training of 3 other PhD students (Purdue U); graduate student training in Senegal (2) and Kenya (2)*
 - *Sensory training of 3 scientists (2 Senegal, 1 Kenya) (U Pretoria, R. deKock)*
 - *Training of primarily women entrepreneur processors (Senegal, Kenya)*

University of Pretoria - Year 2 Summary

Sensory Science

•Workshop 2-5 Nov '15, Pretoria

Djibril Traore, Mamadou Sadji (ITA Senegal)
Violet Mugalavai (U Eldoret, Kenya)
Graduate students (U Pretoria)

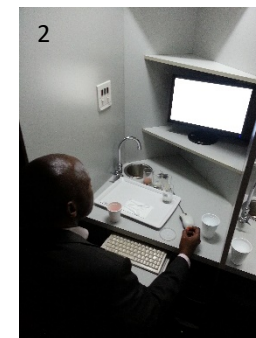
• Descriptive sensory evaluation to determine shelf-life of concept pearl millet-based products

– Planned from July - Aug '16.

(PhD student Isi Onyeoziri)

– Grain used to prepare concept product at Purdue was not guaranteed food grade

- Safety analysis being undertaken
- Product now also being produced in South Africa
- Evaluation to be carried out in Year 3



1. Workshop participants from Kenya & Senegal
2. Descriptive evaluation of fermented cereal beverages UP sensory laboratory
3. Interviewers ready for consumers during workshop
4. Pearl millet products for storage study.

University of Pretoria – Year 2 Summary Continued

Soured sorghum-amaranth porridge:

Mineral bioaccessibility and protein quality

- **Souring by three methods: Back-slopped inoculum; Lactobacillus plantarum or addition of lactic acid**
- **Fermentation (Back-slopping or L. plantarum) significantly reduces phytate levels**
- **Amaranth flour is up to 4 times higher in Fe content than sorghum flour and can be used to boost Fe content of sorghum-amaranth composite porridges. Mineral bioaccessibility to be conducted**
- **Conducting spontaneous fermentation of sorghum (back-slopped inoculum) after cooking improves in vitro protein digestibility of sorghum porridge.**
- **Going forward:**
 - **Mineral bioaccessibility**
 - **Available lysine**
 - **Phenolics and bioactive properties**



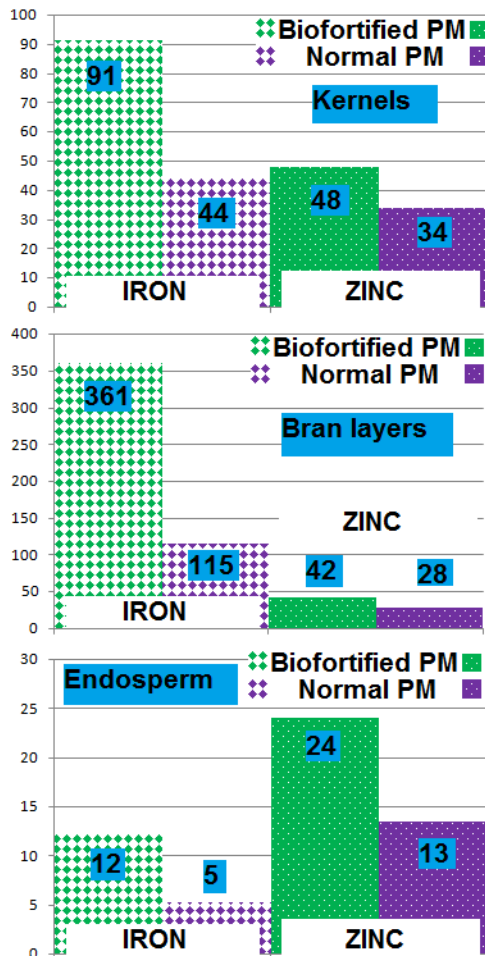


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University of Pretoria – Year 2 Summary Continued

Iron and zinc content (mg/kg) of Pearl Millet (PM) kernels, bran layers and endosperm



μ-PIXE (quantitative elemental distribution) of minerals in biofortified pearl millet grains

- Nutritional contribution 15 g (db) whole and refined (only endosperm) pearl millet to RDA of infants aged 1-2 years:
 - Iron: Whole - 10 to 20%; Refined – 1.1 to 2.6%
 - Zinc: Whole - 17 to 24%; Refined – 6.7 to 12.0%

Characterisation (mineral, total phenolics (TPC), tannin (TC) & phytate (PC) contents) of mineral and provitamin A plant sources

- Moringa has the overall highest iron and zinc contents
- Hibiscus (H), Moringa (M) and Boabab (B) all have high contents of various antinutrients
 - TPC (mg/100 g) H (3451), M (4654) and B (3738)
 - TC (mg/100 g) B (2286)
 - PC (mg/100 g) H (4833), M (828) and B (320)
- Further mineral availability studies are necessary to determine if increased iron and zinc contents outweigh negative effects of antinutrients

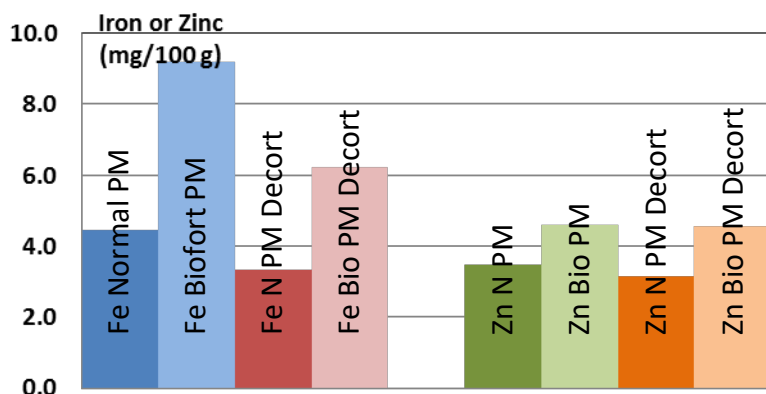


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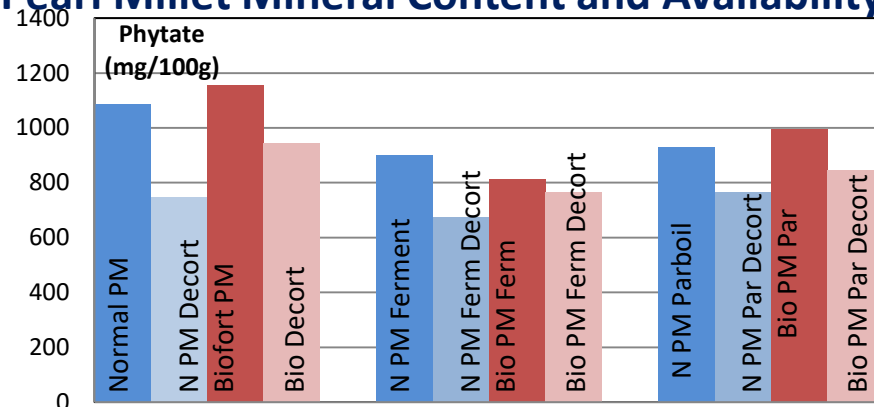
University of Pretoria Year 2 Summary Continued

Effects of Processing and Biofortification on Pearl Millet Mineral Content and Availability



Effect of Decortication and Biofortification on Iron and Zinc Content of Pearl Millet

- Biofortification Doubles Fe Content of Whole and Decorticated Grain
- Biofortification Increases Zn Content of Whole and Decorticated Grain by 30%
- Decortication Reduces Fe Content by 30%
- Decortication Reduces Zn Content by 10%



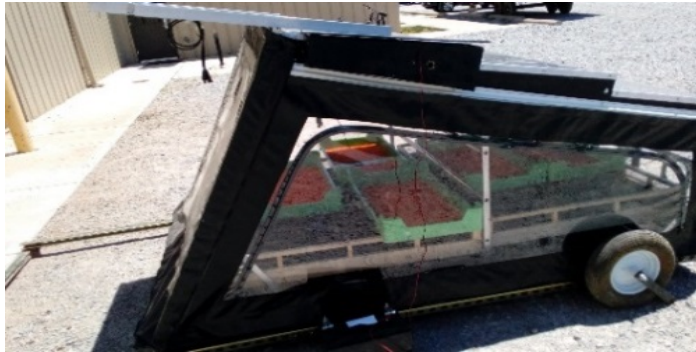
Effects of Decortication, Lactic Acid Fermentation Parboiling and Biofortification on Phytate

- Decortication also Reduces Phytate Content
- Lactic Acid Fermentation Reduces Phytate
- Parboiling Reduces Phytate Less
- No Difference in Processing Effects with Biofortification

- Use of Mineral Biofortified Pearl Millet Would Substantially Improve Iron and Zinc Contents of the Products
- Lactic Acid Fermentation Should be Considered to Help Improve Mineral Bioavailability in the Products

Collaborative Evaluation of Solar Dryer For Low Cost Production of Nutritional Plant Materials (Purdue U)

Objective: Assess a prototype solar dryer designed for grains to preserve provitamin A values in select fruits, and vegetables and generate high value ingredients for local fortification in Senegal and Kenya.



Solar dried used



Raw carrot (sliced)



Solar dried carrot (sliced)

Products dried carrot graded and sliced (1.85 mm) as well as mango sliced 3.25 mm

Materials: Carrot and mango bought from local grocery
Meat slicer for the sliced products and
Cuisinart kitchen aid for the graded samples

Temperatures used: 35, 42 & 55°C
Comparison done on **solar, thin layer (35°C)**, and **dehydrator (35°C)**

High retention of provitamin A carotenoids was observed with solar drying of carrots and mangos

Solar drying of grated carrot yields products with high provitamin A retention

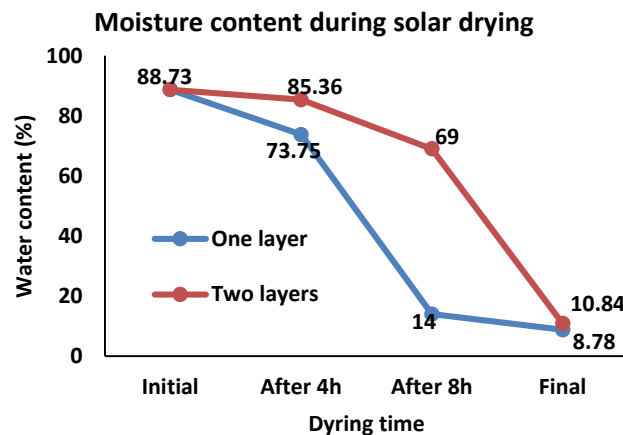
	Raw	Thin Layer	Dehydrated	Solar Dried
TPVA ($\mu\text{g/g dw}$)	1090.7 \pm 17.8	825.2 \pm 6.6	955.7 \pm 10.0	903.8 \pm 10.4
RAE ($\mu\text{g}/100\text{g}$)	7022.0 \pm 26.1	4117.7 \pm 17.8	4712.0 \pm 21.8	4610.4 \pm 19.3



~83% recovery of total provitamin A carotenoids through solar drying

Solar drying of sliced mango (3.25mm): one layer on solar dryer basket vs. two layers

Single layer drying produced highest quality mango powders



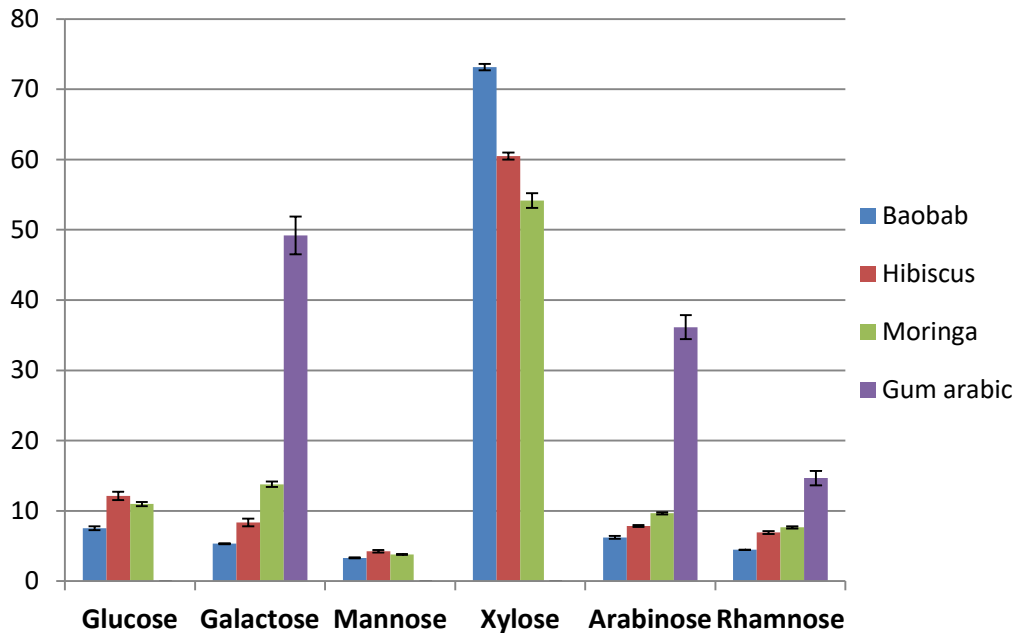
Sliced mango solar dried (3.25 mm) using one-layer

Sliced mango solar dried (3.25 mm) using two layers' rack



Characterization of monosaccharaide composition from selected plant materials

Monosaccharide composition (% w/w)



- all data is expressed as means \pm standard error
- values are expressed as partially methylated alditol acetates present

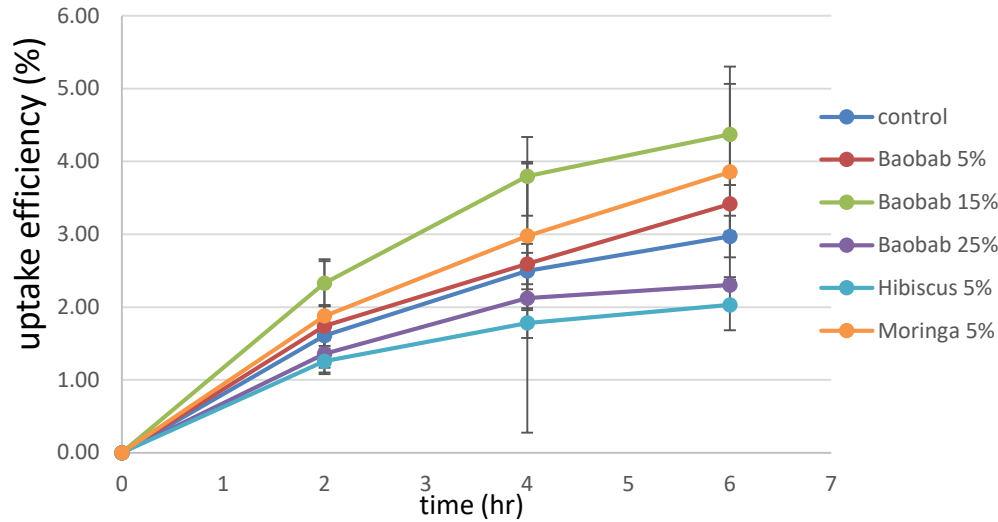
Uronic acids concentration ($\mu\text{g}/\text{mg}$)		
sample	Galacturonic acid	Glucuronic acid
Baobab	2.38 \pm 0.45	1.78 \pm 0.12
Hibiscus	1.81 \pm 0.25	1.71 \pm 0.13
Moringa	1.84 \pm 0.09	1.77 \pm 0.06
Gum arabic	-	1.87 \pm 0.18

- Uronic acids were quantified as trimethylsilyl (TMS) methyl glycosides

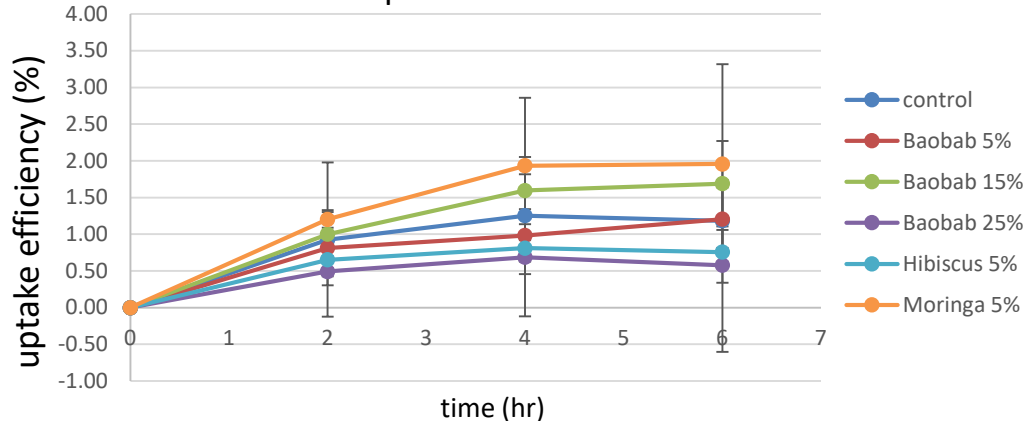


Mineral rich-plant materials from an instant thin porridge formulation modify provitamin A carotenoid uptake by caco-2 cells

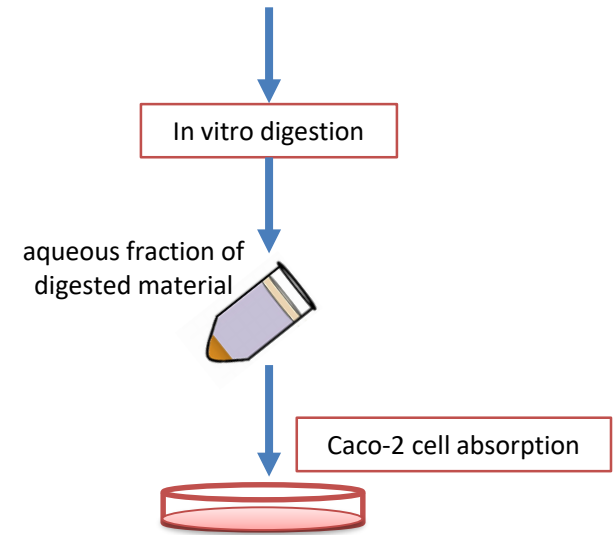
α -carotene



β -carotene



Ingredients	% in dry mix
Millet	45-60
Provitamin A carotenoid source (carrot/mango blend)	30
Mineral source (baobab, hibiscus, moringa)	5-25
Modifier (sunflower oil)	5



Next steps

- Leverage generated wet and dry plant materials in extrusion of cereal fruit blends
 - Wet for fresh production
 - Powders for long term storage and production
- Define the stability and product characteristics of these new blended products
- Characterization of provitamin A bioaccessibility from optimized fruit/vegetable powders and extruded products
- Evaluate combination of natural and synthetic solutions to close micronutrient gap



CIMMYT (H. DeGroot) Economic Assessment Year 2 Summary

- Activities Year 2 - Sept 2015 – August 2016
 - Focus group discussions Senegal (Dakar and Touba) ,
 - Analysis retailer survey Nairobi
 - Consumer study in Touba (March 2016, paper to be presented in Addis at 5th AAEA meeting)
 - Consumer study in Eldoret (July 2016, preliminary analysis available)



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Key results

Touba



- The affective tests indicate that consumers did not distinguish between the sensory characteristics of the different products (millet porridge, instant or not, fortified or not).
- Participants without information were not willing to pay a premium for the different quality traits.
- Participants with information showed an interest in paying a small premium (10%) for instant flour, and large premiums for added mangoes and carrots and for fortification with micronutrients.
- There was no added premium for micronutrients from natural sources.
- Income had a positive effect on general WTP, but not for particular traits or quality.
- Education, on the other hand, increased WTP for instant flour.
- Conclusion: there is a consumer interest, but WTP needs to be compared to costs, and interest of higher income consumers explored



Economic Component Processing - planning

- Activities planned for 2016-2017
 - Home use test of instant cereal mixes
 - Stakeholders meeting in Nairobi with field visit to Eldoret (February 2016)
 - Consumer preference study (WTP) in Dakar market



UNIVERSITY OF ELDORET Year Two _August 2016

Activities covered in Year Two:

- Training on sensory evaluation at UP_SA
- Characterize sorghum varieties according to their tannin levels using the bleach test, and test for sensory characteristics among rural and urban respondents.
- Social experiment on consumer buying patterns of various composites (Urban).
- Carry out FGD on cereal processing consumption and patterns (Rural).
- Renovation and equipping Incubation Centre.
- Train on extruder operations
- Develop and test (sensory) instant cereal products.
- Recruitment of 1st batch of trainees.
- Develop Food Processing manual

Outputs:

- Training on Sensory Evaluation and the application of the six steps to Kenya project was done.
- Seventeen varieties of sorghum were characterized for tanning levels and sensory tests; low tannin/no tannin varieties were the most liked.
- Millet, sorghum, pumpkin seeds, amaranth grain and pearl millet were most preferred flours.
- Process own flour; fortification rarely practiced (rural).
- Center renovated and equipped: mill, decorticator, extruder, etc.
- Eight (8) technicians trained on extruder operation and care.
- Instant cereal products developed and tested.
- Launched Food Processing Training Manual completed and launched.



Establishment and Activities at the Food Processing, Training and Incubation Centre at University of Eldoret, Kenya



Signage for the FPL Centre



Training on extruder operation



Extrusion in progress



Products for taste testing



The researchers during the taste test exercise



Launch of cereal food products manual



UNIVERSITY OF ELDORET (Year Three Plan) 2016/2017

ACTIVITIES

- To improve the instant cereal products.
- To demonstrate on how to make instant porridge and *ugali* at various exhibition forums.
- To carry out home test social experiments with improved instant products with various segments of households.
- Identify and plan for training women and the youth in cereal processing and value addition.
- Fermentation of cereal products.
- To commission the FPTIC.
- To train food processors.

Expected Outputs

- To produce instant products that are highly acceptable .
- Several households will try out the instant cereal products and submit feedback to FPL, UoE.
- Knowledge on Acceptability of instant products in the segments of households.
- Also plan for inclusion criteria of 4th year (UoE) finalists for internships at the training center.
- Acceptable fermented products
- FPTLC commissioned
- Trained food processors with expanded/improved businesses.



(Institut de Technologie Alimentaire, Dakar) Year 2 Summary

- Development and optimization of extruded Products from millet
- Sensorial analyses of extruded products in a rural area (Touba)
- Consumer preference test in a rural area (Touba)
- Contracts with town halls (Touba & Sindia) to supply instant food products
- Laboratory work to develop a microbial starter for the fermented economic couscous (ITA & University of Gembloux)
- Official ceremony for extrusion technology transfer to Touba Darou Salam
- Ongoing theses work PhD students at Purdue (Cheikh Ndiaye) and Cheikh Anta Diop University (Fallou Sarr, Maty Diop, Eliasse Dieme
- Preliminary meetings to design a feeding device for the 2 extruders with local manufacturers
- Preliminary meetings to design a mixed solar and gas dryer for the extruder with local manufacturers to be posted at Touba Darou Salam



(Institut de Technologie Alimentaire, Dakar) Year 3 Plan

- Optimization and scaling up of extruded food products from millet and sorghum
- Consumer preference test on instant foods in an urban area (Dakar)
- Optimization of the millet made fermented economic couscous
- Dissemination of new products in the 14 regions of Senegal
- Commercialization of the new fortified instant foods
- Finalizing consultancy contracts with Dr Salimata Wade and Dr Ndoye
- Planning for human study: impact of instant fortified foods on Senegalese students in 2 Bambey schools
- Manufacturing a mixed solar and gas local dryer for extruded products
- Manufacturing a feeding device for the extruders at Touba & ITA
- Development of instant weaning foods from millet, cowpea and peanut or soy?



Processing/Nutrition Project Overall Year 3 Plan

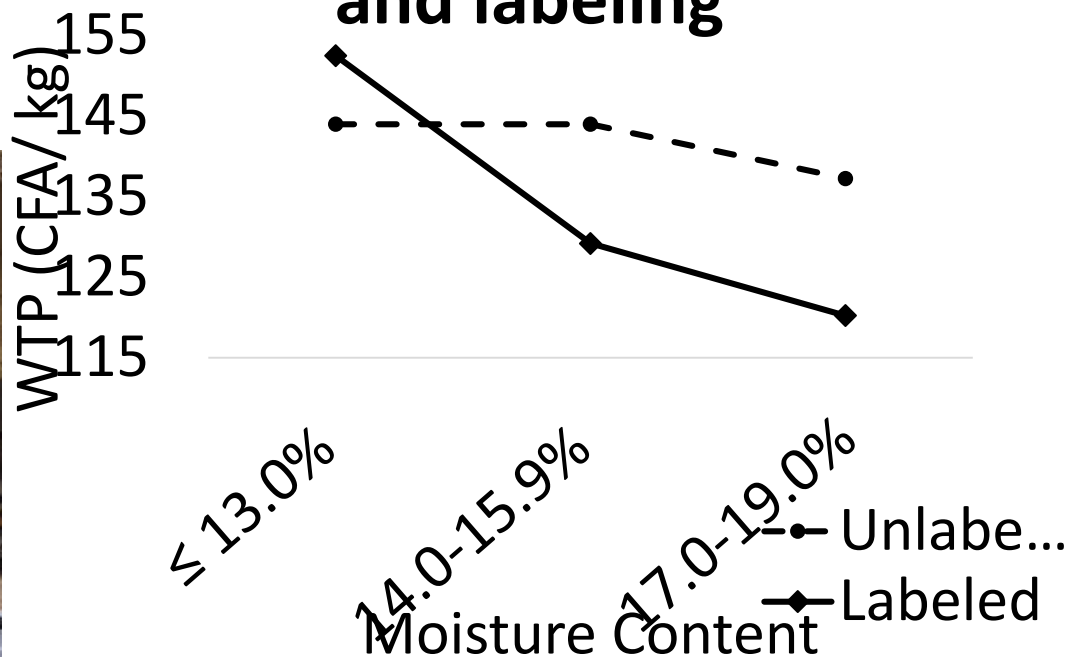
- **Identify and develop cost effective, bioaccessible, and commercially relevant fortified millet and maize/sorghum products**
 - *Use decision tree to identify ingredients and develop products*
 - *Further explore drying technologies for generation of materials as required*
- **Complete understanding of consumer markets, product development, and costs of instant and non-instant products**
 - *How nutritional attributes and high quality products can be used to drive markets for local farmers*
- **Complete work on whole grain products, their stability, and potential in the Senegal and Kenya markets; satiety study of millet-based products**
- **Work with entrepreneur in Touba, Senegal as a model for disseminating extrusion technology; explore scaling-up of millet processing**
- **Use of the new Incubation Center at U Eldoret for training of entrepreneurs and university students**

Year 1 & 2: Experimental Auction to Understand what Consumers and Traders Know about Moisture Content

When moisture content is unknown, buyers have trouble differentiating dry maize from relatively wet maize.

When moisture content is known to buyers, there is premium paid for dryer maize compared to wetter maize.

WTP by moisture content and labeling





Year 2: Baseline Survey conducted in Velingara Department during May and June 2016.

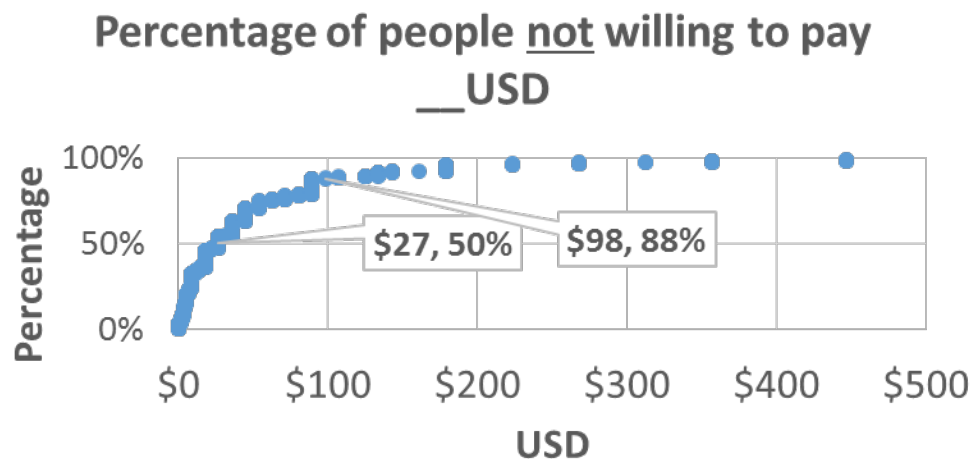
- 1,997 households (3 female HoH) in 213 villages.

Willing to purchase a 10 m² tarp for 3,000 CFA (5.36 USD) / hygrometer for 1,000 CFA (1.79 USD)?

	Yes (%)	Yes (n)	No (%)	No (n)
Tarp	89 %	1,777	10 %	208
Hygrometer	87 %	1,742	12 %	246

How much are you willing to pay for a solar dryer that dries 100 kg shelled maize/ day to a level sufficient for storage?

	Mean (median)
USD	62.04 (26.79)
CFA	34,743 (15,000)





Year 3: Drying Improvements Interventions and Surveys

- Intervention 1
 - Focus on drying technologies ----->
 - August – October 2016
 - Midline survey
 - August 2016
 - Additional time needed to implement recommended practices
- Intervention 2 & Endline survey round 1 ----->
 - Focus on storage technologies with PICS bag
 - January – February 2017
- Endline survey round 2
 - Long-term impacts of drying & storage technologies
 - January – February 2018

Groups		# hh
1.	Control	400
2.	Receives training only	400
3.	Receives training + hygrometer	400
4.	Training + hygrometer + tarp	400
5.	Training + hygrometer + tarp + 1 PICS bag	400
Groups 2, 3, 4: 50/50 split:		# hh
A. Receives PICS bag		600
B. Receives no PICS bag		600
(Groups 1 and 5 do not receive PICS bag)		800



Gender (San Diego State University) Year 2 Summary

- Drs. Betty Bugusu and Cheryl O'Brien – Gender Research, July-August 2016, Kenya and Senegal
- Held Focus Group Discussions (FGDs)
- Total of 8 FGDs / country
- 4 sites / country
- 2 FGDs / village (1 FGD for men farmers and 1 FGD for women farmers)
- Capacity-building for 4 young women (including 3 students) – gained experience w/ facilitation, translation, transcription; Kenyan women also helped organize FGDs)
- Met: partner in Touba on women processors; Femmes Africa Solidarité (FAS) in Dakar on gender & food security and opportunities for university students.



Gender (San Diego State University) Year 3 Plan

Reminders to all teams:

- Disaggregate data by gender (e.g. attendees at trainings; also on HOHs -- male, female, and women farmers in male-headed HHs; boys/girls; etc.).
- Document insights on local gender norms (e.g. income, decision-making, land ownership) & divisions of labor that impact women's participation & productivity -- value chain.
- Collect data (e.g. WEAI) on gender inequalities in our sites as well as the gender impacts of the interventions. (e.g. KSU gender-nutrition synergies)
- Integrate gender and participatory approaches into all stages of the project cycle.
- Publish country & cross-national findings/insights. And include Dr. Cheryl O'Brien on gender updates & gender-relevant manuscripts.



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Questions, Input?