Post-Harvest Technology Needs in Africa & Opportunities

Klein E. Ileleji, PhD.
Associate Professor & Extension Engineer
Agricultural and Biological Engineering Department

July 11, 2017
Mandela Washington Fellowship Meetings
Agenda

- The state of post-harvest technology and its impact on ag. business, income generation and health.
- Key solutions: Drying, moisture determination, storage and markets
- Purdue’s efforts in this area
- Key drivers to fuel African agriculture
- Key aspects to taking technology to market
Mycotoxins (*such as aflatoxin*) can be produced by some molds and is a major health risk.

- Decreased germination
- Decrease in nutrient value
- Insect damage and weight loss
Your Investment in Storage

• Maintaining Grain Quality is Job # 1
Quality – Key to market access
Lack of low cost objective moisture measurement (mc meters)

Moisture Defines:
- Food shelf-life
- Value of the commodity
- Impacts food safety

How farmers measure moisture content?
- Subjective using hardness (biting) (Requires experience)
- It is far from accurate.
- MC meters are quite expensive.
• Pre-Harvest losses from:
  - Insect, molds and birds
  - Harvesting & handling
  - Fire

• Post-Harvest losses from:
  - Molds, insects & rodents
  - Handling & transport

• Problems:
  - Grain spoilage
  - Mycotoxin contamination
  - Quality loss

• On-Farm Intervention:
  - Timely harvest
  - On-farm storage
  - Timely off-field transport

• Post-Harvest Intervention:
  - Timely drying
  - Timely and appropriate shelling and cleaning
  - Timely handling/transport
  - Grain & pest management
  - Grading and Sorting
  - Improved logistics

• Post-Harvest losses from:
  - Handling & transportation
  - Molds, insects & rodents

• Post-Harvest losses from:
  - Poor receiving operations
  - Poor quality grading system
  - Poor stored grain management
  - Poor marketing strategy

• Post-Harvest Intervention:
  - Provide recurrent training to staff in warehouse operations management through a certified training and licensing program for warehouse operators and staff.
  - Grain & pest management

• Post-Harvest losses from:
  - Poor receiving operations
  - Poor quality grading system
  - Poor stored grain management
  - Poor supply chain management

• Post-Harvest losses from:
  - Poor supply chain logistics/mgt
  - Poor storage during marketing
  - Poor end-use storage/mgt

• Product quality losses from:
  - Poor in-house storage

• Product quality losses from:
  - Poor in-house storage

- Small-holder farmers
- Aggregators/Merchants
- National Strategic Grains Reserves/State Buffer
- Processors

Target end-use as Food and Feed
Low Cost Hermetic Storage Bag
(Dr. Murdock & PICS Team)

Purdue Triple Inner-Bag
(PICS)
Moisture Content Measurement with low-cost hygrometer (Dr. Charles Woloshuk)
Moisture sensor networked to a mobile phone concept (Ileleji, Otero, Bernal)
Current prototype

Moisture Content Meter

Corn

Moisture (%)

0

Temperature: 00 °C

State

<table>
<thead>
<tr>
<th>MID</th>
<th>MC (%)</th>
<th>T (°C)</th>
<th>MeterID</th>
</tr>
</thead>
<tbody>
<tr>
<td>001</td>
<td>13.5</td>
<td>22</td>
<td>abc123</td>
</tr>
</tbody>
</table>
Our Solution: We provide an energy saving solar dehydrator that enables the timely on-farm drying of perishable crops into high quality value added dry foods that are storage stable and can be exported to distant market. The drying basket & trays can be used independently from the dehydrator.
DESIGN FEATURES for Mini

Equipment Features

- Portable multipurpose power unit
- 0.64 m³ drying chamber volume
- 9 stacked drying trays (6 - 60 kg dry wt.)
  - 30" by 32" drying floor space/tray
- Drying chamber dimension:
  - 1.3 m (49.97") length
  - 1 m (40.25") width
  - 0.48 m (19.12") height
- 100 W PV power source charging a 12 VDC Battery; power for lighting & electronics
- 10 - 120 CFM; 3750 RPM; 0.6A Fans
- Heats up to 10° above ambient
- Smart Control & DAQ
- Modular supplemental gas fueled heat option for all weather operation

JUA Technologies International is seeking to partner with end-users to beta test technology on the field.

Please contact Klein Ileleji – Klein.ileleji@dehymeleon.com
+1-765-490-2151
Solar POD Dryer (Drs. Stroshine & Raman)
Other Technologies

- AFLASAFE – IITA/USDA-ARS technology to reduce aflatoxin contamination
- UC-Davis Dry Card: Moisture detection technology
Key Drivers to Fuel African Agriculture

• Growing population than any other continent – sustained food demand
• About 62% of inhabitants in Africa live in rural areas and lack electric power.
• There are about 500 million smallholder farmers worldwide and 80% of the food in Africa and Asia are produced by them
• Over 40% of the population in Africa are below 15 years – they are future of farmers in the continent, more educated and technologically savvy.
How digital technology can revolutionize African agriculture

- “But digital technology can act almost like a secret decoder ring that links the formal (markets, banks, etc.) and informal (smallholder farmers) sectors.” – Bill Gates, January 20, 2016

- “By 2025 half of sub-Saharan Africa’s billion strong population will have internet access, 360m via smartphones according to McKinsey, the consultants.” Smart Africa - Financial Times, January 26, 2016

Source: Financial Times
IT is a large part of the solution

“The future of technology for Africa is not in playing catch-up. But in looking at the things we lack and using each of those gaps as an opportunity for us to invent something we can use to leapfrog the rest of the world,” Mr Essien
Mobile phone trends

- The cell phone is changing the way we do business, November 2009: Dawanau Market, Kano, Nigeria
- We don’t use moisture meters, February 2011: Kumasi, Ghana
- Pay by cell phones, Japan 2007
- Kenya, 2015, M-PESA
- Going paperless, Alipay, China 2017
Key Aspects of Taking Technologies to the Market

- **Awareness** of technology to demonstrate value creation for the smallholder farmer through training,

- **Access** of technology through affordable pricing and financing, and

- **Availability** of technology through innovative and reliable distribution channels.

Strategy was paraphrased from C.K. Prahalad’s book – The Fortune at the Bottom of the Pyramid
Acknowledgements

- FPL team in Senegal (Dr. Sarr & Papa Diop), Kenya (Dr. De Groote & Patrick Ketiem)
- FPL Team @ Purdue (Woloshuk, Ricker-Gilbert & others, Bugusu, Nielsen, Lowenberg-Deboer)
- Other students: Marisol Pantoja and Diana Ramirez-Giuterrez, MS Students in ABE
- Alba Graciela Avila Bernal, Assoc. Professor in EE, University of Los Andes
- Yung-Hsiang Lu, Associate Professor in ECE
- Administrators in the College of Ag, Dean & Associate Dean (Drs. Akridge & Plaut) & ABE Dept. head (Dr. Engel)
Solar Dryer R&D Team @ Purdue

David Latka, USA
Electronic Engineer

Mayo Olasubulumi, Nigeria
Mechanical Engineer

Diana Ramirez, Colombia
Agricultural Engineer

Mirlande Hector, Haiti
Agriculture/End-User Technology Transfer

Ravindra Shrestha, Nepal
Agricultural Engineer

Yifan Li, China
Electronics & Computer Engineer

Cheikh Ndiaye, Senegal
Food Scientist
Commercialization Team @ Purdue

- Abhijith Karve, OTC, PRF
- Dan Dawes, EIR, Foundry, PRF
- Tim People, Foundry, PRF
- Gregory Deason, Purdue Research Foundation
- PRF and Ag. Communication Units
ACKNOWLEDGEMENTS for JUA Technologies International

Dr. Reiko Habuto Ileleji, Cofounder of JTI
Larry Loehr, Board of Advisors
Questions?