Improved Packaging for Optimal Protection of Food Aid Products

June 28, 2018
Food Assistance for Nutrition Evidence Summit
Washington D.C.
Chaired by Quentin Johnson, Quican, Inc.
Please cite this presentation as:

Overview

• Current challenges with Food Aid Packaging
  – Introduction by Quentin Johnson, Quican, Inc,

• Packaging for Optimal Performance
  – Presentations from ProAmpac, Didion Milling, WFP

• Panel: The Future of Food Aid Packaging Research
  – Representatives from USAID, WFP, US Army Natick Soldier RD&E Center

• Q&A
Review:
Food Aid Packaging Challenges
Review: Food Aid Packaging Challenges

CHALLENGES

• Long supply chain
• Extreme environmental conditions
• Multiple handling points
Review: Food Aid Packaging Challenges

CHALLENGES

• Long supply chain
• Extreme environmental conditions
• Multiple handling points

CONSEQUENCES

• Losses
• Inefficiencies
• Reconditioning
• Infestation
• Organoleptic degradation
• Nutrients losses
• Quality and Food Safety concerns
Review:
Food Aid Packaging Challenges

Main Objectives:
• Develop performance criteria and extend shelf-life
• Optimize costs and cost-effectiveness
• Improve functionality

• Obtain more data on losses and issues throughout the supply chain
Review: Food Aid Packaging Challenges

Photo credit: USAID

Presentations:
Improved Packaging for Increased Cost-Effectiveness

1. New and Improved 25-kg Hybrid Bags – Vance Fortenberry, ProAmpac

2. Optimization of the Packaging of SC+ – David Silver, Didion Milling

3. Development of HEB Packaging – Shane Prigge, WFP
INNOVATIONS IN PACKAGING:

CORNMEAL / CSB+ HYBRID BAGS

June 27-28, 2018
Food Assistance for Nutrition Evidence Summit
Washington D.C.
Vance Fortenberry: Director, Product Development: ProAmpac
SUMMER 2017: Overall Objectives for Improved 25 kg US AID Bags

- Reduce the breakage of bags throughout the distribution cycle
  - During the distribution cycle, the US AID bags are manually handled dozens of times. This handling results in excessive breakage and product loss.
- Eliminate pest infestation of the product
  - In addition to breakage, a significant amount of product is lost due to pest infestation.
- Maintain use of existing filling equipment
  - In order to prevent suppliers from having to retool, the mandate was to offer solutions that used the existing filling equipment.
- Suggest a size for 12.5 kg packaging
  - The main recipients of the US AID bags are women. A request was made to suggest a 12.5 kg size to make the filled bags easier to carry.
SOLUTIONS:

• Reduced Breakage:
  – Laminated a 100 ga. Nylon film to the outer ply of the bag. Nylon gives the package excellent puncture resistance.
  – Replaced the historic XF liner film with a 2.75 mil high-strength sealant. This sealant provides excellent sealability, strength, and moisture barrier while reducing the dependence on a single supplier for the XF film.
  – Used stripe lamination of the inner kraft paper to the liner film. This allows for this lamination to “give” slightly to eliminate the possibility of bursting.
• Elimination of Infestation:
  – The main reason for pest infestation is the need for air evacuation holes. In order to eliminate the possibility of infestation, the bag is vented as follows:
    – 50-100 micron micro-perforation on the outer paper/nylon lamination
    – Unperforated middle 50# NK layer
    – 50-125 micron micro-perforation on the inner NK/liner lamination.
  – Another possible path for infestation is the gusset folds at the manufactured end of the bag. In order to eliminate this source of contamination, the bottom of the bag is heat sealed AND mitered. The mitering process adds a layer of insurance against infestation.
• Maintain Existing Filling Equipment:
  – The Hybrid PBOM solution allows for millers to use the same filling equipment as with conventional US AID bags.
  – A significant amount of research and trial-and-error was put into finding the best hot melt for the supplier end to ensure lock-up seals without the bags sticking together prior to filling.
• 12.5 kg packaging:
  – Three new sizes were recommended for use with 12.5 kg of product, depending on densities. These three sizes are 13 x 4 x 24, 13 x 4 x 26 and 13 x 4 x 28.5.
  – Samples have been created in each of these sizes for evaluation.

SOLUTIONS (continued):
COMPLIANCE:

• Construction: 100 ga. BON / Ink / Adh. / 41# CWK, 50# NK, 50# NK, 2.75 mil Coex Sealant film

• FDA Status (US AID Commodity Specification, Part 2, Section 2.1 A): All components of this bag are FDA Compliant for their intended use in food packaging.

• Sourcing (US AID Commodity Specification, Part 2, Section 2.1 B): Gateway Packaging’s Hybrid Bags are manufactured and assembled in the United States.

• Bag Sizing: These bags are manufactured to meet the sizing outlined in US AID Commodity Specification, Part 2, Section 2.2 B.

• Recycled Content (US AID Commodity Specification, Part 2, Section 2.2 C): All components of this bag are manufactured with virgin stocks.
COMPLIANCE (continued):

- **Bag Sealing (US AID Commodity Specification, Part 2, Section 2.2 D):** All bags are sealed in a manner which prevents the product from leaking through the seams during handling, storage and distribution.

- **WVTR (US AID Commodity Specification, Part 2, Section 2.3 A):** Michigan State testing on the “standard” XF film yielded WVTR (37.8°C / 100% RH) values of 4.29 – 4.51 g/m²/day. The new Hybrid Liner Film yielded WVTR values of 3.92 – 4.09 g/m²/day. The Hybrid Liner Film shows a 9% improvement in WVTR over the conventional film.

- **Heat Sealability (US AID Commodity Specification, Part 2, Section 2.3 B):** The seal initiation temperature of the liner film is 200°F at 40 psi / 1.0 second.

- **Antiblock (US AID Commodity Specification, Part 2, Section 2.3 C):** These hybrid bags will not block at the specified temperatures.
COMPLIANCE (continued):

• Outside COF (US AID Commodity Specification, Part 2, Section 2.3 D): The outside-to-outside COF of the supplied bags is greater than 0.70.

• Print Retention (US AID Commodity Specification, Part 2, Section 2.3 E): The Hybrid bags are reverse-printed and laminated, thereby eliminating any possibility of print scuffing.

• Impact Testing (US AID Commodity Specification, Part 2, Section 2.3 G-I): Filled bags were submitted to Michigan State University for Impact Testing. The result of this testing is “ten bags passed the minimum impact tests (butt and side) with no visible damage or loss of product.”
THANK YOU
Packaging Technologies for Improved Cost-effectiveness: Super Cereal Plus Packaging Modifications

David Silver
Didion Milling, Inc.
# Super Cereal Plus Packaging Progression

<table>
<thead>
<tr>
<th>1. Original</th>
<th>2. Revised</th>
<th>3. Modified</th>
</tr>
</thead>
<tbody>
<tr>
<td>a) Original bag</td>
<td>a) Original bag</td>
<td>a) New bag</td>
</tr>
<tr>
<td>b) Original box</td>
<td>b) Original box</td>
<td>b) New box</td>
</tr>
<tr>
<td>c) Original chimney</td>
<td>c) Modified stacking pattern without chimney</td>
<td>c) Original chimney</td>
</tr>
<tr>
<td>stacking pattern</td>
<td>pattern without chimney</td>
<td>stacking pattern</td>
</tr>
</tbody>
</table>
• Initiated in-house packaging in 2014
  – Film Size: 17” width x 13” height
  – Box Size: 19” length x 10” width x 8.5” height

• Shipping method: Floor loaded rail cars

• Shipping destination: Houston, TX
Original Bag
Original boxcar with hand stacking, alternating pattern (12 high)
Crushed cases in boxcar upon arrival
ISSUE

Stacking pattern did not create structural support

Crushed cases in boxcar upon arrival, full view
MODIFIED STACKING PATTERN

• Entirely flush, stronger stacking pattern
• Vertically stacked
• No chimney format
• No gaps
Significantly better condition upon arrival
Boxcar of palletized packaging with corner boards
Boxcar of palletized packaging with corner boards, cont.
New Bag and New Box

- Modified Film Size: 19” width x 12” height
- Modified Box Size: 19¾” length x 12¾” width x 6⁷⁄₈” height
Modified stacking pattern (left); original stacking pattern with new bag and box (right)
Food Assistance for Nutrition Evidence Summit
Packaging technologies for improved cost-effectiveness
Packaging improvement process:

1. Field Interview Audit / Observation
2. Lab Analysis
3. Materials and Specification improvements
4. Manufacturing issues and field/supplier collaboration
Packaging improvement process

Field Interview Audit / Observation

- Supply chain assessment
- Evidence gathering
- Recommendations to WFP operations for better food storage and handling
Packaging improvement process: supply chain assessment

Readjusting stacking practices from a local sub-contractor

Local packaging suppliers audit and selection
Packaging improvement process: Evidence gathering

Examples of issues on oil packaging & SNFs
Packaging improvement process: example of recommendations

- Column stacking of the 3 first layers from supplier production, transport to warehouse stacking
- Addition of solid planks every 4 to 5 layers

- Results:
  - preservation of 40% of carton box strength
  - Stacking layer increased in warehouse from 10 to 16 layers
Packaging improvement process

Lab Analysis

- Baseline suppliers specification analysis
- Recommendations of new material or optimizations
- Deep technical analysis for incidents management
Film analysis: example of High Energy Biscuits

Material layers:
coex oPP / ink / adh / metallised PP

Thickness:
Total thickness: 48-50 µm
Coex oPP: 20 µm
PP: 25 µm (top seal layer of 2 µm contains styrene)
~ metallisation towards coex oPP-layer

Adhesive:
Aromatic PU

Performance:
OTR: 8,12 cc/(m²-day)
WVTR: 0,29 g/(m²-day)
Packaging improvement process

Materials and Specification improvements

• Determination of adequate performance parameters and standards to verify them
• Performance based specification improvement
  o From material definition to performance definition
  o Strengthening minimum regulatory requirements
• Roll out to suppliers
LNS-MQ shall be packaged in food-grade sachets, hermetically sealed and robust enough to prevent leakage and protect the product throughout its shelf life. Sachet material shall not represent a hazard for infants and young children when sachets is opened and put in contact with the mouth.

<table>
<thead>
<tr>
<th>Performance criteria</th>
<th>Requested performance</th>
<th>Unit</th>
<th>Standard of evaluation</th>
<th>Evaluation document</th>
</tr>
</thead>
<tbody>
<tr>
<td>WVTR</td>
<td>Maximum 1 gms/m²/24h (at 38°C &amp; 90% RH)</td>
<td>ASTM - F1249</td>
<td>CoA</td>
<td></td>
</tr>
<tr>
<td>OTR</td>
<td>Maximum 2 C²/m²/24H (at 23°C &amp; 38% RH)</td>
<td>ASTM - D3985</td>
<td>CoA</td>
<td></td>
</tr>
<tr>
<td>Seal initiation temperature</td>
<td>Minimum 5N at 120°C</td>
<td>N/15mm</td>
<td>ASTM F88/EN 868-5</td>
<td>CoA</td>
</tr>
<tr>
<td>Seal Strength</td>
<td>Minimum 40 N/15mm</td>
<td>ASTM F88/EN 868-5</td>
<td>CoA</td>
<td></td>
</tr>
<tr>
<td>Gelbo test</td>
<td>WVTR and OTR remain as indicated under its related performance criteria</td>
<td>5 Cycles</td>
<td>ASTM F392</td>
<td>CoA</td>
</tr>
</tbody>
</table>
Packaging improvement process

Manufacturing issues and field/supplier collaboration

• Technical support to suppliers
  o New specification implementation
  o Quality improvement
  o Manufacturing practices

• Technical support to Country Offices
  o Review of local packaging specification
  o Audit and support to COs packaging procurement
Supplier support: example of vegetable oil

FEA* Analysis of different bottle designs from our partner Amcor

*FEA : Finite Element Analysis = a simulation of a physical constraint through algorithm
Packaging improvement process: Feedback loop

- Total cost on non quality
  - Evaluation of the amount of reconditioning
  - Reduction of the losses due to packaging

- Feedback from the field
  - Gathering data to improve packaging functionalities
Packaging improvement process: Sustainability initiatives

• Packaging waste evaluation study

• Waste management guideline

• Switch to brown boxes

• Packaging second use in the field

• Feedback loop from the beneficiaries to design packaging upfront for a better second use or recycling
Partnerships:

Nothing would be possible without collaboration and partnerships!
Panel: The Future of Food Aid Packaging

1. Ruffo Perez, USAID FFP
2. Shane Prigge, WFP
3. Jo Ann Ratto Ross, Natick Soldier RD&E Center
What are the main constraints when trying to develop new packaging technologies for food aid products, or MREs?
Panel: The Future of Food Aid Packaging

• What would you need to see to confidently move forward with a new packaging technology for a product?
Panel: The Future of Food Aid Packaging

• In one phrase, what do you think should be the next priority in food aid packaging research?
Q&A Session