



# **RESILIENT GRAIN MARKETS:** **UNLOCKING AFRICA'S FOOD SECURITY POTENTIAL**

**2ND-4TH, OCTOBER 2025 | ZANZIBAR, TANZANIA**

Main Session 3

## **Grain quality and food safety.**

**Harmonizing standards and combating aflatoxins for competitive trade**

**Session  
Sponsors:**



**Rose**  
**Ndung'u**

**Chief Strategy Officer**  
GrainPro Inc

## **Resilient Grain Markets:**

Unlocking Africa's Food Security  
Potential

## **Grain Quality and Food Safety:**

Storage, Trust, and Transparency in  
the Digital Age



# Who is GrainPro?



**GrainPro is an Environmental, Social Purpose, and Good Governance (ESG) company.**

Leading innovator in developing and providing post-harvest Ultra-Hermetic™ technology solutions for drying, storing, and transporting dry agricultural commodities and quality monitoring equipment.



EcoWise

# GrainPro Solution: Hermetic Technology

It the **modification of the storage environment** through generation of an **oxygen-depleted** and **carbon dioxide-enriched atmosphere** by the respiring organisms in a **sealed or gas-tight storage**.

**EVOH** - Ethylene-vinyl alcohol copolymer, a flexible, crystal clear, glossy thermoplastic copolymer incorporated through multi-layer coextrusion with PE which is the material that the hermetic bag is made of.



The effect of low-oxygen and high-carbon dioxide will help to (1) control all life-stages of insects, (2) inhibit mold growth, (3) prevent oxidation & rancidity, and (4) preserve germination and viability.

# GRAINPRO DRYERS



Collapsible Dryer Case (CDC)™



Solar Bubble Dryer (SBD)™



# GrainPro Hermetic Storage Solutions

Safeguarding stored commodities from **mold growth, insect infestation, and moisture build-up** avoid massive post-harvest losses and retains quality.



GrainSafe™



Self Verifying Cocoon™



Cocoon Lite™



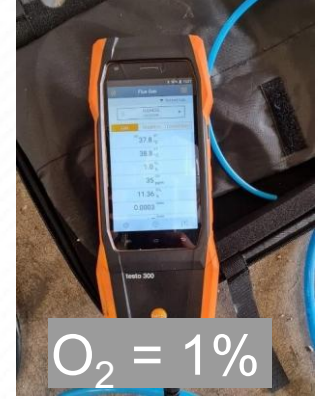
Cocoon Indoor™

# CARBON DIOXIDE (Fumigation) GAS TREATMENT

*Combinations of Low Oxygen and High Carbon Dioxide*



# NITROGEN GAS TREATMENT



# GRAINPRO TRANSPORTATION SOLUTIONS

TranSafeliner™



(FIBC) Pouch™



(FIBC) Liner™



# Quality Monitoring

## Oxygen Analyzer™



## EcoWise Wireless Sensor™



## Cocoon Cap Sensor™



## Moisture Meter (MM5)™

### Measured Data

- ✓ Relative humidity (%RH)
- ✓ Temperature (°C)
- ✓ O<sub>2</sub> levels

# TRUST & TRANSPARENCY CHALLENGES & SOLUTIONS

1. Digital Information:  
Evidence-Based  
Scientific Data
2. Data visibility – In  
Storage



# Research Into Use Partner Institutions

## Academie

University of the Philippines at Los Baños - Philippines  
Hohenheim University - Germany  
Monterey Institute- Mexico



## Government Agencies

Philippine Center for Postharvest Development and Mechanization  
National Food Authority  
Philippine Rice Research Institute  
MinAgri – Rwanda  
National Cereal and Produce Board (NCPB Kenya) - WRS



## International Agencies

International Rice Research Institute (IRRI)  
International Maize and Wheat Improvement Center (CIMMYT)  
AfricaRice – Cote d'Ivoire  
KARI – Kenya Agricultural Research Institute (Kenya)



AfricaRice





Contents lists available at ScienceDirect

## Journal of Stored Products Research

journal homepage: [www.elsevier.com/locate/jpsr](http://www.elsevier.com/locate/jpsr)

## Efficacy of metal silos and hermetic bags against stored-maize insect pests under simulated smallholder farmer conditions

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## ARTICLE INFO

Article history:  
Received 30 December 2015  
Received in revised form  
9 August 2016  
Accepted 13 August 2016

Keywords:  
Hermetic grain storage  
Natural and artificial insect infestation  
Pesticide-free grain storage  
Insect-induced perforations  
*Prostephanus truncatus*  
*Sitophilus zeamais*

## ABSTRACT

Pesticide-free hermetic grain storage is an environmentally-benign alternative to synthetic pesticides, currently being used in many countries. However, in some African countries knowledge gaps exist on the effectiveness of hermetic maize storage, particularly where the Larger Grain Borer (LGB), *Prostephanus truncatus* occurs. Trials simulating African smallholder farmer conditions were conducted at two sites in contrasting agro-ecological zones in Zimbabwe for up to 12 months during the 2013/14 storage season. There were two hermetic treatments: metal silos and hermetic bags; and two non-hermetic treatments: a registered synthetic pesticide and untreated control, in polypropylene bags. Two modes of infestation: natural and combined (natural plus artificial) were used as factors. Treatments were arranged in a completely randomised design and stored in ordinary rooms. Hermetic treatments were significantly superior ( $P < 0.001$ ) to non-hermetic treatments in preserving germination, controlling insect population development, suppressing maize grain damage, controlling grain dust production and consequently limiting weight loss during storage. Hermetic bags were more effective than non-hermetic treatments in reducing storage losses despite the plastic liners having multiple insect-induced perforations of more than 300 holes per plastic liner at termination. However, there were no significant differences between metal silos and hermetic bags regardless of the mode of infestation. There was strong correlation between total insect population per kg and: percentage grain damage, percentage weight loss, and grain dust which indicate the importance of controlling insect pest development during storage to reduce losses. Results show that hermetic storage can be an effective pesticide-free alternative to synthetic pesticides in reducing grain storage losses under smallholder farming conditions, even where LGB occurs.

## Effect of hermetic storage in the Super Bag on seed quality and on milled rice quality of different varieties in Bac Lieu, Vietnam

Diep Chi Ben, Bac Lieu Department of Agriculture and Rural Development (ILDARD), Bac Lieu Province, Vietnam; Phan Van Lien, Nguyen Tam Dao, Bac Lieu Seed Center, Bac Lieu Province, Vietnam; M. Gummert and J.E. Rickman, 1998

The IRRI Super bag is a farmer friendly 30 kg storage bag that allows cereal grains to be safely stored for extended periods by using the hermetic storage principle. Hermetic storage systems rely on having the atmosphere within the grain modified through respiration of the grain, insects and fungi. In hermetic systems the oxygen content in the atmosphere surrounding the grains inside the grain bulk is reduced, often to less than 3%, and the carbon dioxide content increases to a level where aerobic respiration is minimized. The Super bag fits as a liner bag inside a conventional storage bag and can therefore be used in ways similar to existing bag storage systems. The objective of this study was to determine the effect of hermetic storage in the Super bag compared with traditional open storage on the quality of seed and milled rice stored for 8 months. The experiments were conducted at the Bac Lieu Seed Center, Vietnam, using two traditional and two modern varieties.

## Experimental Design

Rice seeds of two traditional varieties, Tai Nguyen and Mat Bui Do, and two modern varieties, Jasmine 85 and OM717, were stored inside the seed storage building of Bac Lieu Seed Center in Super bags with initial moisture content between 11.26 and 13.58. Seeds from the same lots were stored in conventional woven PVC storage bags in open storage as control. All treatments were replicated three times and the bags were placed on pallets, surrounded by metal sheets and covered with plastic to protect them from birds and rodents. Initial samples were taken at the start of the storage period in February 2005 and final samples were collected after 8 months of storage for seed quality and milling quality analysis.

## Effect on Seed Quality

The Super bag effectively prevented moisture exchange between the surrounding air and the grains, and there was only a slight increase of about 1.2% moisture content in the hermetic systems caused by respiration from grains and insects. In contrast the moisture content of the control treatment increased by an average of 4.7% to a final moisture content of 16.5–18.2%, mainly through moisture exchange with the surrounding air (Figure 1A). Levels far above safe storage moisture content. The Super bag also effectively reduced living insects to 1 insect/kg without using pesticides, while in open storage, insect levels increased to an average of 53 living insects/kg (Figure 2B). The germination rate in the control treatment dropped to an average of 43% for the traditional varieties and to 48% for the new varieties under open storage system, while hermetic storage maintained high germination rates between 90% for Mat Bui Do and 99% for Jasmine 85 with an average germination rate of 96% (Figure 2C).

## Effect on Milling Quality

After 8 months of storage the milling recovery in the open storage samples was reduced by an average of 2.9% when compared to the initial sample. In hermetic storage the milling recovery was only 0.3% lower than in the values obtained from the initial sample. Hermetic storage thus led to a 2.14% higher milling recovery on average.

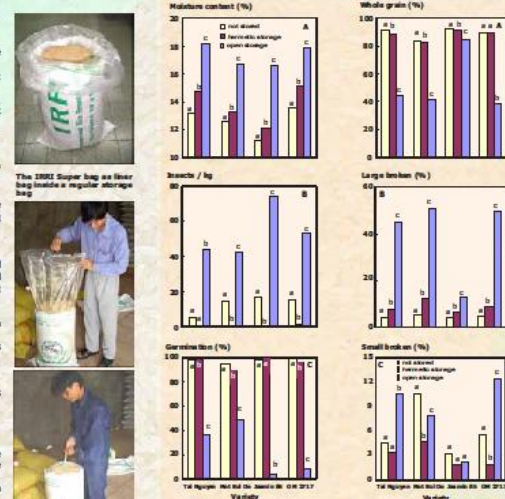


Figure 1. Effect of eight months hermetic storage on A) moisture content, B) insect infestation and C) percent whole grain, percent large grain and percent small grain.

Within a variety, means with the same letter are not significantly different at the 5% level.

The benefit of hermetic storage in terms of maintaining a high percentage of whole grains is much more obvious. In the open storage system, the whole grain percentage was reduced by 37.1 percentage points on average. In comparison, the samples stored hermetically only had 1.2% less whole grain than the initial samples. Using hermetic storage the whole grains were increased by an average of 35.9% compared to open storage (Figure 2A). This was due to an increase in both, small broken and big broken, which were caused by the repeated drying-wetting cycles the grains in open storage went through when being exposed to the ambient air conditions.

## Conclusion

The results of this study showed that hermetic storage provides simple means to retain high seed germination, lower insect infestation and also helps to maintain high percentage of whole grains after milling.

## Acknowledgement

This work was supported by the Irrigated Rice Research Consortium (IRRC) which is funded by the Swiss Agency for Development and Cooperation (SDC).



# Evidence-Based Data Capture & Visualization

## Oxygen Analyzer™



### Measured Data

- ✓Relative humidity (%RH)
- ✓Temperature (°C)
- ✓O<sub>2</sub> levels

## Ecowise Wireless Sensor



## Cocoon Cap Sensor



# GrainPro Videos

[The GrainPro Corporate Audio-Visual Presentation  
2017 - YouTube](#)

[12 years in a GrainPro Cocoon – YouTube](#) – Food Security in collaboration with Rwanda Government

[Grainpro cocoon || Agricultural Technology – YouTube](#) – Safe storage through reduced Oxygen levels

## 2. Solutions Costs vs Value to Users

### Value for Smallholder Farmers

Cost of GHB - \$2-\$3 (90-100kg)  
- \$1.2 - \$2.5 (50kg)

Use: 3-5 seasons

#### Grain Price:

At harvest - \$0.35/kg  
3-6 months after harvest – \$0.53/kg (50% Increase)

#### 50kg Bag

At harvest - \$17.50  
3-6months Post harvest - \$26.25

Difference - \$8.75

#### 90kg bag

At harvest - \$31.50  
3-6months Post harvest - \$47.70

Difference - \$16.20

### Value for Larger Grain Handlers

#### Cost:

SVC Cocoon – Avg cost/Tonne - \$100  
Capacity Range 5MT – 300MT and custom made capacities.  
Use: 5-10 Years

Cost per MT/Month - \$7



# Disposal of Post-Harvest Storage Technologies – Sustainably

**GP GRAINPRO**  
STORING THE FUTURE

— **4 STEPS** —

- 

**1 Empty Your GrainPro Bags**  
Remove all coffee beans.
- 

**2 Pack in a box**  
Another GrainPro bag may also be used.
- 

**3 Fill out the form.**  
For inquiries, contact us at [sustainability@grainpro.com](mailto:sustainability@grainpro.com).
- 

**4 Ship your package.**  
Address:  
NKG Kala Hamburg GmbH  
Hohe-Schaar-Kamp 3  
21107 Hamburg  
Deutschland

**NOW EASIER TO RECYCLE**



# Return. Recycle. Rebate

GrainPro + Gargeon



# GrainPro Plastic Fantastic Recycle Unit





## Cocoon Set-up outside in Houston Texas

- ✓ Cocoon setup by USAID & WFP in Houston.
- ✓ Duration – 10 months.
- ✓ Stored: Rice, Yellow Split Peas, Sorghum and Corn Soy Blend.
- ✓ 8000MT stored collectively.
- ✓ TSLs for food aid shipping into Africa.
- ✓ Only 3% of loss even with Hurricane Beryl.

# Conclusion

## Call to action:

1. **Private Sector** – Technology uptake with visibility on data of stored produce.
2. Aggregation with off-take intension by private sector.
3. **Policy makers** – Preferential duties as focus is agri-sector.
4. **Research & Academia** – Trials and collaborations for evidence-based scientific and academic papers.
5. **NGOs and Grant Funders** – Collaborations for technology adoption by key sector players.
6. **Access to finance for SHFs** - data visibility for financing institutions.





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# THANK YOU.

