

# Hermetically Sealed Grain Storage Systems

## Introduction

Hermetically sealed grain storage systems are a very effective means of controlling grain moisture and reducing pest damage during storage. Hermetic storages restrict the air movement between the outside atmosphere and the grain, which ensures that the initial grain moisture levels are maintained and pests are easier to control. Grain insects are controlled through a reduced level of oxygen caused mainly by their own respiration. Insects in the grain use the oxygen from the inter-granular space and expire carbon dioxide. Within a relatively short period of time, oxygen levels will be reduced from 21% to less than 5%. At this level insect activity is minimal and reproduction ceases. Rodents and birds also do not appear to be attracted to the grain in this types of storage. This may occur because they are unable to smell the grain.

## The System

Technological advances in manufacturing have led to the development of PVC liners that provide the required durability, gas permeability and physical properties to enable airtight storage for extended periods of time in open environments.



Commercial systems

Studies undertaken by IRRI evaluated the use of large commercial systems and smaller farmer built systems developed which was developed from recycled plastic, steel containers and clay water pots. The systems ranges from 25 liters to 300 metric tons in capacity.

## Research Findings



Seed viability improved

- Seed viability was maintained for a much longer period (extended from 6 months to 12 months).
- There was a significant reduction in the number of live insects pests without the use of insecticides. Less than 1 insect/kg of grain
- Grain moisture levels inside the storage did not vary between the wet and dry season. Traditional storages varied by up to 3%.

- Moisture movement did not occur from the lower to upper levels in the storage.
- High milling recovery and head rice yield were obtained.
- When correctly maintained there was no rodent or bird damage.
- The system could be used for paddy, milled rice and other cereal crops.
- The large commercial systems and smaller farmer built systems function in the same manner.



High milling recovery

## Management Issues

- Intermittent opening and closing of the commercial storage systems may sufficiently replenished oxygen levels inside the stored grain which could lead to the rapid re-infestation of the lesser grain borer (*Rhizopertha dominica*).
- These insects were capable of piercing the commercial plastic liner.
- Grease or an airtight sealant must be used to seal the filler opening of the containers. Similarly clay pots must be painted both inside and out. If not sealed properly oxygen leakage may occur and insects will multiply.



Lesser grain borer



Small containers

- If the smaller containers are not completely utilized at any one time the air space to grain ratio inside is too large to allow oxygen levels to be reduced sufficiently to control insects.
- Large commercial storages can be damaged by rodents if not managed

- correctly. Plastic liners must be pulled tight and a clear space around the containers maintained.
- **All recycled containers must be cleaned thoroughly before use.**

## Cost

The cost of a hermetic storage system depends on the size of the commercial storage or the cost of locally recycled containers and water vessels.

- The large commercial systems cost from \$50-100 per ton capacity to purchase. With an expected life of at least 10 years this equates to a cost of approximately \$5-10 per metric ton/year.
- The cost of locally constructed systems will depend on the purchase price of recycled containers or clay pots, 200 liter oil drums may cost from \$2.5.

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