



African Organic Agriculture Manual Booklet Series  
No. 10 | Post harvest management and storage

# HOW DO I MANAGE STORAGE PESTS IN GRAINS?

# What to know about storage of grains?

**A considerable portion** of grains is lost after harvest because of poor handling and poor storage practices that expose the stored grains to insect pests and diseases.

Insect pests like the Larger Grain Borer, grain weevils, flour beetles and vertebrate pests like rodents can destroy entire stocks of stored grains. Fungal infections can also cause heavy losses and are very dangerous for human health because they produce toxins. These toxins remain in the stored product and cannot be destroyed by boiling, pressing or even processing. Infected product must be destroyed.

Storage pests and diseases can be introduced to the granary with infested grains. Or they result from an infested or not pest-tight store room. Humid conditions promote the multiplication of storage pests and diseases, whether the humidity is introduced with the grains or results from a leaky roof.

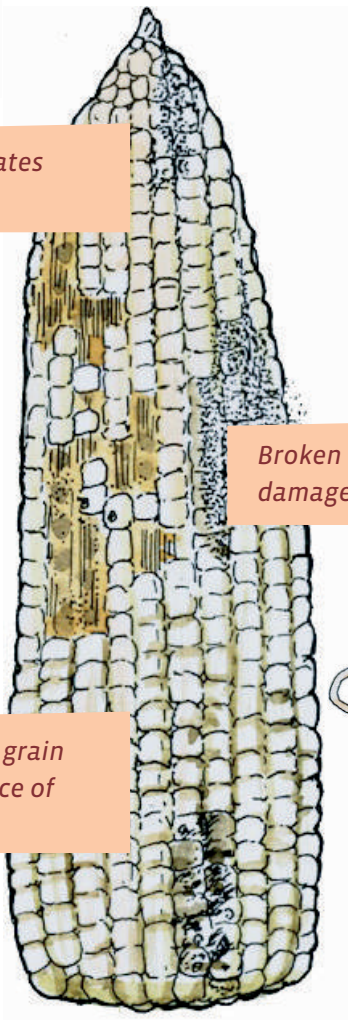
Contaminated or moist grains will not store well, even under the best storage conditions. Only clean and well-dried grains in pest-tight storage rooms store well.

Proper storage, therefore, begins by ensuring grains are properly dried and have minimal contamination. Proper monitoring of the moisture content in and around the stored grains is essential.

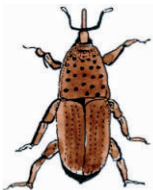
**How high** do you estimate your losses at storage? Do you know the reasons for the losses?



*Presence of mould indicates fungal infections.*



*Broken or spilled grains indicate damage by rodents or birds.*



*Holes in grain seeds and grain dust indicate the presence of insect pests.*



## How do I handle grains before storage?

**Timely harvesting**, proper drying, threshing and shelling, sorting and grading contribute to healthy grains that store well.

Proper hygiene at all stages of handling is important to ensure minimal exposure of the grains to pests and moisture after harvest.

**Timely harvesting** minimises contamination in the field. The longer ripe grains remain in the field, the higher the risk that they will get infested by insects or moulds. Most grains store well when they are harvested during dry or sunny weather.

**Proper drying** of the grains after harvest prevents germination of grains during storage and development of fungi. Drying must be done immediately after harvest. Properly dried grain seeds snap open when bitten. Heat used for drying the grains will also kill pests and fungi.

To test for appropriate moisture content, take a dry soda bottle and add a handful of grains and half a handful of salt and shake them together for 2 or 3 minutes. If the salt does not stick to the walls of the bottle, the grains are dry enough for storage.

After drying, grains should be **properly threshed** to reduce losses by insects and diseases. To avoid contamination at storage, grains should not be stored with threshing residues.

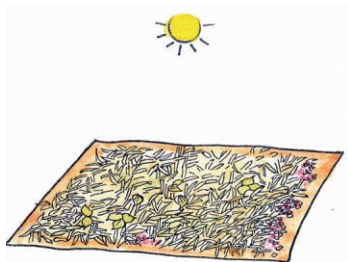
Proper threshing is done by beating sheaves with a wooden flail on a threshing mat, tarpaulin or paved yard. Motorized threshers facilitate threshing.

Irrespective of the threshing method, **sorting and grading** are important to minimise contamination and to sort out all foreign materials and damaged and diseased grains. The sorted grains should be packed in jute bags.

**Do you see any potential for improvement in handling grains on your farm?**



1. Harvest the crop as soon as it is ripe, ideally in dry weather.



2. Dry the pods properly.



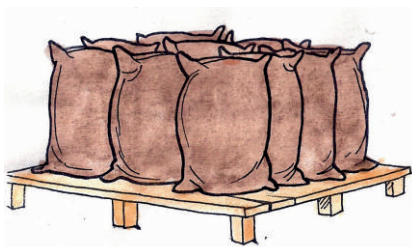
3. Thresh the grains, if necessary.



4. Clean the grains to remove the trash.



5. Sort the grains to remove all damaged grains.



6. Pack the grains properly and store them off the ground.

## How do I ensure proper storage?

**Proper storage** requires clean and sealed granaries.

When we store grains we aim at protecting the grain against deterioration due to rain, moisture, direct sunshine or insect and vertebrate pests. This requires a number of precautions.

Grain deterioration prevention in the grain storage area first consists of general hygiene in and around the grain store and in pro-per sealing off of all potential entry routes of pests and diseases. Preventive measures include the following precautions:

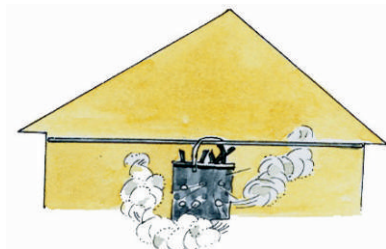
- › Residual stocks must be removed because pests might be hiding within the remaining product from the previous harvest.
- › Proper cleaning of the entire granary or silo including all dark areas helps avoid early infestation.
- › Cracks that may shelter insects should be sealed with a mortar compound of powdered insecticidal plants such as chilli powder, pyrethrum or neem.
- › Burning of millet or maize stalks or chilli powder inside the granaries repels and kills pests. While burning chilli powder one must keep out of the granary.
- › To reduce the risk of the bags getting humid they should be stacked off the floor and away from walls.
- › Pheromone traps can be hung up inside the granary to monitor storage pests.

**Do you** apply all the mentioned precautions on your farm? Do they prove efficient to protect your grains from pests and diseases?

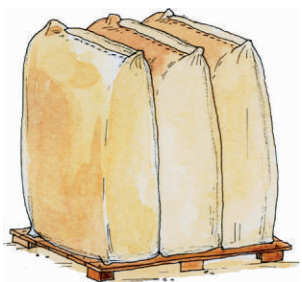
1. Remove all residual stocks.



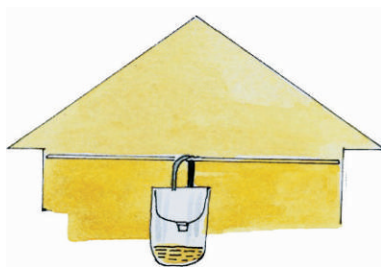
2. Clean the entire granary or silo.



3. Seal off any cracks.



4. Burn millet or maize stalks or chilli powder to repel and kill pests.



5. Stack the bags off the floor and away from walls.

6. Hang pheromone traps to monitor storage pests.

## Can I use any natural additives?

**A number of** natural substances can be used to hinder, repel or kill storage pests. But natural additives are not a substitute for other preventive measures.

**Powdery substances** are particularly useful for protecting small amounts of seed for replanting. For storing seeds, it is usually more practical to mix the seeds with any strong smelling plant material able to repel insects. The powdery substances fill the spaces between the grains making it difficult for the pests to move and respire. Effective powdery substances include:

- › Fine sand, to be mixed at 50 kg on 100 kg of grains
- › Clay dust, to be mixed at 5 kg to 100 kg of grains
- › Diatomite, an earth consisting of silica, to be mixed at 300 grams to 100 kg of grains
- › Kaolin, a special clay, to be mixed at 100 grams to 100 kg of grains
- › Lime, to be mixed at 300 grams to 100 kg of grains

**Dry wood ash** from the wood of casuarinas, derris, mango and tamarind is efficient in hindering infection by storage pests. Mixing the ash with powdered chilli pepper, pyrethrum, Mexican marigold or syringa seeds increases the repelling effect.

**Vegetable oils** from coconut, castor bean, cottonseed, groundnut, maize, mustard, safflower, neem and soybean oils can control storage pests. However, the effect of the oil treatment decreases with time. Therefore, seeds stored this way should be treated again if there are signs of infestation.

Neem seed oil or any other non-food oil leaves a bitter taste on the grains. This is why it works as a repellent. The bitter taste can be removed by immersing the grains in hot water for a few minutes before food preparation.

Proper coating of the grains with oil requires half a litre of oil per 100 kg of grains.





*For weighing powdery additives a scale is needed.*

*Proper measuring of liquid additives requires a measuring cylinder.*



*Spread solid additives evenly over the grains and mix them well with a rake.*



*Oils are best sprayed over the grains with a hand-sprayer.*



*After mixing, fill the grains into bags for storage.*

## When should I monitor stored grains?

**Regular monitoring** helps to identify infections early and to control them before the entire harvest is affected.

**Some farmers in Africa** have traditionally been using plant substances to repel storage pests. Plants such as pyrethrum and derris can even kill storage insects. Plants that help protect stored grains or seeds are:

- > Chillies: Dried whole or ground pods are mixed with ashes or fine clay.
- > Neem: Leaves, crushed seeds or oil are used.
- > Pyrethrum: Dried whole or ground flower heads are used.
- > Derris: All plant parts can be used as powder or spray for mixing with grains.
- > Eucalyptus: Only the leaves are used.
- > Syringa: Whole dried leaves or powder of ripe seeds are mixed with the grains.
- > Mexican Marigold: Dried whole plants are filled-in as a three finger thick layer in the base of grain bins.
- > Spearmint: Dried whole plant powder is mixed with the grains.
- > Aloe: A powder of the dried whole plant is used.



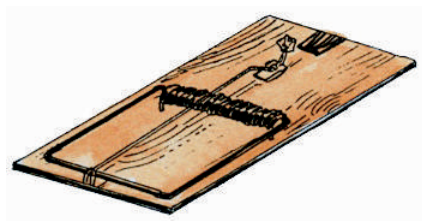
1. Bring all the product out of storage and spread it again under direct sun to eliminate excess moisture.

2. Carefully separate and remove all infected grains.

3. Clean the grain storage area again and check that all openings to the granary or silo are properly closed.

4. Physically move the bags to trace the intruder rodents and trap or chase them away.

5. To catch rats, place an attractive bait on rat traps such as a piece of meat.



This booklet is an outcome of the African Organic Agriculture Training Manual project and was conceived as a handout for farmers.

### Imprint

#### Publisher:

FiBL, Research Institute of Organic Agriculture, Switzerland, [www.fibl.org](http://www.fibl.org)

#### Collaboration:

- > IFOAM, International Federation of Organic Agriculture Movements, Germany, [www.ifoam.org](http://www.ifoam.org)
- > NOGAMU, National Organic Agricultural Movement of Uganda, [www.nogamu.org.ug](http://www.nogamu.org.ug)
- > FENAB, Senegal
- > OPPAZ, Organic Producers and Processors Association of Zambia, [www.oppaz.org.zm](http://www.oppaz.org.zm)

Draft version 1.0, June 2011.

African Organic Agriculture Training Manual: ISBN 978-3-03736-197-9

All materials resulting from the Africa Organic Agriculture Training Manual project are available free of charge in the internet under [www.organic-africa.net](http://www.organic-africa.net)

This booklet can be reproduced without permission.

Please cite this publication as follows: FiBL (2011): African Organic Agriculture Training Manual. Version 1.0, June 2011. Edited by Gilles Weidmann and Lukas Kilcher. Research Institute of Organic Agriculture FiBL, Frick

All the information contained in this manual has been compiled by the authors to the best of their knowledge. Reasonable efforts have been made by the Research Institute of Organic

Agriculture (FiBL) and their partners to publish reliable data and information. The authors, the editors and the publishers cannot assume responsibility for the validity of the materials. Neither the authors, nor the publishers, nor anyone else associated with this publication, shall be liable for any loss, damage or liability directly or indirectly caused or alleged to be caused by the training manual and its tools.

The African Organic Agriculture Training Manual is based on research funded by the Bill & Melinda Gates Foundation and the Syngenta Foundation for Sustainable Agriculture. The manual's findings, conclusions and recommendations are those of the authors, and do not necessarily reflect positions or policies of either Foundation.

### Contact

For further information on organic agriculture in your country please contact:

