

# Safe and Effective Grain Storage Methods

## Learning Outcomes – Participants will:

1. Analyze the current grain storage practices in their community and the economic impact of grain storage losses
2. Understand the causes of grain storage losses
3. Learn methods to minimize grain storage losses
4. Decide which grain storage technologies are relevant in their environment
5. Practice some of the grain storage technologies

## Pre-Requisites:

1. None

**Timing of this Lesson:** This lesson should take place one month before harvest

## References:

-  Baributsa, D. *et al.* 2015. A Guide On The Use Of PICS Bags For Grain Storage. Purdue Extension Publication E265W. <https://extension.entm.purdue.edu/publications/E-265.pdf>
-  PICS Bags: Chemical Free Crop Storage (instructional posters in many languages) <https://www.entm.purdue.edu/PICS3/resources.php>.
-  Hayma, Jelle. 2003. [Agrodok 31: The storage of tropical agricultural products](#). Agromisa Foundation, Wageningen.

## Materials Needed:

1. Posters: “Grain Storage Pests” and “Grain Storage Methods” Flip chart, magic markers and masking tape
2. 100 g samples of dry and not-dry maize (see Appendix A)
3. 20-40 kg of grain for experimenting (if the project doesn’t have budget for this, recruit a volunteer farmer who is willing to use his/her grain to test different storage methods)
4. Damaged grain
5. 20 liters of wood ash, sieve, buckets, dried neem tree leaves, rubber gloves, dust mask, grain storage insecticide, hermetic (PICS) bags, 3 jute sacks, 4 m of string for tying
6. Sheet metal for rat excluders (optional)

## Preparation:

1. Review all discussion questions and be prepared to guide the discussion appropriately
2. Repeat all demonstrations to be sure you can perform them effectively. Be sure to study the drying methods in Appendix A, and the storage methods in Appendix B so that you will be ready to lead these demonstrations.

## Learning Activities (Total time required: 4 hours)

### I. Introduction: (30 minutes)

#### A. Get Their Attention

1. Physically show some badly damaged grains

#### B. Discussion Questions:

1. What have you seen?
2. Have you seen something like this in your household?
3. What are the greatest causes of grain damage on your farm?
4. At what stage of the crop cycle does most grain loss occur? (*Their answer might be any time from planting to eating.*)
5. Show Poster: “Grain Storage Pests”
6. Which of these pests is most damaging in your household?



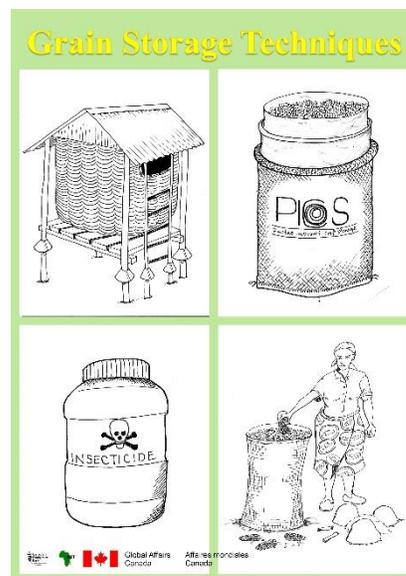
### II. Grain Storage Methods: (1 hour)

#### A. Demonstration: Importance of drying grain thoroughly

1. Pass samples of dry and not-dry maize grain for participants to compare
2. Question: How do you know whether your maize is dry enough for storage?
3. Demonstrate the thumbnail test for maize grain and the salt test for beans (Appendix A)
4. How can we tell if other kinds of grain are dry enough for storage?

#### B. Presentation and discussion of grain storage methods

1. What methods do you already use to prevent grain storage losses? *List their methods on the flip chart*
2. Use the poster to illustrate methods of improved grain storage. Describe each method in detail (see Appendix B).



3. Which methods of grain storage do you prefer to use on your farm? (*Help them select 3-4 methods which they want to experiment with*)

### **III. Experimenting with different grain storage methods: (2 hours)**

**A. Activity:** Practical demonstration of each of the methods they have chosen using a minimum of 5-10 kg for each. Include safety precautions for chemical grain storage.

1. Prepare all required materials ahead of time
2. Let participants prepare the grain using each method (see Appendix B for details)
3. If they choose to make rat excluders, hold the lesson at a farm with a grain store ready to be fitted with the rat excluders.

#### **B. Debriefing Questions**

1. Which method do you think is most effective and affordable? Why?
2. How and when will we measure the effectiveness of each method?
3. Which methods will you start trying at your household? Why?
4. What (materials) will you need to prepare for the method you have chosen?

### **IV. Concluding Discussion (30 minutes)**

1. Ask if they have any unanswered issues.
2. Challenge them to start preparations for effective grain storage at their individual households.
3. Make a plan for future training. This should include evaluation of the methods you used in the present lesson.

## **Appendix A: Methods of Testing Dryness of Grain for Storage**

**A. Maize thumbnail test:** When maize is drier than 12.5%, the kernels become dry enough that it is difficult to pierce the germ (the softer, light-colored area on one side of the tip) with your thumbnail. If your thumbnail can penetrate the germ, it is not yet dry enough for storage. Practice this technique with grain of different moisture content, and bring some kernels of each (dry and not yet dry) for the demonstration.

### **B. Salt Test (for legumes and millet)**

1. Place 160g of grain (200 ml) and 8g of dry salt (1/2 heaping teaspoon) in a 500 ml water bottle
2. Shake for about one-and-a-half minutes.
3. Leave this for 5-15 minutes to settle down. If the salt clings to the walls of the bottle the moisture content is above 15%

### **C. Maximum moisture for storage (Hayma, 2003)**

1. Safe moisture contents for various groups of products
  - a) maize, yellow 13.0
  - b) maize, white 13.5
  - c) rice paddy 14.0
  - d) sorghum 13.5
  - e) millet 15.0
  - f) wheat 13.5
  - g) legumes 15.0
  - h) lentil, pea 14.0
  - i) Oil crops 6- 8%
2. Safe moisture contents for seed storage:
  - a) cereals 10%
  - b) pulses 8%
  - c) vegetables 6%

## Appendix B: Detailed Procedures for Improved Methods of Grain Storage (details of each method and advantages and disadvantages of each method)

### A. PICS Bags:

1. **Remove inner polythene bags** and examine to be sure there are no holes.
2. **Place 5-10 kg grain in the inner bag**, then place inside the other bags.
3. **Continue filling** bags until finished.
4. **Squeeze the top of the inner bag to remove as much air as possible.** Tie tightly with string.
5. **Tie 2<sup>nd</sup> polythene bag in the same way.**
6. **Tie the outside bag.**
7. **The bags need to remain closed for 2-3 months** to suffocate all insects in the grain.
8. **After this period, the bags can be opened** to remove some grain, but they should be closed again immediately to prevent other insects entering the bag.
9. **Grain for seed will retain its germination viability** in hermetic storage, but it must be dried much drier than grain for eating.

### B. Wood ash:

1. **Sieve wood ash** to remove larger particles, stones, etc.
2. **Place equal volumes of grain and ash in 5 cm layers** in bag, finishing with ash on top.
3. **Rock the bag back and forth** to distribute the ash evenly, and tie the top.

### C. Botanical pesticides:

1. **Dry leaves or plant parts in shade** so sun doesn't destroy active chemicals in the plant.
2. **Crush to a powder.**
3. **Layer grain 5 cm deep in bag, then powdered leaves 1 cm deep.**
4. **Continue layering** until you finish the grain.
5. **Rock the bag back and forth** to distribute the leaf powder evenly, and tie the top.

### D. Pesticides:

1. **Consult the label** and calculate the proper amount of chemical for the grain you are treating.
2. **Use rubber gloves and dust mask** to protect your health.
3. **Mix chemical thoroughly with grain**, place in bag, and tie the top.

### E. Underground air tight pits:

1. **Dig a pit** in the ground inside a house.
2. **Line with polythene plastic**, overlapping different pieces by at least 20 cm. Cover the bottom, all sides and the top
3. **Cover with soil** on top of all.
4. **The insects will suffocate** after several months.

**F. Grain storage structure with rat excluders:**

1. **Cut sheet metal** in a circle with a 40 cm diameter
2. **Remove  $\frac{1}{4}$  of the circle**
3. **Mark a circle in the center** the same size as the pole on which the excluder will be mounted. **Cut slits from the center out to this line**, and fold the metal upward to form mounting tabs.
4. **Punch holes with a nail** on the 2 inside edges of the excluder.
5. **Mount on the pole** using nails in the center tabs, and wire to tie together the inside holes.

