

# household metal silos

key allies in FAO's fight against hunger



# household metal

## key allies

### Introduction

The household metal silo is a key post-harvest technology in the fight against hunger and for food security. It is a simple structure that allows grains to be kept for long periods and prevents attack from pests such as rodents, insects and birds. If the grains have been properly dried (<14 percent moisture in the case of cereals and <10 percent in the case of pulses and oilseeds) and the household metal silo is kept under cover, there are no problems of moisture condensation in its inside. Household metal silos generally hold between 100 and 3 000 kilos. A household metal silo with a capacity of 1 000 kilos can conserve the grain needed to feed a family of five for one year. A small or medium farmer with more than one silo can store surpluses for off-season sale when prices are more attractive, thus increasing household income.

Other institutions, such as Swiss Cooperation in Central America in the 1980s, have had positive experiences with household metal silos and FAO has successfully disseminated this technology in the last ten years in 16 countries in three continents through the Agricultural and Food Engineering Technologies Service (AGST) of its Rural Infrastructure and Agro-Industries Division (AGS).

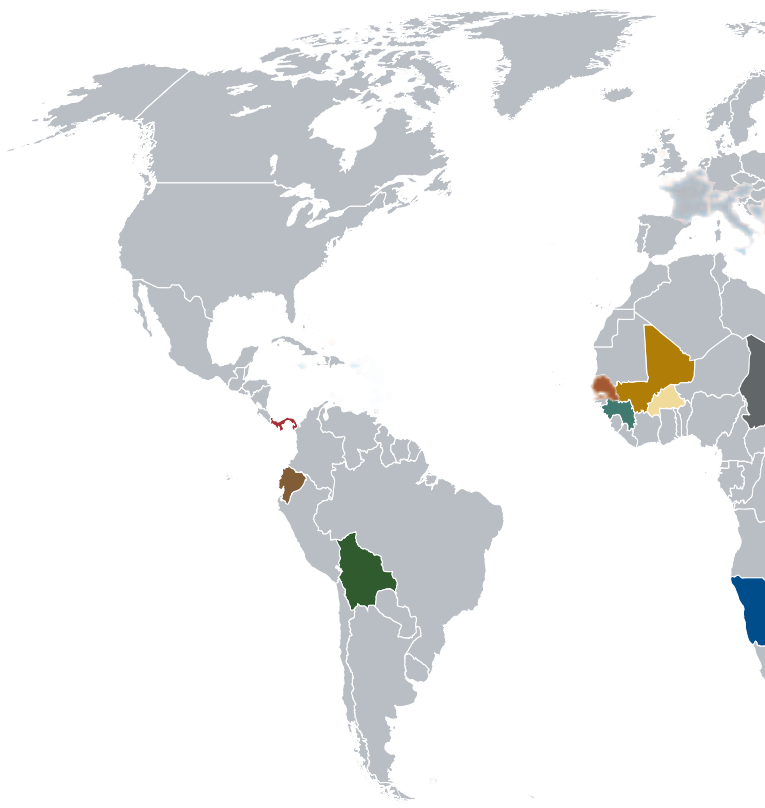
### Why the household metal silo is an effective ally for food security?

There are clear technical and socio-economic reasons why the metal silo is suitable for food security. As is known, the heaviest losses occur during the grain post-production phase, especially in developing countries and during storage. These losses are mainly due to the use of traditional storage structures that are inefficient for the storage and preservation of grain.

In the most serious cases, grain losses can reach 50 percent of initial stocks. Added to that are collateral losses during production, such as input losses, labour, opportunity costs and unfulfilled farmer expectations

and hopes. The concept of losses is obviously difficult to estimate, but in these circumstances the household metal silo is a valid option because it offers a series of advantages and benefits:

1. it maintains the quality of stored product;
2. it is airtight and permits effective non-residual fumigation;
3. it avoids the use of insecticides;
4. it requires little space and can be placed near the home;
5. it reduces losses to virtually nil;
6. it enables farmers to take advantage of fluctuating grain prices;
7. it prevents rodents and other pests that can harm consumer health;
8. it is easy to use, profitable and an effective tool against poverty;
9. it is inexpensive and can last for more than 15 years, if properly maintained;
10. it can hold from 100 to 3 000 kg;
11. it facilitates women's work;
12. it can be built in situ with local labour and easily available materials;
13. it is a form of decentralized storage;
14. it is a tried-and-tested technology in several countries.



# silos

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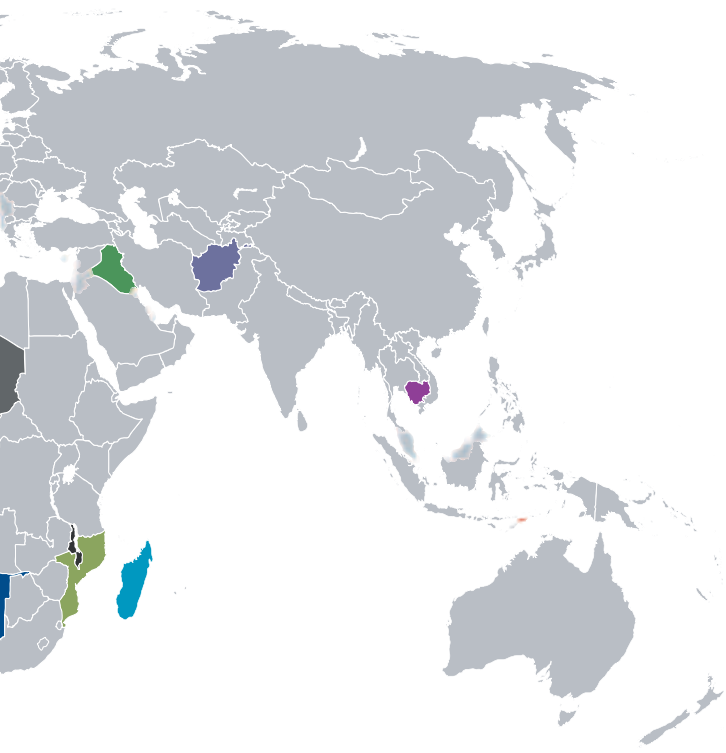


### Criteria that favour the use of the household metal silo among small and medium farmers

- efficiency;
- availability of construction materials;
- price;
- economic returns;
- user acceptance.

### Countries where FAO has introduced household metal silos through projects in the period 1997-2007

1. Afghanistan
2. Bolivia
3. Burkina Faso
4. Cambodia
5. Chad
6. Ecuador
7. Guinea
8. Iraq
9. Madagascar
10. Mali
11. Malawi
12. Mozambique
13. Namibia
14. Panama
15. Senegal
16. East Timor



Some 45 000 household metal silos were built in these countries to train craftsmen in their construction, use and handling and for delivery to beneficiary farmers. These silos can store about 38 000 tonnes of grain with an estimated value of US\$8 million. More than 1 500 professionals, technicians and craftsmen were trained in the construction, use and handling of household metal silos. That was the estimate at the conclusion of the projects, without considering each project's multiplier effect after implementation. Multiplier agents for silo technology include national institutions and NGOs and their staff.

FAO projects have helped the construction of various types of metal silo for household use. These projects have been financed by the governments themselves or by emergency projects supported by international donors, or have been implemented under FAO's Technical Cooperation Programme, among others. Many requests for the construction of these silos have been received through the TeleFood programme.

### FAO's experience with household metal silos in Bolivia

A socio-economic study carried out for an FAO post-harvest project in Bolivia identified the household metal silo as the most widely accepted of six post-harvest technologies analysed. A total of 96 percent of the 142 beneficiary farmer-users of these silos in four departments of Bolivia stated that the household metal silo improved food security, reduced post-harvest losses, maintained grain quality and safety, and thus safeguarded human health and nutrition. The same study also sought the opinion of groups associated with the project, including technology transfer institutions, market authorities, agricultural governmental and non-governmental organizations, and technicians and craftsmen working in this area; all agreed that the household metal silo had a positive impact on physical and market infrastructure and enhanced food security in the beneficiary communities. A summary of their commentaries and recommendations follows.



## Comments and recommendations of groups interviewed on the household metal silo

### Technology transfer institution:

1. theoretical and practical workshops, demonstrations and audio-visual discussions help transfer this technology;
2. total/partial credit and the “bartering” of voluntary work are appropriate strategies for acquiring a household metal silo;
3. subsidies are needed for training and the acquisition of household metal silos.

### Market authorities/institutions:

1. the organization of household metal silo users enhances socio-economic impact;
2. training on markets and information networks places the user in a stronger position on the domestic and international market;
3. users who kept their maize when the immediate post-harvest market price was US\$13/100 kg sold it four months later at US\$38/100 kg;
4. the household metal silo is also useful for cattle and poultry production, as it serves to keep feed grains and concentrates.

### Agricultural governmental and non-governmental organizations:

1. the household metal silo contributes to food security and higher farmer income;
2. the technology is sustainable, low-cost and adaptable to the national environment;
3. technology transfer institutions and technicians and craftsmen are the ideal targets for household metal silo training and dissemination;
4. technical assistance together with micro-credit and participatory research are useful to household metal silo beneficiaries;
5. seed for sowing stored in a household metal silo retains its colour and germination capacity better than seed kept in jute or plastic bags.

### Technicians and craftsmen:

1. commend and recognize FAO as pioneer organization in the introduction of the household metal silo;
2. report that NGOs have adopted these silos as frontline technology in their work programmes;
3. identify as major problems for post-harvest grains (in descending order): pest (insects, rodents, fungi and birds), lack of storage infrastructure, poor handling practices, inadequate marketing and dirt in the grain.

### Farmers on the price of the silo:

Most recommend not sparing expense in acquiring a household metal silo, as this will provide medium- and long-term benefits and contribute to household food security (Table 1).

## FAO's experience with household metal silos in Afghanistan

Two FAO technical assistance programme projects on agricultural production and post-production technologies were implemented to strengthen food security in 42 districts of seven vulnerable provinces of Afghanistan. The household metal silo was one of the technologies most widely disseminated. Most relevant facts:

1. 25 national professionals and technicians were trained as experts in the construction, use and handling of the household metal silo;
2. the national group of experts trained 61 tinsmiths and blacksmiths who in turn trained a further 300 national craftsmen;
3. some 25 000 silos with a storage capacity of 250 kg to 1 800 kg of grain were built in the seven beneficiary provinces;
4. technical staff from governmental and non-governmental organizations learnt the

TABLE 1

How the farmers interviewed in Bolivia consider the price of the household metal silo (%)

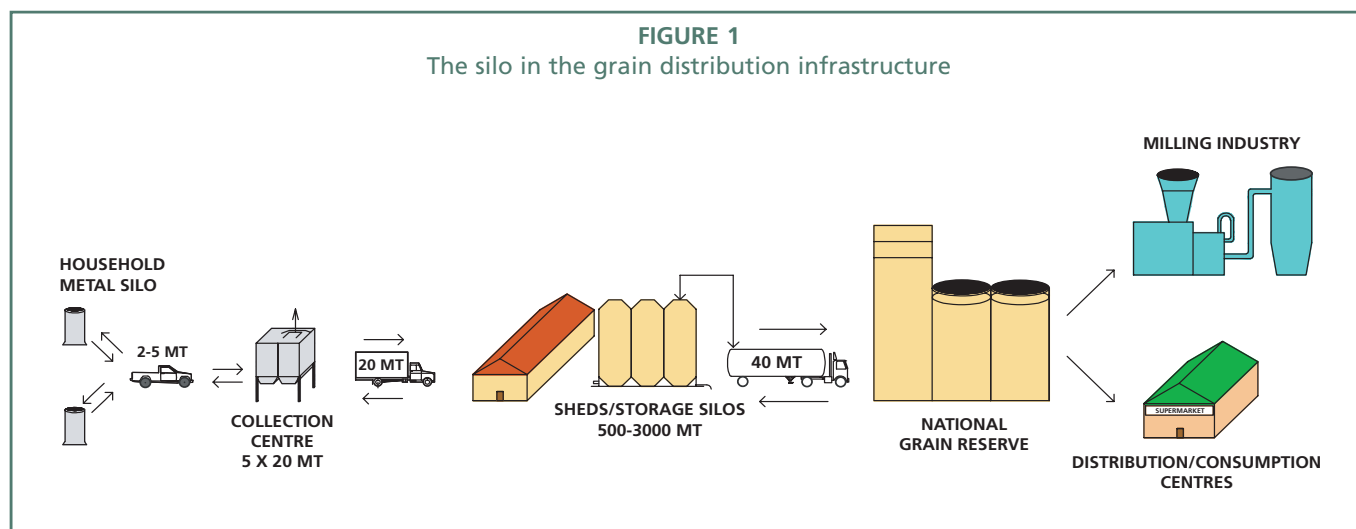
Cheap	59
Normal	17
Expensive	14
Quite expensive	8
No reply	2



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**FIGURE 1**  
The silo in the grain distribution infrastructure



Source: A.Mejía, 2008

technology and joined the project's national training programme for the household metal silo;

5. the beneficiary farmers identified the following comparative advantages of the metal silo over the traditional clay silos; the household metal silo is lighter and more manageable, it lasts longer and is immune to insect attack because airtight, so losses are virtually non-existent;
6. farmers who were not direct beneficiaries of the project chose to buy the building materials and paid craftsmen to build the household metal silo or bought it directly from them;
7. some 4 500 additional household metal silos were built by trained tinsmiths and/or blacksmiths and craftsmen, who set up their own silo manufacturing micro-enterprises on the strength of the training received from the projects.

there will be 100 tonnes left for other uses or sale. This sale can be to other consumers, local authorities or cooperatives who might store the grain in community storage centres. In this example, the community storage structures might be five 20 tonne units, which enable the grain to be stored before subsequent transportation to other centres with larger storage capacity, for example 500 to 3 000 tonne structures, generally located near towns. Next comes transfer to the national storage reserves which have larger storage capacity, for subsequent processing in industrial mills or transfer to other distribution or consumption centres. This dynamic grain distribution model operates from production area to area of major consumption, such as towns. The inverse process applies when there is dependence on imports, i.e. the flow is from the national reserves in towns to the deficit areas. In both cases the household metal silo is important for food security as indicated in Figure 1

### The household metal silo is an important element in the grain food security infrastructure

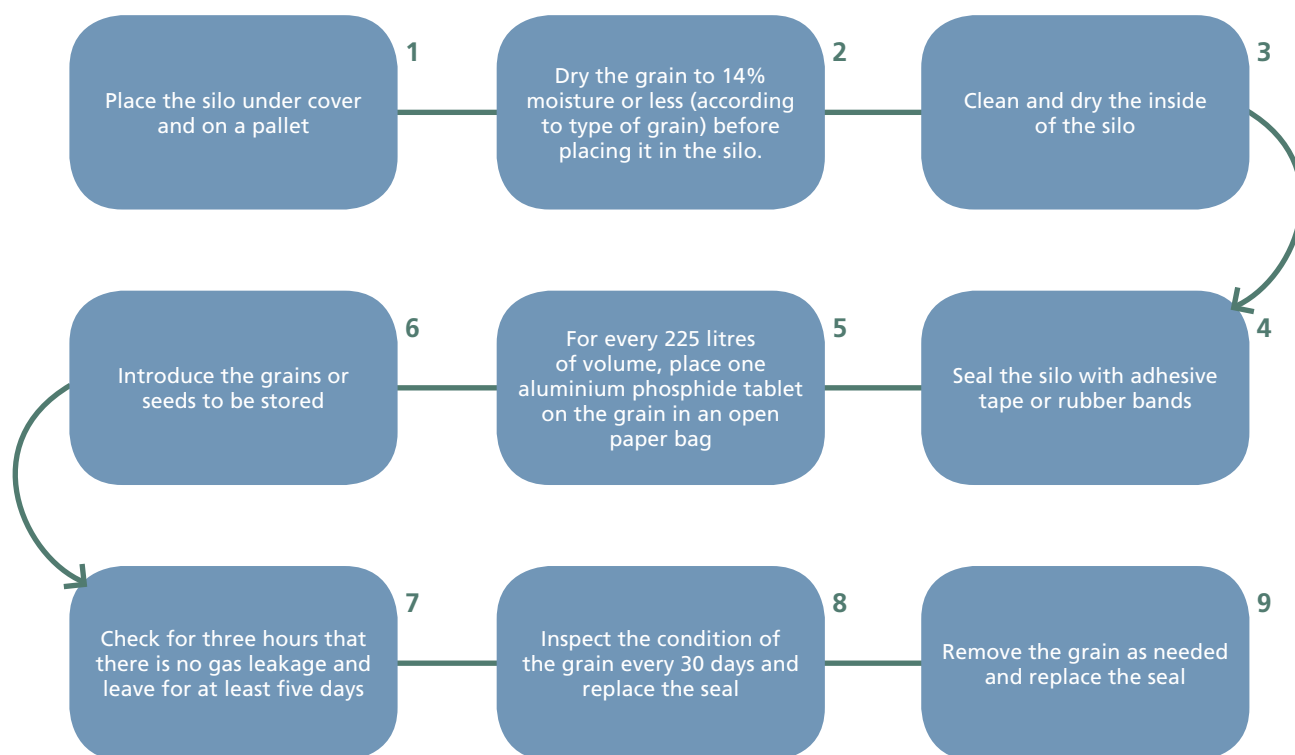
The household metal silo is a useful food security element in the grain production and distribution chain. For example, if we take an agricultural community of 1 000 persons, equivalent to some 200 families, and assume that each family consumes slightly more than 1 kg of grain per day, average consumption per family per year amounts to approximately half a tonne. If each family has a silo to keep 1 tonne of grain, then 200 families will have 200 tonnes of stored grain. If we subtract the 100 tonnes that are consumed annually,



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**FIGURE 2**  
Basic steps for appropriate silo use



### Cost of the household metal silo

The production costs indicated in Table 2 only include materials, labour and depreciation of equipment. They do not include utility, transportation of silo to destination and other costs. Although the costs presented here vary according to the circumstances in each country, the prices are generally affordable.

The projects implemented by FAO promote silo acquisition through revolving credit funds and payment in grain, among other strategies. The storage cost per kilo of grain falls as silo capacity increases. It is generally recommended to store seeds for sowing in small silos and grains for consumption in larger silos.

**TABLE 2**

Production cost and household metal silo capacity in selected countries with FAO projects (in US\$)

Country	120k	250k	500k	900k	1 800k
Afghanistan	-	28	70	-	92
Bolivia	20	35	60	-	-
Burkina Faso	26	29	42	56	70
Cambodia	12	20	30	-	50
Chad	-	66	97	128	187
Guinea	-	-	59	-	70
Madagascar	-	40	50	70	100
Malawi	-	22	45**	60***	-
Mozambique	20	34	54	75	-
Namibia	-	-	22*	-	-
Senegal	23	42	60	76	100

\* A silo of 400 kilos; \*\* a silo of 700 kilos; \*\*\* a silo of 1000 kilos.



### Basic requirements for the construction and successful adoption of the household metal silo

Agricultural technicians and trained craftsmen (tinsmiths and blacksmiths) are needed to disseminate knowledge about the construction, use and handling of silos in agricultural communities (Plate 1).

Building a silo requires galvanized sheeting of 100x200 cm and 0.5 mm thick (No 26) and simple tools for the job (Plate 2).

Grain to be stored should be dried before being placed in the silo to 14 percent or less moisture content, depending on the type of grain. Inadequate drying may result in total loss (Plate 3).

The silo with the grain should be placed in an area protected from sun and rain (Plate 4).

### FAO strategies to transfer the household metal silo technology

1. Through South-South cooperation and one-to-two week training workshops.
2. The first group to be trained usually comprises 15-20 post-harvest professionals and technicians from national agricultural institutions.
3. A second group to be trained is made up of farmers, craftsmen (tinsmiths and blacksmiths), and technicians from non-governmental organizations and other related institutions.
4. Household metal silos are promoted through demonstrations and publicity, which directly and indirectly creates a socio-economically important critical mass among stakeholders: farmers, technicians, craftsmen, traders, hauliers and consumers in general.

### Conclusions

1. By preventing post-harvest losses, the household metal silo becomes a very useful technology for food security, especially for small and medium farmers.
2. The household metal silo represents an important element in the grain distribution infrastructure.
3. In most countries where it has been introduced, the household metal silo has created a positive impact and critical mass among players directly or indirectly associated with the grain production and distribution chain.



**Plate 1**  
Technicians and craftsmen.



**Plate 2**  
Tools



**Plate 3**  
Dry the grain before storage



**Plate 4**  
Silo placed under cover





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This information sheet was prepared by the Agricultural and Food Engineering Technologies Service (AGST) of the Food and Agriculture Organization of the United Nations.

For more information please contact:

**Agricultural and Food Engineering Technologies Service**  
**Food and Agriculture Organization of the United Nations**  
Viale delle Terme di Caracalla  
00153 Rome (Italy)  
E-mail: [AGS-registry@fao.org](mailto:AGS-registry@fao.org)

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