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## Improving Local Grain Storage



Practical Notes Spate Irrigation

## Introduction

According to a local proverb the definition of a rich person is the one that has stored enough grains to last the year round. Another proverb adds that if one who has enough grains in the house then even his foolishness is taken as intelligence. Grain storage is highly important for food security – local and national.

This note discusses the scope for improved local grain storage in spate irrigated areas. Unlike the canal irrigated areas, large scale warehouses are unusual in spate irrigated areas. PASCO and the provincial food department procure, transport and store wheat in the country – but as such mainly operate in the canal irrigated areas of Pakistan. In Pakistan total wheat storage capacity in public sector is about 5.2 million tons. In addition there is capacity to store 1.3 million tons of wheat in the private sector, usually by large companies.

The above figures do not include local storage by farm households and local traders. In spate irrigation areas local storage is most important and serves both local subsistence, trade as well as the conservation of seeds for the next season. Spate irrigation areas are characterized by coarse seed crops such as pulses, oil seeds, sorghum and millet. It is relatively easier to store such coarse seeds having hard coat as compared to wheat. Nevertheless losses are

substantial and are estimated between 6-20%. There is considerable scope for gains on this front. According to the Prime Minister's Committee on Agricultural Storage for instance, only 30% commodities have cover storage facility in the country.

## Traditional storage practices

For centuries people have used different methods to store grains - depending on local economic and climatic factors. Grain storage occurs in different stages in spate irrigation areas - at field level when shoots are cut and dried before threshing and at field level when grains are kept for several days during threshing season before being taken to farmer's compounds. At every stage care is taken to protect grains against damage. Grain is affected by moisture level, especially at early stage of harvest, aeration process, sunlight, temperature, microorganisms and various diseases and pest attacks. Women play an important role in grain storage everywhere and they are familiar with different stages and steps of storage process.

There are several traditional methods of local storage. A first common method is to build mud/clay jars - prepared a little above ground to avoid contact with the soil and thus preventing moisture and access by pests, insects and



Figure 1. PASCO storage site at field level. Pakistan, 2010

rodents. Moreover, the clearance from the earth allows aeration and cross ventilation in order to maintain a suitable temperature inside the jar. To strengthen the walls of the clay jar mud is mixed with fine wheat straw and occasionally ropes and threads of palm or similar plant are used for further reinforcement.

The second method is to store grains in a mat container made out of dwarf palm leaves or date palm leaves. Several mats are sewn together to form a round jar 1.5 meters in height and 5-6 meters in circumference. The height is kept in view of accessing the lid of jar using a bed (charpai) as stairs. The size of jar depends upon the amount of grains and is made accordingly. The mats have the quality of providing aeration to some extent and are of organic materials which help to minimize the effects of high and low temperature. Care is also taken to keep domestic animals away from the storage. Grains are dried and cleaned before storage as extra moisture may attract a pest attack. Moreover, separate jars are made for each crop. Before placing grains in the jar a straw layer of few inches is placed underneath and direct contact with bottom of the jar is avoided. In case of a mat jar more straw is used and base is made of wooden beam structure and then the mat is placed over it. The clearance in that case is at least one foot above ground. This is

called *Binda* and *Bindi*.

In some cases grains are stored in heap of wheat straw without an inside structure made from local available thatches and reeds. In such cases the heap of wheat straw is pressed on the ground and a bowl shaped depression is made in the centre of this heap and grains are kept inside and then covered by heavy layers of straw. This is basically for larger amounts of grains than household level. Farmers believe that in this way



Figure 2. Clay made grain storage

#### Box 1: Survey on grain storage in DI Khan

##### Results of survey

- Almost all the stores were affected by varying degree of infestation by insects like *Trogoderma sp.*, *Sitotroga sp.*, *Tribolium sp.* and *Zoophiles specie.*
- Damages were 7 % at an average, but in 10 % of the storages losses were recorded between 10 to 20 %.
- At an average there is 5 % (by weight) foreign materials in the grain stores, i.e. weed seeds, clods and straw.
- 90% of the farmers used to store grain in rooms meant for multipurpose (living room, straw store, house hold store, animal room): all these rooms are highly humid - making the management process difficult.
- Mixed type of old receptacles i.e. polythene bags, gunny bags, binda (large polythene bag), bolarh (earthen bin), etc are using for years without disinfecting.
- Receptacles were not closed tightly to resist the insect access to grains.
- No use of pesticides due to high cost, non-availability and difficulty in application.

##### Experiments

- Use of small polyethylene bags (50 kg capacity) for storage does not reduce storage loss, because of thin coats.
- Binda (large size bags with capacity of 2000 kg) placed on bricks or traditional plate form of straw proved significantly better - reducing the losses to 0.25 %.
- Fumigation of grains in the same binda (once in July) gave best results.
- Binda cost (USD 10) is an obstacle however.
- Proper resealing after examining or drawing of grains each time reduces loss to almost nil.

Source: VEER 2003

pest attack is minimized. This system is called 'pulla'.

Grains are also stored in the ground by digging a circular ditch. Special care is taken while selecting the site to avoid flooding, seepage or collapse of soil and quality of soil such as access of salts etc. to avoid any possible contact and reaction with grains. Usually this is practiced in more arid areas and desert region and is called 'khurram'.

In general special care is taken with respect to the timing of storage. Humidity in the air is avoided and sun light is preferred during the storage

operation. Additional coverage is provided by cloths and plastic sheet during rains and storms. It is made sure that no drainage water drainage passes near the storage site. The storage site is detached all around. In areas of high velocity winds additional support of beams or stones are provided. Even storage facilities are affected by humidity and losses are common. The most prevalent infestations by insects are *Trogoderma sp.*, *Sitotroga sp.*, *Tribolium sp.* and *Zoophiles specie.*



Figure 3. Pulla - local grain storage made of reeds and thatches. Grains are stored by cover of wheat straw, DG Khan, Pakistan



Figure 4. Metal Bins used at household level and found useful, Pakistan 2010

#### Box 2: Special methods

Owners keep leaves of certain plants having an aroma not liked by insects and pest such as tobacco, leaves of neems or wild mellons. Chemical tablets have also been in use. since last two decades and introduced by business organizations. Special measures are taken against rodents by applying crushed glass to mud plaster so that mouse and other rodents are not able to dig and enter the storage site.

Some farmers store grains in the natural shoots cut at time of harvest. According to local knowledge this natural packing of grain is the "stone boundary against any pest or insect attack". Usually this practiced is used for crops of high value but small quantity. The only danger is the direct attack by a rodent or similar creature. However, farmers store these shoots in oven fired jars or containers and seal it and sometimes with woollen bags are used and are hang them from roofs inside the houses room to avoid such attack. This special method of grain storage is attributed to Joseph's story from Egypt/ Palestine during Old Testament era. When Joseph predicted that a seven year long famine would occur and requested people to store grains, he advised the people to keep the grains inside shoots.



## Recommendations

Improved local storage can serve several purposes (1) protection from high temperature and temperature changes, which can be done by using a roof and insulating material; (2) controlling moisture, which can be done by placing the storage on a dry underfloor, platform, or moisture barrier or by suspending the material; (3) protecting against insects, which may be done by using airtight containers, by smoking and preservatives (many local plants have this function) or insecticides (requiring utmost care in handling); (4) protecting against rodents, which requires securely closing the storage or using rat baffles; (5) protection from domestic animals for instance by fencing off the storage and (6) protection against thieves by locking inflows and

outflows to the storage. By bringing grain losses back to 1% improved local storage facilities are a very useful investment.

In recent years several improved methods for local grain storage are introduced - see table 1. These include the use of plastic sheets to avoid external moisture and humidity and the use of simple household fans for cleaning and drying the grains and seeds to be stored. Iron bins on small stands (for ground clearance) using a small window and top lid to fill and take out grains have also become more common. The main feature to distinguish these metal bins from traditional bins is that they are air tight and block outside humidity. The metal also serves to increase temperature and in various cases this has been found beneficial to minimize pest growth.



Figure 5. Cleaning grains before storing

Table 1. Storage techniques

Storage	Typical capacity	Improvements
Baskets	0.025 - 2.0 ton	Plastering with mud; lining with plastic bags; drying commodities; commodities before entering
Underground storage	0.5 - 0.7 ton	Roofing; pit lining (plastic, ferro-cement)
Polyethelene bags	0.3 - 2 ton	Commodities entered after drying; proper closing; care with rapturing or puncturing
Jute bags	0.1 ton	Careful stacking to allow ventilation; avoid contact with moisture (use pallet); cleaning of used bags
Mud storages		Waterproofing outerwalls with cement, mortar or painting/ coating
Brick and cement silo	2 - 6 ton	Multi-celled structures, use of ferrocement
Iron sillos/bin	0.5 - 3 ton	Plastic sheet insulation, rain and sun protection

Based on Hayma (2003)

Box 3: Improved mud storages

Another innovation introduced in the spate irrigated areas are improved mud storages. These earthen containers of 150 by 90 by 120 cm, containing 1200 kg of grain, are placed free from the walls and floors, containing an opening closed with a wooden plug to take out the grains. Similarly are large polyethylene bags (binda), containing 2000 kg of grain, placed on elevated platform and tightly closed with plastic sheet on top. Before entering the storage grain is cleaned and in case the grain is still affected it is treated by fumigation.

Local organizations, including NGOs, can play an important role in promoting improved local grain storage facilities. Micro credit schemes should be widened so as to also cover the purchase of metal bins or the construction costs of improved earthen storage facilities. Improved local storage facilities present large opportunities for increased local food security and increased farm returns and can be achieved at very reasonable cost.

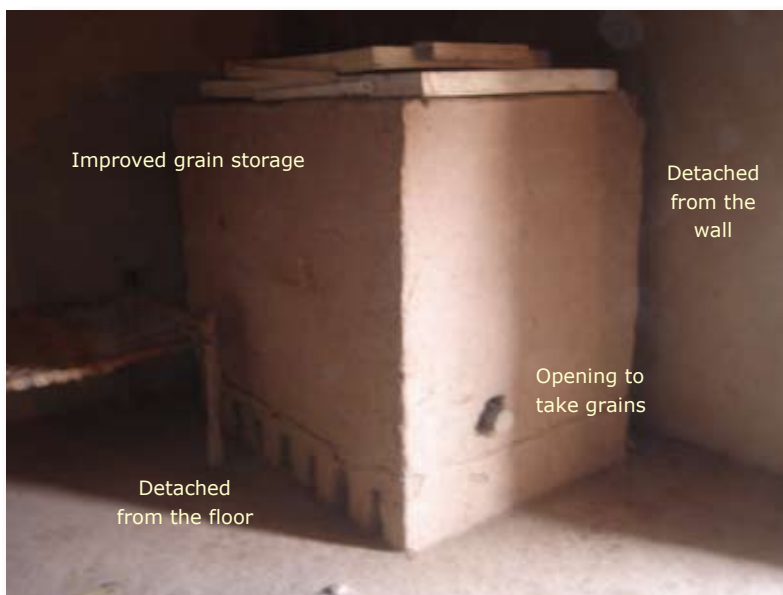


Figure 6. Improved earthen storage



Figure 7. Special opening to take grains from storage

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The Pakistan Spate Irrigation Network supports and promotes appropriate programmes and policies in spate irrigation, exchanges information on the improvement of livelihoods through a range of interventions, assists in educational development and supports in the implementation and start-up of projects in Spate irrigation. For more information: [www.spate-irrigation.org](http://www.spate-irrigation.org).

