

Grain storage – Temporary storage of grain, basic design principles

Authors: Troy Jensen, and Ken Bullen, DPI&F, Plant Science, Toowoomba, and Alan Andrews, Customvac Australia Pty Ltd

Options for temporary storage

Temporary grain storage may be necessary during unusually large harvests when available on-farm and off-farm storage capacities are likely to be exceeded. The major advantage of temporary storage is that capital costs are much lower than for permanent storages. On the other hand, labour requirements and handling costs are higher.

Options for temporary storage include:

1. Pad storage (ground dump with a cover)



Pad storages or bunkers are ground dumps covered with protective sheeting and, usually, formed on a ground sheet.

Information contained in this publication is provided as general advice only. For application to specific circumstances, professional advice should be sought. The Department of Primary Industries and Fisheries has taken all reasonable steps to ensure the information in this publication is accurate at the time of publication. Readers should ensure that they make appropriate enquiries to determine whether new information is available on the particular subject matter.

Note No: Note number
ISSN 0155 – 3054
Created: Month and Year
Revised: Month and Year
Replaces Note No: Replaces Note no. - if not replacing, delete
No of pages Insert number of pages in numerals

©The State of Queensland Department of Primary Industries and Fisheries 2005

Produced by: Business Group Name

Site requirements are similar to those for a ground dump. A floor slope of at least 1 in 200 towards the open end is necessary for drainage. The floor must be smooth and hard packed.

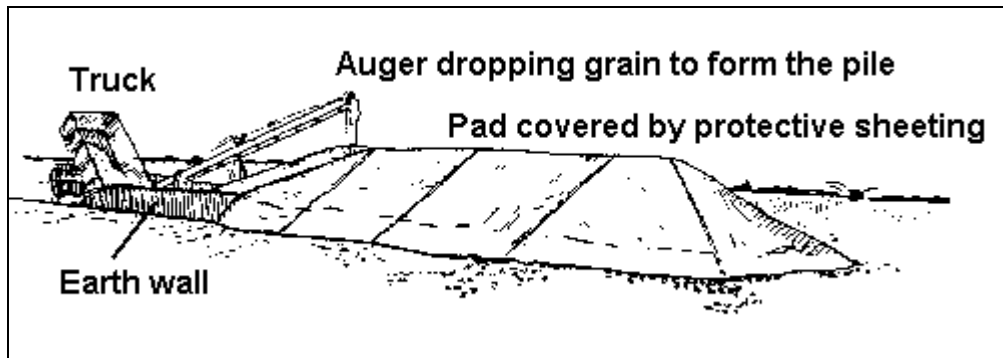


Fig 1. Adding grain to partly completed pad storage

Earth walls

A typical pad storage (Figure 1) has three low earth retaining walls arranged in a U-shape around the outer edge of the pad site. One end is open for access when filling or emptying

Earth walls around the pad can be formed using soil from the immediately adjacent surface outside the pad perimeter. This creates a drainage area around the pad which is essential to divert run-off from the plastic covers. The soil should be compacted during formation of the walls. The walls are typically about 0.5 metres high and 1.5 metres wide at the base with a 45° side slope. Walls higher than 0.5 metres are difficult to construct using simple earthmoving machinery.

Lining and cover sheets

The top cover sheet can be woven polyethylene, coated woven PVA, or PVC coated polyester. The sheet should be gas-tight to allow fumigation, and resist water penetration, puncturing and UV breakdown. Woven polyethylene is cheaper, lighter and more easily handled, and will last for several seasons if handled carefully, but may not be as long lasting as PVC covers.

A waterproof plastic lining laid across the floor and walls of the pad prevents moisture entering from below and grain contamination by soil. The sheets of plastic should be progressively unrolled as the auger is moved to avoid damage by the auger wheels, and new sheets lapped over the sheet already in place.

Cover sheets that are folded and rolled as shown in Figure 2 are easiest to place. The bundle is rolled from one side to the other across the top of the stack. One end of the cover can be pulled back to cover the end of the stack and the rest unfolded as necessary. The bunker should be covered progressively as it is filled to avoid problems caused by sudden storms. The leading edge of the top cover should be unrolled over the exposed grain face at night. to simplify placement on the grain pile

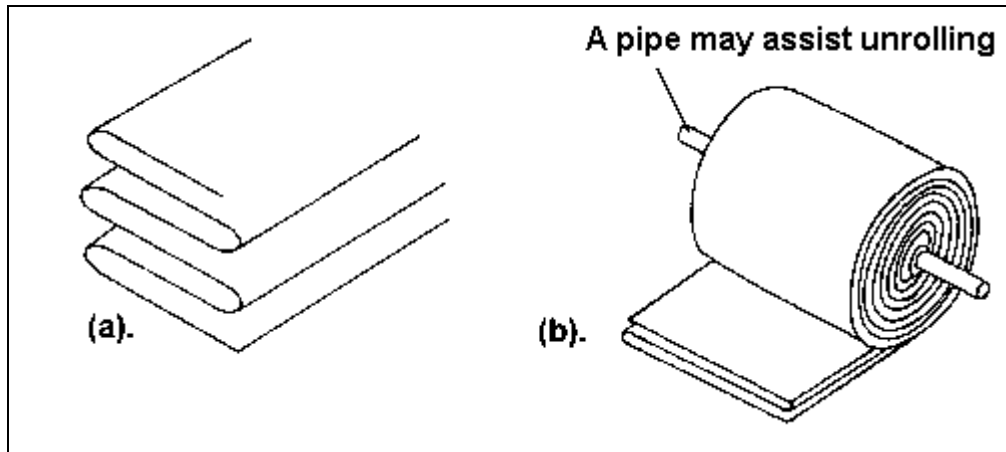


Figure 2 Covers are firstly folded concertina fashion (a), then rolled (b)

A pad should be aligned so that the closed end faces into the prevailing wind, if possible. This will reduce problems in handling the cover sheets when covering the stack. Do not attempt to handle large covers in windy conditions. Always ballast the leading edge of the cover during loading and unloading.

Pads are best covered with a single piece, prefabricated top cover if possible. Joining methods for use on-farm are both difficult and tedious. Seek advice from the supplier of your sheeting if you need to join sheets.

The top and bottom sheets must be sealed to exclude insects, rodents and water. Well sealed pads allow effective fumigation to control grain insects. One simple method of sealing is to bury the floor liner and top cover sheet in a previously dug trench about 250mm deep at the base of the earth walls (Figure 3). Once buried the remaining edge of the sheets should be folded back over the soil backfill to minimise erosion of the backfill.

It is advisable to ballast or tie down the top sheet to prevent damage due to billowing and flapping in the wind. Avoid using objects with sharp projections that could puncture the cover. Place wear patches under ropes or ballast objects to minimise abrasion due to wind movement.

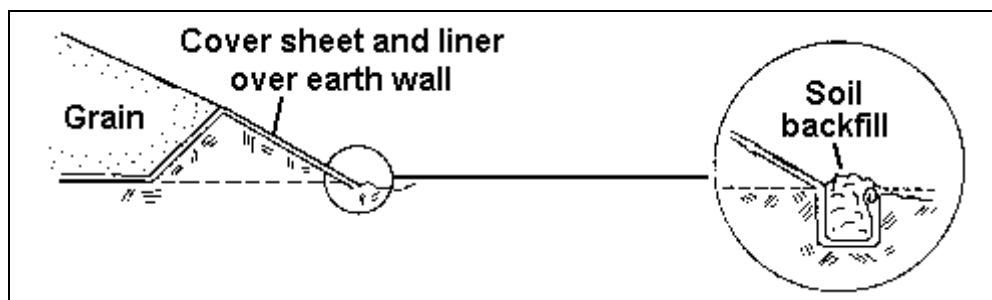


Figure 3 The cover sheet and liner can be sealed by burying together in a trench beside the pad

Suppliers of cover sheets are listed under “Canvas & synthetic fabric products” in the yellow pages. Some larger suppliers based in Toowoomba with experience in pad covers are:

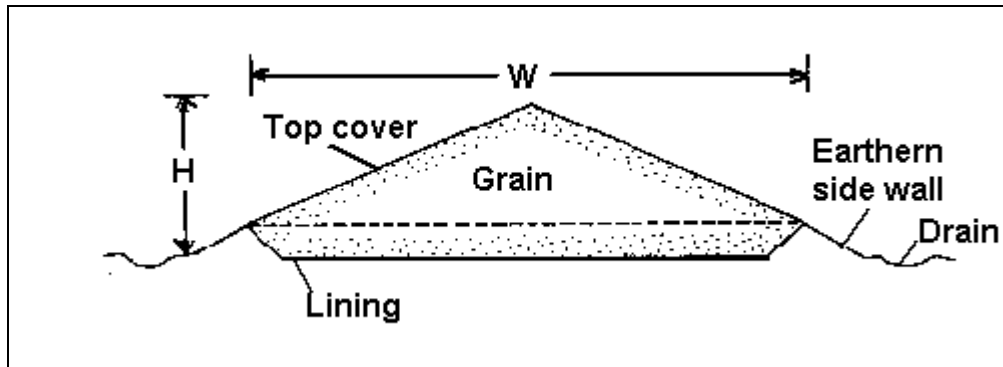


Fig. 4. Cross section of a pad (not to scale)

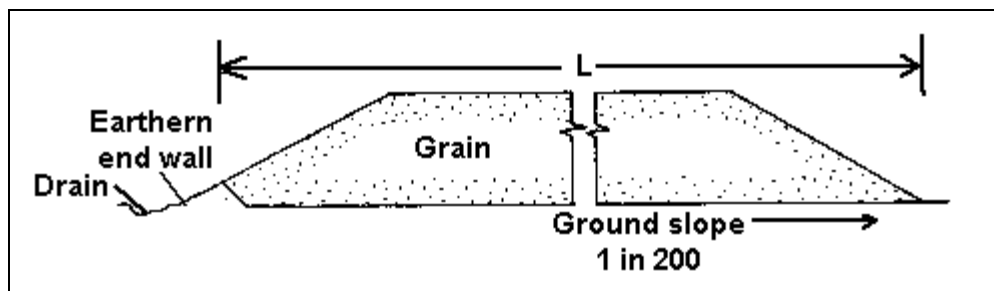


Fig. 5: Longitudinal section of pad storage (not to scale)

Fumigating pad storage

If a pad storage is to be fumigated for insect control, this should be done soon after the last grain is added and the end sealed. Phosphine is the most commonly used fumigant to treat pad storages. Phosphine can be applied from a gas cylinder (Phosfume® available from BOC Gases or through Graincorp) through small holes cut in the cover sheet. A licence is needed to use the gas, and Graincorp has licensed applicators. Alternatively blanket formulations, containing material similar to phosphine-generating tablets, can be pushed through slits cut in the cover sheet using a long rod to spread the blanket on the grain surface. The holes in the cover sheet must be sealed with waterproof adhesive tape after application.

2. Ground dump without a cover

Seldom used in Northern grain region due to weather concerns. An uncovered pile of grain is the cheapest form of temporary grain storage. However, the risk of damage by water, insects, animals and moulds is greater than for other storage types. Grain should be moved from the dump as quickly as possible to minimise damage.

The dump site should be higher than the surrounding area, well drained, well above the water table, and should be formed with a slight slope away from the centre of the site to prevent water damage at the base of the grain pile. Water must be able to drain away freely from the base of the pile.

The grain pile is formed as for a pad – see 'Loading and emptying the pad' (below). For small amounts of grain, a simple conical heap can be formed. If a larger storage is needed, a long heap can be made. A smooth, peaked grain surface without hills and troughs tends to shed water. Any hollows in the grain surface made during formation of the pile or by livestock, birds or animals can trap rainwater, so the surface should be hand trimmed. The dump should be fenced to keep livestock out.

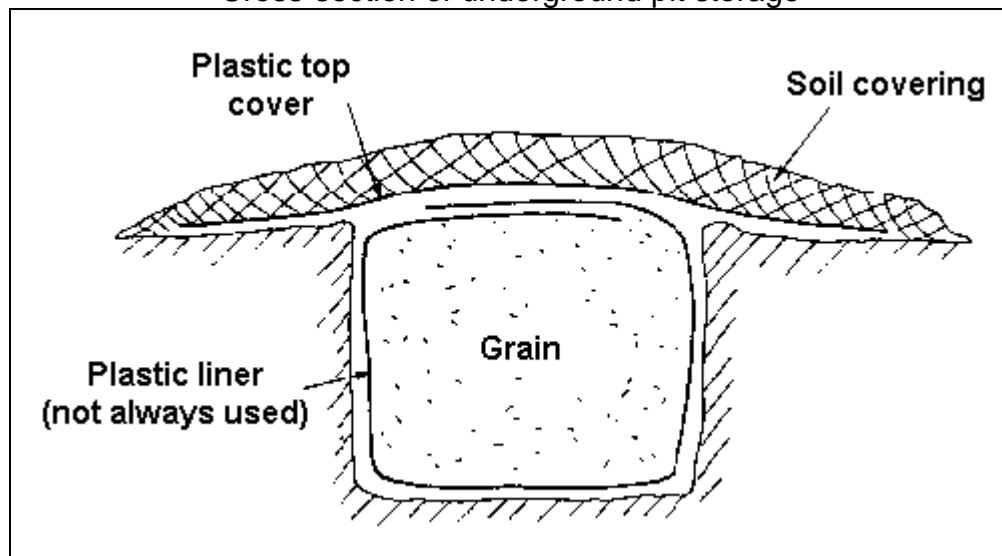
3. Mesh (bull-ring")silos

We have been unable to source either current information or steel mesh product recommendations for this type of temporary grain storage. Our advice is that manufacturers of steel mesh no longer recommend this form of grain storage *due to safety concerns*.



4. Underground pit storage

Cross-section of underground pit storage



Underground pits are an effective, low-cost method of long-term grain storage especially for feed grain storage. Their most common use is for storing drought feed reserves on farms. Feed grain has been recovered in good condition after more than 10 years. The main drawback of underground storage is the difficulty of removing grain. The method is successful only if careful precautions are taken. Grain moisture content must be less than 12% to keep the risk of spoilage low.

Locate the pit on a well-drained site above the water table, with the immediate surrounds graded to prevent rainfall run-off collecting in the pit area. Water seepage through the side walls of the pit is a major concern. Keep pits at least 10 metres apart to prevent seepage from an empty pit to a full one.

The pit should not be more than three metres wide. This allows the covering soil to be placed and removed by a front-end loader without having to drive over the top of the grain. The depth will be determined by the unloading facilities. Match pit capacity to available silo and truck capacity so that the pit can be completely emptied once it is opened.

Filling can be done either by driving into the pit, or using an auger from the side. Be sure not to drive too close to the edges of the pit. Keep heavy machinery, such as trucks and tractors, away from the pit edge by a distance at least equal to the depth of the pit.

A pit may be unlined if the floor and walls can be made firm and clean. Plastic lining is often used and this should be laid at the starting end just before loading begins. The lining can be unrolled as filling progresses. Fill the pit until the grain forms a slight ridge along the centre.

After filling a pit, the grain should be covered with plastic sheeting and soil. A layer of soil about 0.5 metres thick will provide good protection. An initial layer of sand will prevent rocks or hard clods from damaging the top cover. The soil should be shaped to aid run-off. Mark the location of the pit with a peg at each corner.

To unload the pit, it is necessary to be able to remove all the covering soil without contaminating the grain. This can be difficult and is the reason for using narrow pits. Always unload the entire contents once the pit is open, otherwise losses due to drainage problems are likely. Pneumatic conveyors are ideal for emptying pit storages, and allow much easier final clean-up of grain than other methods. Mobile augers or belt conveyors with fixed and guarded cross-sweeps, or a front-end loader can be used to empty the pit.

A well-constructed pit storage is air-tight and oxygen levels gradually reduce over time. The low oxygen levels prevent development of damaging numbers of grain insects. If in doubt about the gas-tightness of the pit, grain protectants can be applied to the grain when it is placed in storage.

Insect and mould control in temporary storages

Insects and moulds are potential problems in temporary storages. Mould problems can be avoided by not placing cereal grains above 12% moisture into temporary storage.

Grain going into temporary storage will have been infested by stored grain pest insects from harvesting and handling equipment and by insects flying over the area. If you have cleaned your equipment before harvest and there are no sources of stored grain pest insects on your farm or surrounding farms, the number of insects entering the grain will be low and you should be able to store the grain for at least three months without major insect problems. If the equipment was not cleaned or there are possible sources of stored grain pest insects within a kilometre or two, the safe storage period before major insect problems develop can be less than six weeks.

If you are likely to be storing the grain for longer than the safe storage period, the grain should be sprayed with an insecticide as it goes into the storage, or pad storages can be fumigated. For current recommended protectant insecticides, see DPI&F Note, 'Grain Storage – Insect Control in Stored Grain', available at <http://www2.dpi.qld.gov.au/fieldcrops/3947.html> (**Check New Web address**). However, some markets will not accept grain that has been

sprayed with insecticides. Disposing of the grain within the safe storage period will avoid potential insect problems.

Dichlorvos will kill all insects present at the time of spraying, but will not provide residual protection. If you expect to hold the grain for more than a few months, you could use residual protectant insecticides. Residual protectants and dichlorvos can be mixed and applied in the same operation.

Text section heading

Sub section heading

Sub sub heading

Text goes here

Further information

If you require further information,

DPI&F website www.dpi.qld.gov.au

DPI&F Call Centre open from 8.00am to 6.00pm Monday to Friday (telephone 13 25 23 for the cost of a local call within Queensland; interstate callers 07 3404 6999) or email callweb@dpi.qld.gov.au ■