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Department of Agriculture
New South Wales

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Grain storage—underground pits

Agfact E3.8, first edition 1986
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In years of high grain production long-term storage of grain as drought insurance is an attractive proposition.

A very low cost and successful method is to store the grain in underground pits. In Australia oats have been stored underground for ten years, and in Egypt wheat has reportedly lasted in underground pits for thousands of years!

However, you must use the correct techniques as outlined in this Agfact for successful storage.

WHAT TO STORE

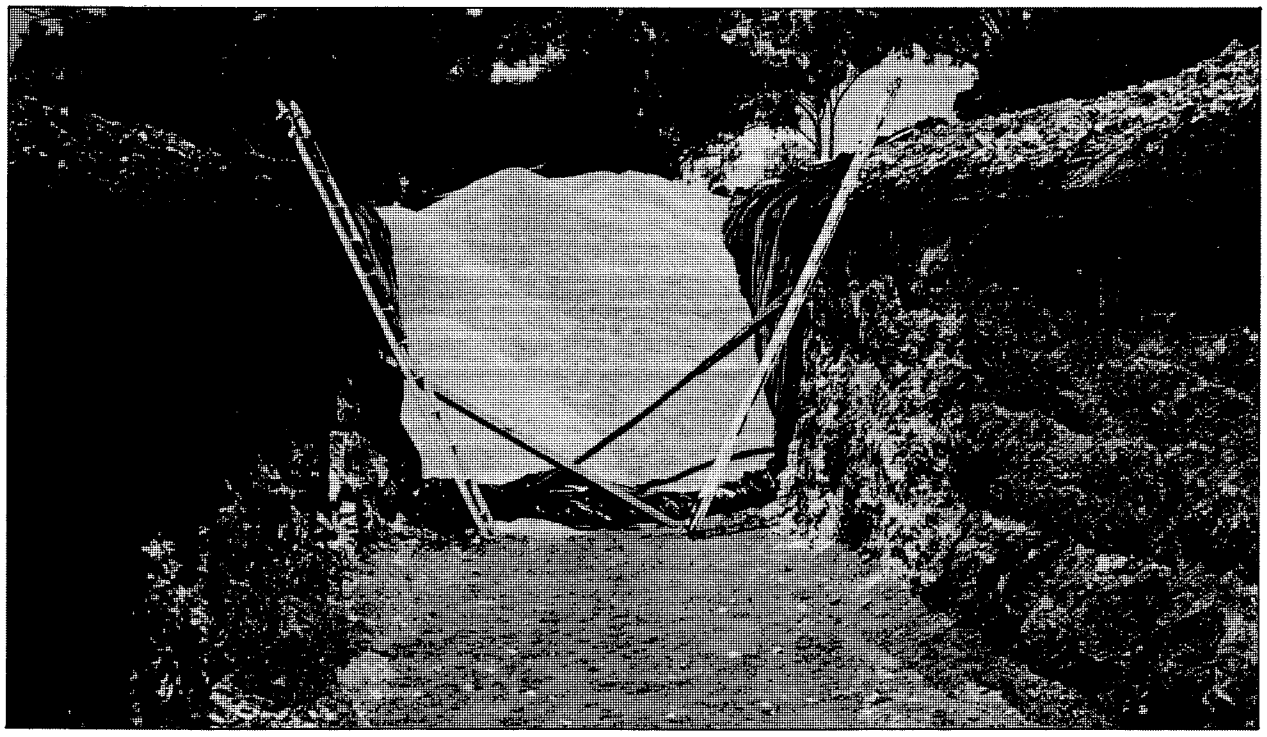
Small grains such as wheat and oats can be safely stored if the grain moisture content is below 12 per cent. Storing grain that is too wet will affect its germination and lead to general deterioration. For this reason the storage of seed grain in underground pits is unwise unless it is particularly dry (below about 10 per cent moisture).

LOCATION

The pit should be located on a *well drained site*. The side of a hill with pit access at the lower end is ideal, but a relatively flat elevated site can be equally successful. The area surrounding the pit should be graded to prevent any surface runoff water collecting in the pit area.

Soils with poor infiltration rates are preferred because a major consideration is the prevention of side infiltration by water. If the pit is not lined with plastic extra care must be taken with pit drainage. If a number of pits are planned keep them 10m apart—this will reduce any moisture seepage from an empty pit to a full pit.

A partly filled pit near Orange.



SIZE

To allow easy removal of soil when emptying the pit should not be more than three metres wide. This will allow a front-end loader or rear mounted grader to be used to remove soil from the top cover when emptying the pit without driving onto the grain. Two metres is a typical depth for pits, but this is not critical—provided of course that you consider the facilities that are available for emptying.

Pits are always an uneven shape, often with a sloping entrance. The approximate capacity can be calculated using the following formula:

Length (m) × width (m) × depth (m) × 27.5 = bushels in pit.

Pit capacity should match you silos. This means that when the pit is opened all the grain can be quickly transferred to the silos. This is preferred because grain in an open and partially filled pit will be damaged if the weather breaks.

Do not forget to consider at this stage how you will remove the grain. Consider your auger size and the availability and accessibility of equipment. Putting the grain in is easy. Removing it can be difficult!

CONSTRUCTION

If you plan to fill the pit from above, rather than reversing the truck or bin into the pit, consider carefully the safety aspect. A heavy truck can cause the side wall to collapse, with serious results. Ensure that a long auger is used and that the truck is kept away from the pit edge by a distance at least equal to the pit depth.

Excavating the pit should not be left until harvest time, when the pressure of work could result in a rushed job. Carry out this work early and use the soil if necessary to provide banks to divert any surface runoff.

The pit sides and base should be as smooth and firm as possible. This will reduce contamination of the grain by soil. Any jagged rocks that will puncture the plastic seal should also be removed.

If the pit is on fairly level ground it should be made with a gradual slope in at one end to facilitate filling and emptying. A slight outwards slope on the walls is preferred as this will help to prevent caving-in.

FILLING

Plastic lining should be laid at the starting end of the pit and along the sides and base just before the first load of grain is tipped. Unroll the floor and side sheets a few metres ahead of the grain as filling progresses.

Where possible the initial loads of grain should be tipped by reversing into the pit. The upper layers are then filled by auger from above, taking care not to drive too close to the pit and collapse the edge.

Fill the pit until the grain peaks slightly along the centre. The grain will not settle and the peak will assist drainage.

In some situations you may choose not to use floor or wall linings. In this case you can dump the grain direct into your clean, well formed pit.

PEST CONTROL

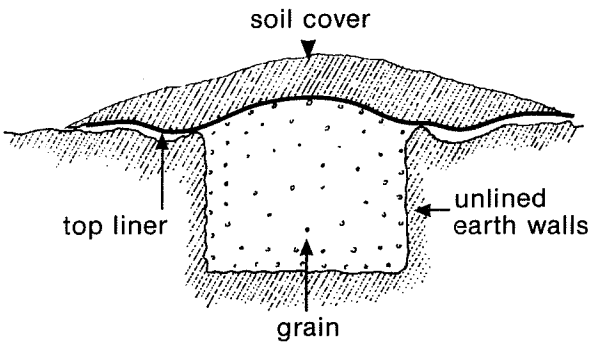
If the pit is well sealed, infestation or damage by grain insects is unlikely because any insects in the stored grain die as oxygen is used up. However, if you think that some protection is desirable use recommended fumigants as considered necessary. Remember also that insecticides could be applied during filling.

SEALING

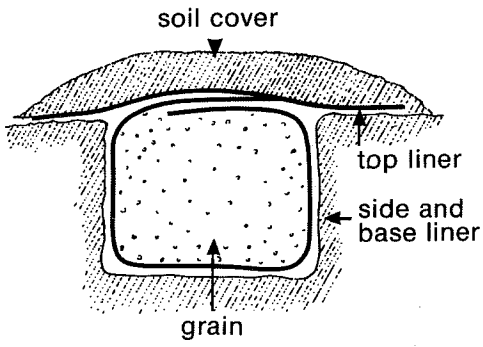
Sealing is extremely important. Any water infiltration can result in costly losses. 200 micron heavy duty plastic sheeting should be used.

A total seal with maximum security will be obtained by lining the sides and base as well as the top. However, depending on the soil type and the location many farmers have found it possible to use just a top sheet. In this case the sheet must extend at least a metre beyond the pit sides to prevent any moisture infiltrating through the side walls. Another option is to use wall and top covers without a base lining.

Underground grain storage with top sheet and soil cover.



Underground grain storage with side, base and top sheets and soil cover.



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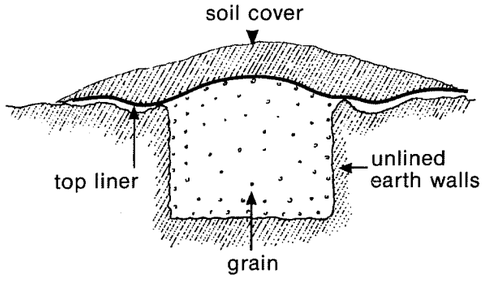

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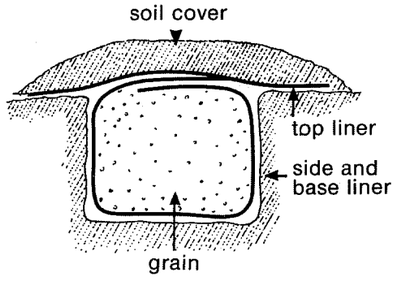

To assist drainage, grain should be heaped up slightly along the centre of the pit and the plastic laid as in the diagrams. A soil layer of at least 500 mm is then placed over the plastic to prevent any damage by vermin. Fine soil that is free of rocks must be used for the initial covering to avoid puncturing the plastic. A thin layer of straw or sand between the plastic and soil may make soil removal easier when emptying.

All joins in the plastic must overlap 150 mm and be sealed securely. When completed the sealed pits should be such a shape as to encourage all water to run off. It is a good practice to clearly mark the location of the storage after sealing, perhaps with a peg at each corner, to aid location.

GRAIN REMOVAL

To unload the pit you must be able to remove all soil and the top cover without contaminating the grain. This can be difficult and is the reason why wide pits are undesirable. Use a front-end loader or rear blade to remove most of the overburden soil, avoiding driving onto the pit; then remove the plastic. The grain is then removed using an auger or a tractor bucket.

When emptying pits that are fully lined with plastic the plastic lining will inevitably be damaged, so take care to avoid contaminating the grain with soil.

Conversions

$1m^3$ = 27.5 bushels
$1m^3$ = 9 bags
$1m^3$ of wheat = 0.75 tonnes
$1m^3$ of oats = 0.50 tonnes
$1m^3$ of barley = 0.62 tonnes

Edited by A. T. Munroe
Division of Agricultural Services

ISSN 0725-7759

PROUDLY PRINTED IN AUSTRALIA
D. WEST, GOVERNMENT PRINTER N.S.W.