

# **On-Farm Grain Storage – What system is for me?**

## **INTRODUCTION**

There are a variety of ways grain can be stored, the key success is understanding the pros and cons of each type. On-farm grain storage is going through a revolution, and one of the big changes is the length grain will be stored for and the changes in market requirements and meeting these now and into the future. Grain quality is influenced by insects, moisture, temperature and chemicals, all need to be managed and this will be determined by the choices made with the system put in place.

The ability to kill insects and maintain quality is what every system needs to achieve, killing insects is getting harder and harder and will increasingly rely on gas-tight sealed storage.

There are many aspects to consider, but the key is to focus on market requirements for now and the future. Whilst no one can predict the future, there are many things which can be done to prepare for the future.

Planning your storage system to meet enduser requirements for grain will ensure grain can be stored safely and maintain it's quality.

## **ON-FARM STORAGE SYSTEMS**

On-farm storage systems vary according to needs, however- the following points should be considered:

- Always know your endusers requirements
- How long will grain be stored for?
- silos on slabs to aid in cleaning and maintenance
- ease of insect control
- a site with all weather access
- ease of in loading and outloading
- correct application of any protectants/fumigant used
- gas tight sealed storage for insect control
- ability to use aeration

The reasons for storing grain are many, however insect infestations often occur because grain is kept longer than thought. Either it is no longer protected from a chemical protectant or is stored in a system which cannot be treated correctly for an infestation. It is true that a gas-tight sealed storage system allows growers to store grain for long periods confident that quality can be maintained, and insects fumigated if necessary.

However, in the real world there will always be many ways to store grain. The best thing growers can do is ensure that they carefully choose the system they end up using and match it to their needs now and into the future.

Grain storage bags have become a bigger and growing part of on-farm storage. Storage bags are a great way to manage harvest, and store grain short term (ie up to 3-4 months). Bags on their own will not kill insects in our environment, so you are relying on excellent hygiene and not putting insects into the bag. GRDC have researched bags, the report recommended that they be used for short term storage, if longer was considered the grain should be treated. With

resistance to grain protectants increasing it will be harder and harder to control insects using them.

Grain bunkers are another inexpensive way to store grain. It should always be remembered that bunkers were always intended as a temporary storage method. Treating grain with protectants or fumigating the grain are ways to control insects. As mentioned before protectants will be a problem, and getting a bunker gas-tight is very hard to do, to ensure a successful fumigation.

A combination of some of these methods and silos is probably what most growers will do. If any new silos are purchased, ensuring they are gas-tight is essential. I believe it is prudent to have a minimum of 30% gas-tight sealed storage in a system, and wherever possible the ability to aerate grain. Matching storage with timelines is another important thing to do. Storage which is hardest to control insects in should be emptied first.

## **ON-FARM STORAGE**

In the majority of cases grain stored on-farm (except seed storage), will be used directly for human consumption or as feed which will be fed to animals for human consumption. Grain fed to stock is turned into meat, milk, cheese, etc. Food safety is becoming more and more common place at the farmgate. Endusers want to know what grain has been treated with and what it is that they are purchasing.

Ensuring chemicals are safely and correctly used is very important. Both phosphine and dichlorvos, which are widely used by farmers in grain storage have specific requirements in their use. Both are S7 chemicals and have control of use legislation, and have workcover (OH&S) requirements regarding their use

Ensuring your storage system will control insects is paramount. Currently all the contact insecticides have resistance issues to varying degrees. Even with the advent of new chemicals, there is a definite need to ensure that there is an element of sealed storage in your system to kill insects. Phosphine is only effective in sealed storage, and the alternatives, carbon dioxide and nitrogen need sealed storage to be effective.

Regardless of when the contact pesticides become resistant, there is an increasingly clear message from end-users that their preference is for chemical residue-free grain. This should be seen as a positive, farmers are able to meet this requirement reduce there exposure to that risk, and in doing so will generally find that treating the grain is cheaper and easier than applying contact pesticides.

Grain quality is affected by temperature in a variety of ways. Insects are more active and have the potential for more generations in hot grain. Contact pesticides break down rapidly in hot conditions. There is a direct link between poorer flour quality and hot storage, and germination percentage and hot storage. Keeping grain cool will enhance the quality of grain in storage and minimise storage insects.

## **WHAT CAN YOU DO**

Insect control is essential for successful grain storage. It starts before harvest with a hygiene strategy. Headers, grain handling equipment and storages should be thoroughly cleaned down after use. This should include a 'structural treatment' such as Dryacide or Absorbicide. Clean up spillages in areas around silos and destroy all residues from clean-ups to prevent reinfestation. Insects that migrate to untreated grain can multiply 10-50 times within 10 weeks at typical harvest temperatures.

Well designed storage facilities aid the control of insects. Ease of access, inspection and cleaning are features to look for in grain storage. It is preferable to store grain in gas-tight sealed silos and fumigate using phosphine. Grain stored for any length of time needs to be protected from insect infestation. Infestation can occur within 6 weeks, even where good hygiene practises have been used. With poor hygiene, this interval can be as little as a few weeks.

## **GRAIN PROTECTANTS**

Determine the end use for the grain, and treat with chemicals acceptable to that particular end use as per label directions. Sealed storage offers greater flexibility, as a majority of markets will accept grain treated by phosphine fumigation.

As with any chemical used on-farm, application is critical in ensuring efficacy. All contact pesticides are treated at a rate of 1 litre of mixture per tonne of grain. Calibrating equipment and applying treatments correctly is critical in ensuring you do not under or overdose.

## **SEALED STORAGE**

Ideally, grain should be stored in sealed storage and fumigated with **Phosphine**. Depending on the formulation used (tablets or blankets), the complete fumigation process (including withholding and aeration period) can take up to 25 days. Phosphine is not a quick fix solution and will only be effective if given the time it requires to work.

To use phosphine, carbon dioxide or nitrogen successfully, a sealed silo must be used. When using these gases, the area being fumigated must be able to hold a concentration of gas for a length of time. In unsealed structures these requirements are not met, even if the dose rate is increased. At best adult insects may be killed, but if pupae or eggs are present it is unlikely all will be killed. These will continue to develop into adults to reinfest the grain. If left unchecked can do a lot of damage to the grain

In the longer term, sub-lethal doses of fumigant provide conditions in which grain insects will increase their level of resistance to phosphine. Eventually using phosphine in unsealed storages will become completely ineffective.

A sealed silo should be pressure tested before use to ensure it is suitably sealed. The pressure relief valve is used as a gauge for pressure testing. Always follow manufactures instructions on how to pressure test your sealed silo.

Fumigate immediately the silo has been filled or new grain is added. Place tablets on trays on the grain surface, removing prior to outloading. Prepackaged phosphine (ie blanket/chain type formulations) can be placed on top of the grain or hung in the headspace. Remove these before outloading.

Sealed silos should be checked yearly to ensure that they are able to meet a standard pressure test. Check for any perishing or damage to seals or to sealant material. Replace any worn seals and repair any damage. Pressure test the silo to test that it is gastight.

Fumigate the silo as per label directions, and take advantage of the marketing flexibility and potential available through storing residue-free grain of a high quality.

## **GRAIN MOISTURE AND TEMPERATURE**

Grain must be dry for safe storage. Aim for an upper limit of 12% moisture content for farm stored wheat, barley, oats and triticale. The ability of stored pests to breed in dry grain varies between species. Even those species which can breed in dry grain will breed much faster in moist grain. The optimum relative humidity for insect development is about 70-80 percent. In wheat, this is equivalent to a moisture content of about 14-15 percent.

Excessive moisture will cause grain protectants to break down rapidly, encourage fungi and moulds to develop and cause grain to sprout. It is recommended that a moisture meter always be used to determine the moisture content of grain during harvest.

Stored grain should also be kept as cool as possible. Aim for an upper limit of about 27°C. The speed at which insect populations grow is influenced by temperature, relative humidity and moisture content.

Storage pests can breed at temperatures between 15°-40°C depending on the species. Population growth is usually highest at 25°-35°C. At low temperatures (15°-20°C) insect pests multiply slowly and grain maintains its viability. At high temperatures seed viability is reduced, insect pests are more active and pesticides on grain breakdown more quickly.

### **Keeping Grain Cool**

Grain temperature can be minimised by putting cool grain into silos (transferring cool grain in the morning, evening or night), applying white paint to galvanised iron silos, using silos made out of zincalume or colourbond, or installing an aeration system.

Growers should aim to store grain at temperatures as low as possible, preferably less than 20°C. Every 1°C below 26°C will have an effect on germination retention and insect activity

### **Aeration**

Aeration is the process of passing cool air through grain to reduce its temperature to a level where insect development, mould growth and moisture migration are dramatically reduced. As grain is cooled, insect development slows down and is negligible at temperatures below 15°C.

Aeration systems can be used for either drying grain, cooling grain and for maintaining grain quality when stored over a longer time frame.

The benefits of aeration are:

- early harvesting of high moisture grain
- greater harvest flexibility
- control over grain quality
- ability to even out moisture levels
- cooling capacity
- ability to even out temperature
- ability to prevent moisture migration

## **WHAT SHOULD YOU CONSIDER NOW**

In most cases it would be impractical to replace all storage with new sealed bins. You should have a proportion of sealed storage in your system to fumigate grain. Where storage is to be increased, good quality sealed storage should be purchased. Existing unsealed storage can be

fitted with aeration, grain fumigated in sealed storage can be transferred to aerated storage and confidently stored until needed.

The key to successful grain storage is planning. Understand your market's needs, and get good information on how to meet these. Invest in quality storage equipment, and manage your system as well as you manage the crop in the paddock.