

# DPI&F note

## Grain Storage - Organic grain storage

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### Key points

- Check with the organic certifying body, prior to any decision on grain insect control
- Clean grain handling and storage equipment and dispose of old infested grain
- Regularly check grain for insects to avoid grain damage and mould development
- Aeration cooling reduces insect activity, but may have to be used with other methods in summer
- Carbon dioxide is effective in controlling insects

### Options for insect control

Good hygiene is an essential part of insect control in stored grain. Other options for pest control include:

- cooling or drying grain with aeration,
- treating grain by mixing an inert dust (amorphous silica) product with the grain as it is put into storage,
- controlled atmosphere treatment (e.g. carbon dioxide),
- treating storages and equipment with inert dust (amorphous silica / diatomaceous earth) prior to storing grains.

Hygiene, aeration, drying, treating storages and equipment, and mixing inert dusts with the grain are intended to prevent or reduce the chance of infestations developing. Controlled atmosphere treatment can be used to kill infestations if they are found.

Delivering the grain to your market within six weeks of harvest usually avoids pest problems, and should be regarded as a pest control option if equipment for other options is not available.

### Hygiene

Clean out all machinery and equipment used to handle grain, including headers, augers, field bins, truck bins, silos and other storages.

Special care should also be taken to clean out bags of seed, feed troughs, shed floors, heaps of old bags or any other places where grain and insects may be present. Grain and residues from cleaning should be buried, burned, or spread thinly over the ground away from buildings and storages.

Grain held over from the previous season should be inspected and treated with carbon dioxide if insects are found.

### Inspection

Grain should be inspected regularly for insects. If insects in grain are left untreated, the grain will

- be unsaleable to most buyers,
- be reduced to dust by the insects feeding on it, and
- go mouldy because of the heat and moisture released by the insects.

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Inspect grain in each storage for insects at least once a month. Take samples of a few litres from all access points, using a grain spear for the top surface, and sieve the grain. Infestations in silos are usually heaviest near outlet hatches (auger hoppers, bagging out chutes) and the top surface.

If you find more than five live insects per litre in grain for use on-farm, then control is needed to prevent excessive damage and cross infestation.

If any live insects are found the grain must be treated before delivery to bulk handlers or to most buyers. To ensure that sufficient time is available for treatment if insects are present, the grain should be inspected four weeks before the intended sale or delivery date.

## **Grain temperature and moisture**

The common grain pests increase by 20-25 times a month at high temperatures (30-35°C) and moistures (14-16% grain moisture for wheat, equivalent to 70-80% relative humidity (RH)).

Reducing grain temperature slows insect development. For example, flour beetles can complete their development in three weeks at 35°C and 70%RH, but take ten weeks at 22.5°C and 70%RH. Although adult grain insects live a long time at cool temperatures, their young stages stop developing at temperatures below 15 °C for weevils or 20 °C for most other species.

Reducing moisture also slows development. Weevils cannot reproduce in wheat below 10-10.5% grain moisture, but the lesser grain borer will build up in numbers at moistures as low as 8%.

## **Cooling with aeration**

Controlled aeration can greatly reduce insect and mould activity in stored grain, as well as preserving grain quality. Aeration cooling lowers the temperature of grain by blowing cool, dry air through it. An automatic controller is more effective than thermostats, timers or manual switches in selecting the coldest air available.

Some growers find that a combination of good hygiene and controlled aeration prevents development of problem insect infestations. However other growers have insect problems in aerated grain, particularly in summer. Therefore, aeration may need to be used in conjunction with other pest control methods.

Aeration is strongly recommended for seed or malting barley to maintain germination and malting quality.

## **Drying**

Drying is necessary to prevent mould development in high moisture grain (eg wheat above 14% moisture), and also slows insect development. Drying is achieved by blowing warm or hot dry air through the grain.

Hot air dryers dry grain rapidly but high temperatures can impair germination and milling and baking quality. Because of these effects some markets do not want artificially dried grain, particularly for milling wheat and malting barley. Supply of grain dried at high temperatures could result in loss of markets. Increasing air flow is a safer way of speeding up drying than increasing temperature. Hot air drying MAY NOT BE ACCEPTABLE FOR ORGANIC GRAIN – check with your organic certifying body.

Many growers use aeration systems to dry grain with unheated air. However the drying effect is fairly slow unless high capacity fans and ducting are used. Aeration drying is only effective in hot, dry conditions.

## **Inert dusts (amorphous silica)**

Inert dusts include such products as Dryacide®, Absorbacide®, Perma-Gard D10® may control infestations present at the time of treatment if the higher label dose rate is applied. Many grain merchants and bulk handling authorities will not accept grain treated with these products because they alter the handling characteristics of grains. Treatment of silo surfaces and grain handling equipment with these products is generally acceptable to handlers (see below). Check with grain handlers before treating grain or equipment with these products.

Inert dusts collect on insects and dry them out, causing death to the insect.

- If grain is dusty or infested, increase the application rate of according to label. Generally, inert dusts are less effective on high moisture grain over 12%.
- A pickle applicator or a special Dryacide® applicator, available from rural supply houses, is the best way to apply Dryacide® or other dust formulations..

## Controlled atmospheres

Controlled or modified atmosphere (CA) refers to the process of altering the proportion of atmospheric gases oxygen, nitrogen and carbon dioxide ( $\text{CO}_2$ ) to give an insecticidal gas. The advantage of the CA technique is that it provides a disinfestation method that is chemical-free and suitable for "organic" grain. A major disadvantage is that it is several times more expensive than fumigation with phosphine.

In practice, use of CA's is little different to fumigating with phosphine. Currently, the only practical method available to farmers is to introduce carbon dioxide from a gas cylinder into a gas-tight silo. A very high standard of gas-tightness is required, often with a supplementary bleed of gas, to hold at least 60% carbon dioxide for at least 10 days or 30-40% carbon dioxide for 14 days to kill all stages of the insects life cycle.

Further information on controlled atmosphere fumigation and commercial suppliers of appropriate gas and equipment, contact Graincorp Customer Services (0746 399 253) or BOC Gases Australia Ltd, Rocklea, Brisbane, Ph 07 3212 4228, Fax 07 3212 4116.

## Treatment of storages and equipment

Treating the surfaces of storages and equipment before they are used may kill insects walking on those surfaces, but will not control insects in grain placed in the storage or equipment. If the storage or equipment is not cleaned before treatment, the treatment will be much less effective. Cleaning and treatment of storages and grain handling equipment is an important component of any grain storage insect control strategy.

### Treatment with inert dusts (amorphous silica)

All surfaces of walls, floors, ledges, and machinery may be treated yearly, or twice yearly in heavy traffic areas. It can be applied to surfaces in two ways:

1. As a slurry - this is a very efficient method when applied at the product label rate.
2. As a dust – this requires an air stream to move the product into surfaces and into crevices. When applying the dusts to large areas, use a power duster such as a Stihl SR400. Operators of such equipment should wear disposable dust masks.

## Further information

If you require further information, see

- 'On-farm Storage of Organic Grain', R Neeson and J Banks (Jan 2004), NSW Agriculture Agfacts series, P3.5.1
- DPI&F website [www.dpi.qld.gov.au](http://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](mailto:callweb@dpi.qld.gov.au)
- Details of insect control methods are available in "Insect pests in stored grain" by Eric Sinclair and Graham White (QI90021).
- More general information on grain storage is available in "Storing, handling & drying grain: A management guide for farms" by Alan Andrews and Troy Jensen (QI 96081).■