

# Grain storage pests – nil tolerance in markets

Philip Burrill, DPI&F Hermitage Research Station, Warwick



Phil Burrill, DPI&F, is a Development Extension Officer working with stored grain at Hermitage Research Station, Warwick.

On-farm grain storage is going to become a more important option under deregulation. But finding 'weevils' crawling up the sides of your grain hopper while loading a truck destined for one of your regular grain buyers is frustrating. If left untreated, the load may be rejected resulting in expensive contract fumigation or return transport. Additional costs of \$20 or \$30 per tonne are not uncommon. Maintaining the buyer's confidence in you as a first choice supplier is worth protecting.

## Sorghum in storage

With significant tonnages of sorghum held on-farm this year, storage pest numbers are likely to increase as temperatures start to rise in September and October. At 25°C, 100 Lesser Grain Borers (LGB) could potentially multiply to 22,000 after 8 weeks. However, if aeration reduces the grain temperature below 18°C, it would be too cold for these borers to breed. Grain moisture contents below 11% will also reduce insect breeding rates.

## Our main storage pests

While we generally refer to storage pests as 'weevils', when it comes to controlling them it is important that we identify them correctly to ensure the appropriate treatment. The lesser grain borer (*Rhyzopertha dominica*) is the most common storage pest, followed by the rust-red flour beetle (*Tribolium castaneum*), the rice weevil (*Sitophilus oryzae*), flat grain beetle (*Cryptolestes ferrugineus*), psocids (*Liposcelis* spp), the sawtoothed grain beetle (*Oryzaephilus surinamensis*) and various grain moths. The beetles can fly and will multiply rapidly given warm conditions;



Lesser Grain Borer (LGB)



Rust-red flour beetle

they can complete their full life cycle (egg, larvae, pupae, adult) in about 4 weeks under optimum breeding temperatures around 30°C.

## Clean, dry and cool

Cleaning out grain handling equipment, harvesters and storages when not in use, robs grain pests of food and shelter. Any dirty silo, auger or field bin can become a breeding site and contaminating freshly harvested grain leading to an earlier infestation build-up. Grain with high moisture content usually requires prompt drying to prevent self-heating, moulds and insect build-up, but running aeration fans continuously can be a short-term way for holding moist grain before drying. Sorghum stored at 25°C and with higher than 13.5% moisture will result in a relative humidity above 70% in the inter-granular air space. Holding conditions below 70% RH reduces the risk of heat and mould damage.

## Cooling aeration

During winter months, carefully managed aeration fans should keep grain temperatures of sorghum below 15°C. Temperatures below 20°C will either stop or significantly slow breeding rates of the common pests—except the rice weevil which needs temperatures below 15°C to stop breeding. However, remember that there can be warmer areas such as the silo head space and northern facing walls. Automatic aeration controllers are recommended as they provide appropriate air quality on a regular basis to cool the grain bulk and warmer parts of





*Rice weevil*

storages; they can keep grain temperatures around 20°C even during the summer months of November, December and January in southern Queensland. While these cool temperatures limit the activity of most species, you should still inspect grain on a regular basis. Grain temperatures can be monitored using commercially available probes or cables with sensors.

Dry and cool conditions also help maintain germination quality for wheat and barley held for seed.

### Chemicals, fumigation and resistance

On farm, we have only two products readily available to control an outbreak of live adult insects in infested grain— the insecticide spray dichlorvos and the fumigant phosphine.

Dichlorvos use has disadvantages. It has a 7- or 28-day withholding period depending on the rate applied, and some grain markets may not accept this chemical treatment. It is not registered for use on pulses or oil-seeds. If LGB are present in the infestation, the treatment will most likely fail as LGB resistance to this product is now widespread.

Phosphine fumigation (tablets, bag chains) is the most common treatment for live storage pests. Over-reliance on the product and its repeated use in non-gastight storages has led to resistance to phosphine on farms; however, even highly resistant strains can be controlled if the fumigation takes place in a gas-tight – well sealed silo. If the silo passes an industry standard 3-minute pressure half-life test, the phosphine gas will be held at a high enough concentration for long enough to kill all the life stages of the pest. We require a minimum of 300 ppm of phosphine gas for 7 days or 200 ppm for 10 days. A number of silo manufacturers make an

aeratable, sealable silo which passes the pressure test standard and so can achieve these gas concentrations which are effective against resistant insects.

Phosphine fumigations – steps for success

Check rubber seals on openings for damage, then seal up the silo.

Conduct the 3-minute half-life pressure test. If less than 3 minutes, look for leaks with a soapy water spray

Place fumigation warning signs on silo including fumigation start and end times. Read the safety directions on label.

Place trays in headspace with tablets spread out evenly. Label dose rate is 1.5 tablets per cubic metre of silo capacity. As a guide for dosage, a silo which can hold 100 tonne of wheat should be dosed with 200 tablets regardless of how full it is.

Warm grain (above 25°C) requires a minimum of 7 days under fumigation. When completed, ventilate for one day with the aeration fan. Cool grain in the 20–25°C range requires 10 days fumigation and grain that is cold (15–19°C) requires 14 days.

The key to success is to hold gas concentrations high for the required time. Phosphine is a slow-acting poison for insects, particularly against the life cycle stages of egg and pupa.

As a general rule, grain quality is best maintained under cooling aeration, and the only time the silo remains sealed is during fumigation. If a silo is sealed for a long period, grain can warm up in some areas and this may lead to moisture migration causing grain damage. Grain quality and insect management strategies that combine good equipment hygiene, grain temperature management, along with appropriate selection of chemical controls, will reduce the requirement for repeated insecticide treatments.

Aiming for a quality grain commodity that producers, buyers and consumers have confidence in is of long term value for domestic and export sectors of the industry.

*Know your beetles.  
Which are these?*



Insect photography by Chris Freebairn, DPI&F