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GRAIN STORAGE FACT SHEET

GRDC
Grains Research & Development Corporation
Stored Grain Project

VIGILANT MONITORING PROTECTS GRAIN ASSETS

When grain enters storage it needs regular monitoring, just as a crop does throughout the growing season.

Regular monitoring means problems are detected early and can be managed before significant grain damage occurs. It also avoids surprises at out-loading, prevents costly rejections from grain buyers and maintains your reputation for supplying quality grain.

KEY POINTS

- Regular monitoring allows early action to be taken if insects or grain quality issues arise.
- Failure to monitor grain not only increases the risk of damage and loss but can delay delivery if an issue is first identified at out-loading.
- Monitor grain temperature and moisture content and check for insect pests.
- Testing grain retained for seed after harvest helps plan for the following season.

PHOTO: CHRIS WARRICK, PROADVICE

Avoid surprises: *Take samples from the bottom and the top of grain storages providing it's safe to do so.*

Segregating grain

Monitoring starts at harvest — knowing grain condition and grade as it comes off the paddock determines the appropriate storage conditions.

- High-moisture grain requires drying or blending.
- Warm grain requires cooling.
- Variable quality grain will benefit from segregation.

When the grade is known (test at a registered receival site) ask what parameter(s) it's close to if being downgraded or upgraded. It may be something that can be tested for and managed on farm, such as protein, screenings or test weight.

Having this information on hand at harvest can support segregating grain as it comes off helping it to stay within the grade. Alternatively, blending grain from lower-grade areas of the paddock with that from higher grade areas may improve the overall grade.

In some cases, insect pests can come from machinery, so check grain on the way into storage so it can be treated or fumigated. *Note: contact pesticides are not an option in Western Australia.*

Monitor regularly

When in storage, grain is vulnerable to quality loss. Poor management can see grain come out of storage in an unsaleable condition. Monitor grain so problems can be addressed early before they cause significant damage.

Dealing with an issue earlier rather than later is easier and more cost effective.

Check stored grain at least once a month during the cooler months and fortnightly during warmer months. Collect samples from the bottom of the storage and, if safe, at the top.

In warm conditions (>30ºC) many grain pests can complete their life cycle in as little as 3–4 weeks causing significant damage.

When monitoring stored grain check:

- For insect pests
- Grain temperature
- Grain moisture content
- Grain quality and germination.

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PHOTO: CHRIS WARRICK, PROADVICE

Captured: *Probe traps left in the top of a storage can be removed and checked at each inspection. Tie the trap to something inside the storage so it doesn't get lost if it's forgotten about before out-loading. Position the trap so a small amount is left out at the top of the grain to capture insects crawling across the surface as well as those hiding beneath.*

Sampling stored grain

Collect samples from the areas where insects and mould are most likely to establish first. These areas are generally around openings — hatches, doors, aeration fan inlets, filling and emptying points.

The most common place for insects and mould in a silo is at the top, just below the surface of the peak of grain (see Figure 1). This is because it's the last place aeration cooling or drying reaches, it's exposed to the sun heating the headspace, condensation from the headspace and provides easy access for insects through the top lid, inspection hole or vents.

Always follow occupational health and safety guidelines and only climb to the top of a storage if it's safe to do so.

Always collect samples from beneath the grain surface. At the bottom of a silo this means opening an outlet to run a small amount of grain out. A sampling probe is ideal for collecting grain from the top of a silo, but it's often impractical or unsafe to climb up a silo with a sampling probe.

Checking for insects

Grain pests can be difficult to find because they are small, fast moving and some prefer the dark while others can be seen on the surface. There are numerous ways to detect them.

Tie the trap to something inside the storage so it doesn't get lost or forgotten about before out-loading. Position the trap so a small amount is protruding out the top of the grain to capture insects crawling across the surface as well as those hiding beneath.

Temperature

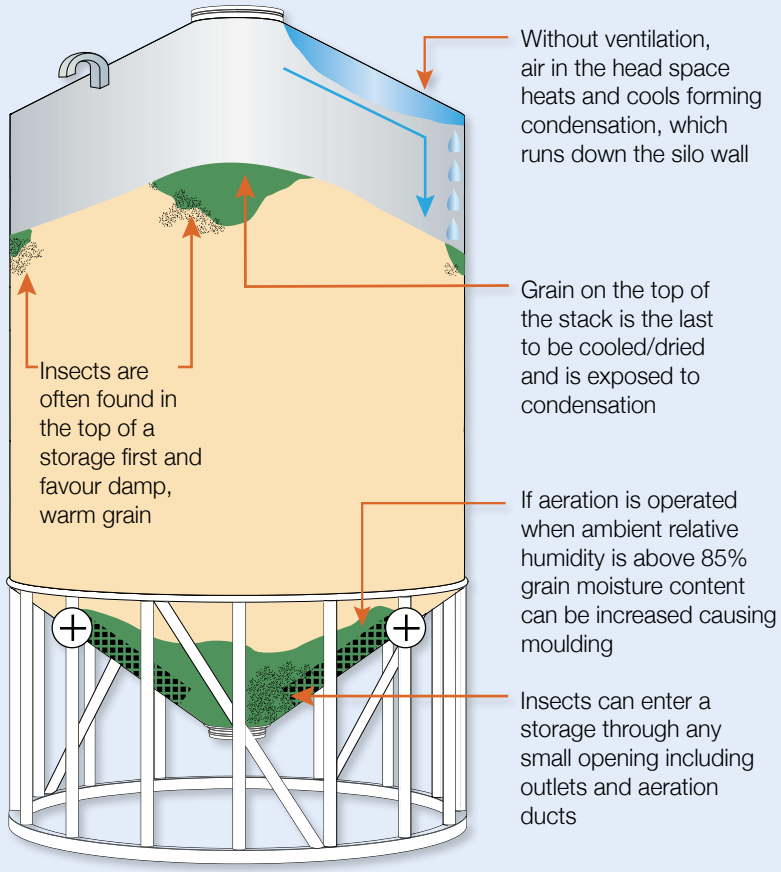
Monitoring grain temperature is not only required to manage aeration, it can indicate potential mould or insect activity in the grain stack.

Insect activity generates heat, which provides favourable conditions for mould. When checking grain temperature, go beneath the surface, measuring in the same spot each time. Record test results to identify any temperature spikes, which will prompt further investigation.

Grain moisture

Grain moisture content influences mould and insect activity (see Figure 2). Identifying a change in moisture can reveal an issue before it causes significant damage. For example, an increase in grain moisture at the top of a storage could be a result of a leak, condensation or problem with aeration management.

FIGURE 1 COMMON PROBLEM AREAS IN GRAIN STORES



Source: Kondinin Group

PHOTO: CHRIS WARRICK, KONDININ GROUP

Beneath the surface: *While a sampling probe is ideal, if it's not practical or safe just scrape some grain aside to get a subsurface sample.*

PHOTO: BEN WHITE, KONDININ GROUP

Revealing the pest: *Sieve a litre sample onto a white tray. Hold the tray in sunlight to warm for 20–30 seconds to encourage insect movement for easier identification. Some insects will continually seek refuge under grain while others stay out in the light — take time to look closely with a magnifying glass.*

Seed germination and vigour

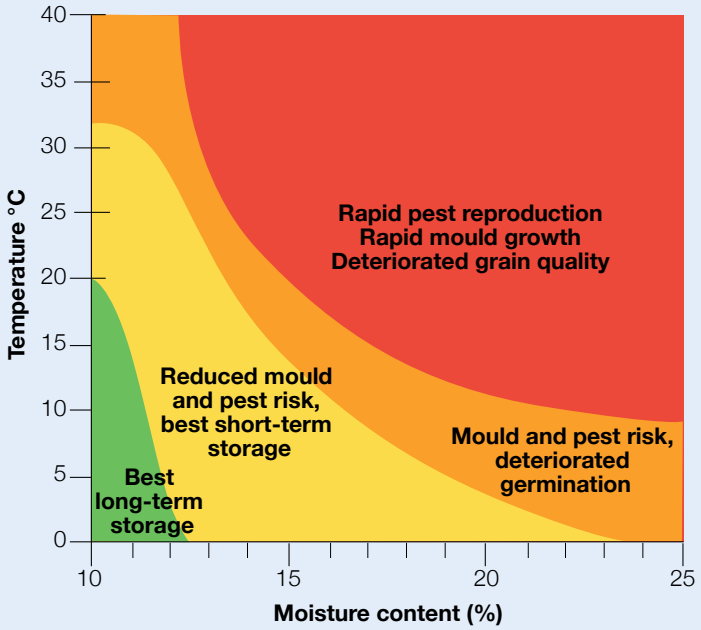
Storing grain at the optimum temperature and moisture content, as shown in Figure 2, not only reduces the risk of mould and insects, it maintains grain quality and germination.

CSIRO research reveals how moisture content and temperature affect the rate at which seed germination declines. A trial was carried out with premium quality wheat at 12 per cent moisture content and an initial seed viability of 100 per cent, stored for 150 days. Storing at 20°C decreased the seed viability by only 1 per cent but storing at 30°C decreased viability by 21 per cent over the 150 days.

Reduced germination rates result from a breakdown of grain cellular structure and function, with related changes in chemical composition and modification to enzyme and other bio-chemical systems.

Stored grain deteriorates with time under any conditions, but poor storage conditions (high grain temperature and moisture) accelerate the deterioration process markedly.

FIGURE 2 EFFECTS OF TEMPERATURE AND MOISTURE ON STORED GRAIN



Source: CSIRO Ecosystems Sciences

PHOTO: CHRIS WARRICK, KONDININ GROUP

Deep temp testing: *Dedicated temperature probes are ideal for testing grain temperature well below the surface. The basic alternative is a mercury thermometer fixed securely to a rod.*

PHOTO: CHRIS WARRICK, PROADVICE

Multimeter temperature test: *Higher grade multimeters can also test temperature. The one pictured includes a temperature wire as well as ambient temperature and relative humidity in addition to all the common multimeter functions used for electrical jobs around the farm.*

PHOTO: CHRIS WARRICK, PROADVICE

Moisture monitoring: *A hand-held grain moisture meter is sufficient for monitoring stored grain. Be sure to calibrate it at the start of the season and record results to identify any change in moisture over time.*

PHOTO: CHRIS WARRICK, PROADVICE

Count them: *A simple seed germination test carried out a month after harvest aids planning, but be aware that germination rates decline during storage, depending on storage conditions.*

Testing germination rates on retained seed

If retaining grain for seed, a germination test and seed count test performed a month after harvest can help guide how much seed needs to be kept to achieve acceptable paddock plant populations.

If the germination test at this stage is poor, it might pay to buy in seed. If germination is satisfactory, use germination rate to guide how much extra seed to keep, adding an allowance for all the other factors that will reduce germination and seed establishment.

Factors influencing how much seed needs to be retained for sowing include:

- Germination rate tested at harvest.
- Further decline in germination between harvest and sowing.
- Screenings, foreign and small seeds graded out at cleaning.
- Allowance for seeds that germinate but don't emerge.
- Seed weight (grams per 1000 seeds).
- Buffer to allow for change of plans in planting area.

Before sowing, carry out another germination test to check for decline in germination rates during storage.

CSIRO research shows this decline can be around 21 per cent if grain is not stored in ideal conditions. A decline of more than 10 per cent in germination rate from harvest to sowing should prompt action to improve the storage conditions or management in future years.

Grain temperature has one of the largest influences on seed germination and vigour. Monitor temperature regularly and ensure sound aeration management.

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USEFUL RESOURCES

GRDC Grain storage extension project
www.storedgrain.com.au

Grain Trade Australia
02 9235 2155
www.graintrade.org.au

Graintec Scientific Pty Ltd
07 4638 7666
www.graintec.com.au

Aerating stored grain – cooling or drying for quality control (Research Reference Booklet)
www.storedgrain.com.au

Aeration cooling for pest control (GRDC Fact Sheet)
www.storedgrain.com.au

Keeping aeration under control (Kondinin Group Research Report)
www.storedgrain.com.au

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