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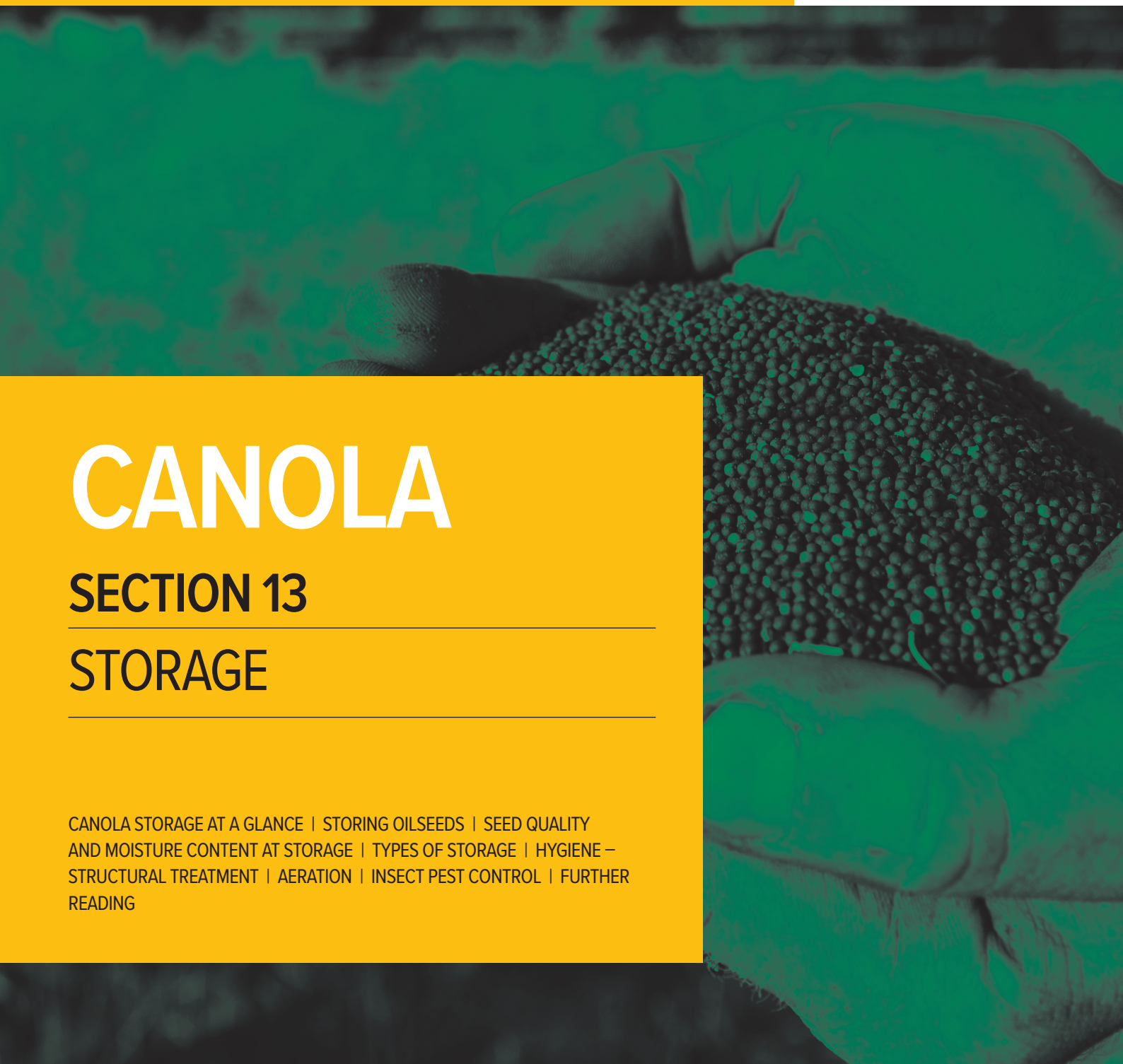

CANOLA

SECTION 13

STORAGE

CANOLA STORAGE AT A GLANCE | STORING OILSEEDS | SEED QUALITY AND MOISTURE CONTENT AT STORAGE | TYPES OF STORAGE | HYGIENE – STRUCTURAL TREATMENT | AERATION | INSECT PEST CONTROL | FURTHER READING

SECTION 13

Storage

13.1 Canola storage at a glance

- For safe storage and optimum quality, canola should be stored 'cool and dry'.
- Aim to store canola seed with 42% oil content at <7.0% moisture content. Samples with high oil content (50%) can be stored safely at <6.0% moisture content.
- Clean out storage facilities, grain-handling equipment and headers to reduce carryover of storage pests from one season to the next. This minimises early infestation pressure.
- Aeration to promote uniform, cool storage conditions is a key strategy for maintaining oil and seed quality. During summer, aim for stored canola temperatures in the range 18°–23°C.
- For oilseeds, monitor storages fortnightly and keep records. Sieve grain and use probe traps to detect insect pests. Make visual inspections and smell the canola. Check canola temperature at a number of locations in the storage. [1]

More information

Storing oilseeds—Grain Storage Fact Sheet

Cool and dry conditions maintain canola quality—Farming Ahead

[1] P Burrill (2012) Safe storage. Module 8. In Better canola—canola technology update for growers and advisors. Australian Oilseeds Federation, http://www.australianoilseeds.com/__data/assets/pdf_file/0019/9082/MODULE_8_-_Safe_Storage_of_Canola_Philip_Burrill_-_V2_Sep_2012.pdf

13.2 Storing oilseeds

Storage of oilseeds on-farm requires attention to detail, because limited tools are available compared with cereal grain storage. Oilseeds are also more susceptible to quality deterioration and have fewer insect-control options. To retain the canola's market value, care must be taken to maintain oil quality, visual appearance, and freedom from moulds, insect pests and unregistered chemicals. [2]

The decision to store oilseeds requires planning, careful management and a suitable storage system. [3]

Points to consider when storing oilseeds such as canola:

- Limited chemical control options for insect pests in stored oilseeds increase the importance of careful management and planning.
- Aeration cooling is required when storing oilseeds to maintain seed and oil quality, limit insect reproduction and reduce risk of mould development.
- Seek advice about the appropriate fan size to use to aerate canola. Canola's small seed size will reduce fan output by 40–50% or more. In some situations, the fan may fail to produce any airflow.
- Moisture content in oilseeds must be much lower than in cereal grains. The high oil content increases the risk of moulds and quality damage.
- Successful phosphine fumigation requires a gas-tight, sealable silo.
- To prevent residues on canola, do not use the standard chemical insecticide structural treatments. Use diatomaceous earth (DE) products such as Dryacide®. [4]

13.3 Seed quality and moisture content at storage

Windrowing canola may have advantages over direct harvesting of the standing crop. It hastens and evens out the drying rate of ripe canola. If direct harvesting, harvest at <7% moisture content to allow for paddock variability with respect to crop maturity.

Timing of harvest and header settings—drum speed, concave gap and fan speed—have a significant impact on minimising trash and impurities and seed damage. If admixture in the seed sample is high, fines can concentrate directly below the storage fill-point, leading to heating and fire risk. Larger pieces of crop trash may also concentrate along silo walls, leading to mould development.

The presence of damaged seeds is more attractive to storage pests such as the rust-red flour beetle (*Tribolium castaneum*).

[2] P Burrill (2012) Safe storage. Module 8. In Better canola—canola technology update for growers and advisors. Australian Oilseeds Federation, http://www.australianoilseeds.com/__data/assets/pdf_file/0019/9082/MODULE_8_-_Safe_Storage_of_Canola_Philip_Burrill_-_V2_Sep_2012.pdf

[3] GRDC (2014) Storing oilseeds. GRDC Stored Grain Information Hub, http://storedgrain.com.au/storing-oilseeds/

[4] GRDC (2014) Storing oilseeds. GRDC Grain Storage Fact Sheet, July 2014, http://storedgrain.com.au/wp-content/uploads/2014/09/GSFS-9_Oil-Seed-July14.pdf

Safe moisture content for storage depends on temperature and oil content. The higher the oil content and storage temperature, the lower the moisture content must be for safe storage. At 25°C, canola with an oil content of 45% is safe to store at <7.0% moisture content. Canola with 50% oil content is safe at <6.0% moisture content (see Figure 1).

The aim is to store the canola in conditions that achieve an equilibrium relative humidity of <60% in the storage (see Figure 1). This reduces the risk of mould development, canola self-heating and oil quality deterioration.

Use of aeration to cool seed temperatures to ≤20°C is a key aid to reliable canola storage. [5]

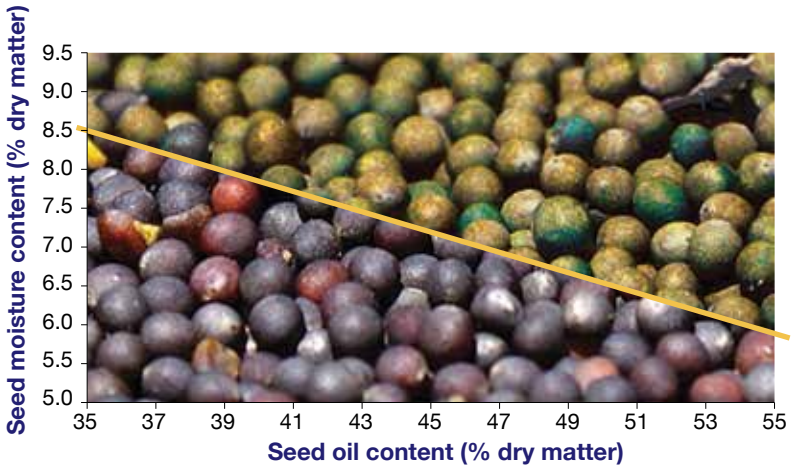

Figure 1: Safe storage conditions for canola at 60% equilibrium relative humidity. The relationship between seed moisture content and oil content is shown at 25°C (yellow line). Canola stored at conditions above the line is at potential risk of seed and oil quality loss. (Source: CSIRO Stored Grain Research Laboratory)

13.4 Types of storage

Ideal storage for canola is a well-designed, cone-based, sealable silo fitted with aeration (Figure 2). The storage should be designed for minimum damage to seed, ease of cleaning and hygiene for empty storages, and suitability for effective use of aeration cooling.

If seed requires insect pest control, the silo is then sealed (gas-tight) for the required period as stated on the product label (usually 7–10 days) to enable effective phosphine fumigation. For all storage types, extra caution should be taken to prevent rain/water ingress into storages. [6]

[5] P Burrill (2012) Safe storage. Module 8. In Better canola—canola technology update for growers and advisors. Australian Oilseeds Federation, http://www.australianoilseeds.com/__data/assets/pdf_file/0019/9082/MODULE_8_-_Safe_Storage_of_Canola_Philip_Burrill_-_V2_Sep_2012.pdf

[6] P Burrill (2012) Safe storage. Module 8. In Better canola—canola technology update for growers and advisors. Australian Oilseeds Federation, http://www.australianoilseeds.com/__data/assets/pdf_file/0019/9082/MODULE_8_-_Safe_Storage_of_Canola_Philip_Burrill_-_V2_Sep_2012.pdf

Figure 2: Aerated, sealable silos.

13.5 Hygiene—structural treatment

Most common insecticide treatments for storage surfaces are not to be used on storages for holding canola. **Warning**: if unregistered chemical residues are detected by grain buyers, it can have serious long-term consequences for domestic and export markets.

Diatomaceous earth (amorphous silica) or inert dust is a naturally occurring, mined product with insecticidal properties. Products such as Dryacide® can be applied as a dust or slurry spray onto internal surfaces of storage areas and equipment. Once old grain residues have been physically removed or washed out of storages and equipment, Dryacide® can be applied as a non-chemical treatment to reduce insect pest carryover.

Insect pests survive in any sheltered place with grain residues—in grain hoppers, augers, field bins and inside headers. All of these attractive locations require attention.

Some products based on pyrethrin + piperonyl butoxide (e.g. Rentokil's Pyrethrum Insecticide Spray Mill Special® or Webcot SPY® natural pyrethrum Insecticide) are registered for moth control in oilseed storage areas or storage sheds. They can be used as a structural-surface spray or fogging–misting treatment. They are not to be applied as a grain treatment. Use only as labels direct and only use products registered for use in the state or territory as stipulated on the label. Discussion with grain buyers and traders prior to use of any products is also important. [7]

[7] P Burrill (2012) Safe storage. Module 8. In Better canola—canola technology update for growers and advisors. Australian Oilseeds Federation, http://www.australianoilseeds.com/__data/assets/pdf_file/0019/9082/MODULE_8_-_Safe_Storage_of_Canola_Philip_Burrill_-_V2_Sep_2012.pdf

13.6 Aeration

Aeration should be considered an essential storage tool for canola. Correctly managed, it creates uniform, cool conditions in the seed bulk and slows most quality-deterioration processes.

Aeration:

- helps maintain oil quality— low free fatty acid content / rancidity, good colour and odour;
- reduces the risk of 'hot spots', moisture migration and mould development;
- slows or stops breeding cycles of storage insect pests (e.g. rust-red flour beetle) by maintaining grain temperatures at <20°C; and
- maintains germination and seed vigour for longer when kept cool and dry. [8]

Canola, being a much smaller seed than cereal grains, adds significantly more back-pressure to the aeration fan. This means that an aeration cooling system set up to produce airflows of 2–4 litres per second per tonne (L/s.t) in cereal grain will typically produce only 40–60% of that when used in canola.

When setting up storages to cater for cereals and canola, seek advice about the fan sizes and number required to achieve the 2–4 L/s.t.

Other factors that affect the amount of airflow through the grain:

- depth of the grain in storage
- amount of fine admixture and foreign plant material in the grain
- design and size of fan ducting and venting on top of the silo

The area and type of ducting must be adequate to disperse the air through the storage and not to be blocked by the small canola seeds. Avoid splitting airflow from one fan into multiple silos, because the back-pressure in each silo will vary and incorrectly apportion the amount of airflow to each. This will be exacerbated if different grains are stored in each silo, such as canola in one and a cereal in the other. [9]

13.6.1 Aeration cooling

Fans providing low airflow rates of ~2–4 L/s.t can both cool seed and provide uniform seed temperature and moisture conditions in the storage. Always check that the fan's design and capacity is suitable for the small canola seed. In some cases, an aeration fan may not be able to create any airflow through canola.

Well-managed cooling aeration typically makes seed temperature fall safely to ~≤20°C within days. Regular checking of canola in storage is essential. Make visual

[8] P Burrill (2012) Safe storage. Module 8. In Better canola—canola technology update for growers and advisors. Australian Oilseeds Federation, http://www.australianoilseeds.com/__data/assets/pdf_file/0019/9082/MODULE_8_-_Safe_Storage_of_Canola_Philip_Burrill_-_V2_Sep_2012.pdf

[9] GRDC (2014) Storing oilseeds. GRDC Stored Grain Information Hub, http://storedgrain.com.au/storing-oilseeds/

inspections, check seed moisture, use a temperature probe to monitor bulk seed temperature, and sieve for insects. [10]

13.6.2 Automatic controllers

Often, 'aeration cooling' fans are simply turned on and off manually or a timer clock is used. However, much can be gained by investing $5000–7000 in an automatic controller that selects the optimum run-times and ambient air conditions under which to turn on the fans. The controller continually monitors air temperatures and relative humidity and may select air from only 2 or 3 days in a week or fortnight. One unit has the capacity to control fans on multiple silos. [11]

13.6.3 Operation of aeration fans

- Run fans constantly during the first 4–5 days when grain is first put into the silo. This removes the 'harvest heat'. Smell the air coming from the silo top-hatch. It should change from a warm, humid smell to a fresh, cool smell after 3–5 days. The first cooling front has moved through.
- For the next 5–7 days, set the controller to the 'rapid' setting. This turns fans on for the coolest 12 h of each day to reduce the seed temperature further.
- Finally, set the controller to the 'normal' mode. The fans are now turned on for ~100 hours per month, selecting the coolest air temperatures and avoiding high-humidity air. [12]

13.6.4 Aeration drying

Well-designed, purpose-built, high-flow-rate aeration-drying systems with airflow rates of 15–20 L/s.t can dry seed reliably. During aeration drying, fans should force large volumes of air through the grain bulk for many hours each day. This ensures that drying fronts are pushed quickly through so that seed at the top of the silo is not left sitting at excessively high moisture contents (Figure 3).

Seeds from oilseed crops are generally well suited to this form of drying when correctly managed. Utilise all ambient air available with relative humidity <70% to provide a low average relative humidity for each run time. This can reduce moisture content without the risk of heat damage to seed oil quality. Monitor regularly and take care that seed in the bottom of the silo is not over-dried. Seek advice when undertaking aeration drying for the first time.

Do not use aeration fans with low airflow rates when attempting to dry high-moisture seed.

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10 P Burrill (2012) Safe storage. Module 8. In Better canola—canola technology update for growers and advisors. Australian Oilseeds Federation, http://www.australianoilseeds.com/__data/assets/pdf_file/0019/9082/MODULE_8_-_Safe_Storage_of_Canola_Philip_Burrill_-_V2_Sep_2012.pdf

11 P Burrill (2012) Safe storage. Module 8. In Better canola—canola technology update for growers and advisors. Australian Oilseeds Federation, http://www.australianoilseeds.com/__data/assets/pdf_file/0019/9082/MODULE_8_-_Safe_Storage_of_Canola_Philip_Burrill_-_V2_Sep_2012.pdf

12 P Burrill (2012) Safe storage. Module 8. In Better canola—canola technology update for growers and advisors. Australian Oilseeds Federation, http://www.australianoilseeds.com/__data/assets/pdf_file/0019/9082/MODULE_8_-_Safe_Storage_of_Canola_Philip_Burrill_-_V2_Sep_2012.pdf

Automatic controllers for aeration drying are also available to run fans at optimum ambient air conditions. Some controller models provide the option to switch to either cooling or drying function. Ensure that the controller is fitted with a good-quality relative humidity sensor. [13]

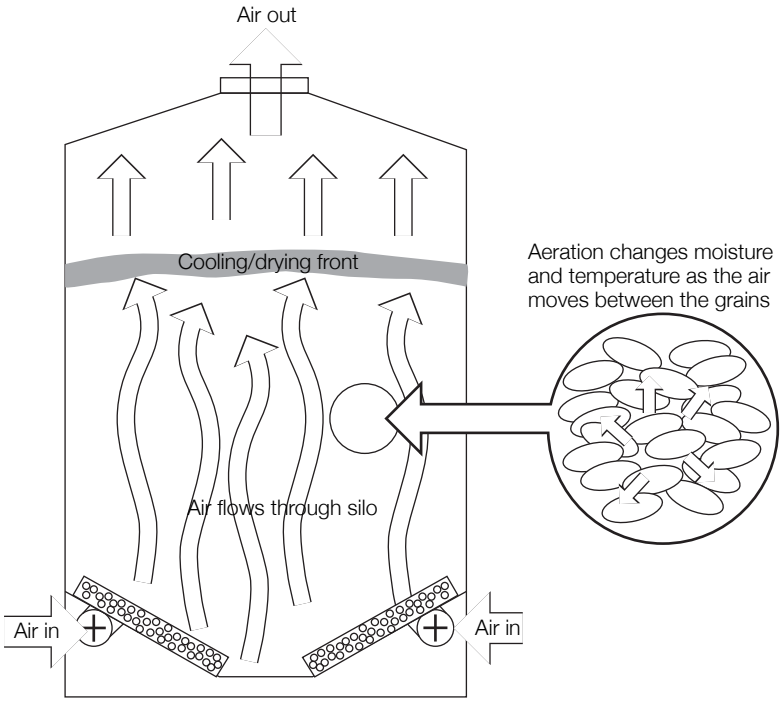

Figure 3: Cooling–drying fronts in the aeration process. (Source: C. Newman, DAFWA)

13.6.5 Heated air drying

For hot-air drying of canola seed, fixed-batch, recirculating-batch or continuous-flow dryers are all suitable for reducing moisture content. Always consider the blending option first if low-moisture canola seed is available. Canola seed dries very rapidly compared with cereal grains, so close attention must be given to temperature control and duration to ensure that seed is not over-dried. It is wise to use the minimum amount of additional heat:

- Use air temperatures in the 40–45°C range.
- Stay nearby and monitor moisture content every 15 min. Over-drying of canola seeds can occur rapidly. Seek advice if drying canola for first time.
- For batch-dryers when moisture content readings reach 8.5%, turn off the heat source and move to the seed-cooling phase with fan only. Retest once cooled.
- Use belt conveyors or run the auger full when moving seed to reduce seed damage.
- Aim to make good use of storage aeration fans, before and after the drying process. [14]

[13] P Burrill (2012) Safe storage. Module 8. In Better canola—canola technology update for growers and advisors. Australian Oilseeds Federation, http://www.australianoilseeds.com/__data/assets/pdf_file/0019/9082/MODULE_8_-_Safe_Storage_of_Canola_Philip_Burrill_-_V2_Sep_2012.pdf

[14] P Burrill (2012) Safe storage. Module 8. In Better canola—canola technology update for growers and advisors. Australian Oilseeds Federation, http://www.australianoilseeds.com/__data/assets/pdf_file/0019/9082/MODULE_8_-_Safe_Storage_of_Canola_Philip_Burrill_-_V2_Sep_2012.pdf

13.6.6 Fire risk

The dust and admixture associated with oilseeds presents a serious fire risk. Harvesting and drying are high-risk operations where constant vigilance is required. Good housekeeping in and around equipment and close observation of problem sites will reduce the threat.

In case of fire, ensure that appropriate equipment is at hand and a plan of action understood by operators. Without careful management, canola seeds in storage with high moisture content and/or high levels of admixture pose a risk of mould formation, heating and fire through spontaneous combustion. [15]

13.7 Insect pest control

Several insect pests will infest stored oilseeds, usually favouring the grain surface. These are the rust-red flour beetle (Figure 4), Indian meal moth (*Plodia interpunctella*) (Figure 5), warehouse moths (*Ephestia* spp.) and psocids (*Liposcelis* spp.)

Figure 4: Rust-red flour beetle (Tribolium castaneum).

[15] P Burrill (2012) Safe storage. Module 8. In Better canola—canola technology update for growers and advisors. Australian Oilseeds Federation, http://www.australianoilseeds.com/__data/assets/pdf_file/0019/9082/MODULE_8_-_Safe_Storage_of_Canola_Philip_Burrill_-_V2_Sep_2012.pdf

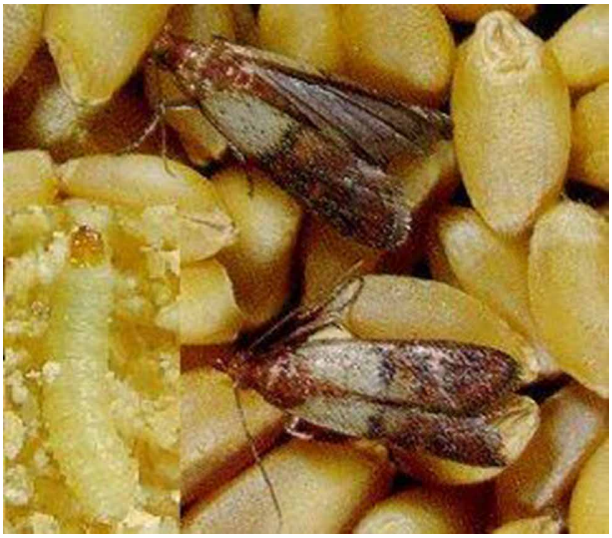

Figure 5: Indian meal moth (Plodia interpunctella).

These pests multiply rapidly given food, shelter, and warm, moist conditions. They can complete their full life cycle in about 4 weeks under optimum breeding temperatures of ~30°C.

Only a few treatments are registered for insect control in oilseeds. Always check labels prior to use and abide by use restrictions for different states and territories in Australia. For most states, treatments include phosphine, pyrethrins, DE, and ethyl formate as Vapormate®. Use of pyrethrins and DE should be limited to storage-area treatments, and Vapormate® is restricted for use by licensed fumigators only. This leaves phosphine as the key farm storage treatment for oilseed storage pests.

Phosphine fumigation must take place in a gas-tight, well-sealed silo. If the silo passes the standard pressure test, it shows that there are no serious leakage points. Given this, phosphine gas can be held in the silo at high enough concentrations for sufficient time to kill all life stages of the pest (eggs, larvae, pupae, adults).

Several silo manufacturers make aeratable, sealable silos that pass the Australian Standard Pressure Test—AS 2628. Like most oilseeds, canola seed has the ability to adsorb phosphine gas, and so it is important to use the full, correct label dose rate.

By using phosphine bag-chains, belts or blankets, placement and removal of the treatment is simplified. If using the standard phosphine tablets, ensure that tablets are kept separate from the canola seed by using trays so the spent tablet dust can be removed following fumigation.

If aeration cooling has been in use and the seed temperature is <25°C, ensure that the fumigation exposure period is ≥10 days. See product label for details.

Once the fumigation is completed, release the seal, vent the gas, and return the stored canola to aeration cooling. [16]

[16] P Burrill (2012) Safe storage. Module 8. In Better canola—canola technology update for growers and advisors. Australian Oilseeds Federation, http://www.australianoilseeds.com/__data/assets/pdf_file/0019/9082/MODULE_8_-_Safe_Storage_of_Canola_Philip_Burrill_-_V2_Sep_2012.pdf

13.8 Further reading

Stored Grain Information Hub for Grain Storage, Quality Control, Insect & Pest Management. GRDC, www.storedgrain.com.au

Storing oilseeds. Stored Grain Information Hub. GRDC, http://storedgrain.com.au/storing-oilseeds/

Vigilant monitoring protects grain assets. Stored Grain Information Hub. GRDC, http://storedgrain.com.au/monitoring-protects-grain/

Northern and Southern Regions. Stored grain pests—identification. Stored Grain Information Hub. GRDC, http://storedgrain.com.au/stored-grain-pests-id-ns/

Hygiene & structural treatments for grain storage. Stored Grain Information Hub. GRDC, http://storedgrain.com.au/hygiene-structural-treatments/

Aerating stored grain, cooling or drying for quality control. Stored Grain Information Hub. GRDC, http://storedgrain.com.au/aerating-stored-grain/

Performance testing aeration systems. Stored Grain Information Hub. GRDC, http://storedgrain.com.au/testing-aeration/

Fumigating with phosphine, other fumigants and controlled atmospheres. Stored Grain Information Hub. GRDC, http://storedgrain.com.au/fumigating-with-phosphine-and-ca/

Pressure testing sealable silos. Stored Grain Information Hub. GRDC, http://storedgrain.com.au/pressure-testing/

Grain storage facilities: planning for efficiency and quality. Stored Grain Information Hub. GRDC, http://storedgrain.com.au/grain-storage-facilities/

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