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Specialist grain storage agronomist Philip Burrill commenting on the safe storage of sunflower seed. GCTV: [Stored Grain: Sunflower Storage](#)

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# Storage

## 13.1 Storing oilseeds

Choosing to store oilseeds on-farm requires attention to detail, because limited tools are available compared with cereal grain storage.

To retain the market value of sunflowers, care must be directed at maintaining oil quality, visual appearance, and freedom from moulds, insect pests and unregistered chemicals.<sup>1</sup>

## 13.2 How to store sunflowers on-farm

For safe storage, the seed needs to be <9% moisture (40% oil), kept cool and with low (<4%) trash levels. Samples with high oil contents need lower moisture content, e.g. 50% oil–7.5% moisture. The sample also needs to have a low level of damaged seed.

Ensure that silos and storage areas are clean and free of other grain residues that could harbour storage insects. No storage chemicals are registered for sunflower, so good hygiene with adequate aeration is essential. Avoid contamination of areas to be used for sunflower storage with chemical residues.

Seed that has been hot-air-dried to reduce moisture content needs to be cooled, with aeration and moisture content levels checked carefully over the first few days. Samples taken immediately out of a drier can give a misleading reading.

Storage contracts are available, providing an opportunity for growers to capitalise on available on-farm storage. Grain for safe storage must meet the specifications outlined above, have a low percentage of damaged seed, and be monitored weekly for temperature and grain moisture. Moist or hot grain needs to be immediately turned and aerated. (Note: use only registered products for storage insect control.)<sup>2</sup>

Aeration to promote uniform, cool storage conditions is a key strategy for maintaining oil and seed quality. During autumn, aim for stored sunflower temperatures in the range 18–23°C. For the winter months, 10–18°C is achievable.<sup>3</sup>

## 13.3 Seed quality and moisture content at storage

Timing of harvest and header settings—drum speed, concave gap, and fan speed—have a significant impact on minimising trash and impurities and broken seed. 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 with high moisture content may also concentrate along silo walls, leading to heating and mould development.

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

Safe storage moisture content depends on temperature and oil content. The higher the oil content and storage temperature, the lower the seed moisture content must be for safe storage.

<sup>1</sup> P Burrill (2010) Safe storage. Better Sunflowers Agronomy Training Package, Module 7. Australian Oilseeds Federation, <http://storedgrain.com.au/wp-content/uploads/2013/06/SUNFLOWER-storage-note-Nov-2010.pdf>

<sup>2</sup> Australian Sunflower Association (2004) Harvesting and storage. The New Big Black Sunflower Pack. p. 30. Australian Oilseeds Federation

<sup>3</sup> P Burrill (2010) Safe storage. Better Sunflowers Agronomy Training Package, Module 7. Australian Oilseeds Federation, <http://storedgrain.com.au/wp-content/uploads/2013/06/SUNFLOWER-storage-note-Nov-2010.pdf>

The oil content of oilseed sunflower is ~40%. Birdseed and confectionery sunflower varieties usually have lower oil content of ~35% owing to a higher proportion of hull to kernel. All three have a trading standard and safe maximum storage moisture content of 9% (Grain Trade Australia (GTA) Standard).

Cooling seed temperatures in storage to ~20°C or lower is a key aid to reliable storage of sunflowers.<sup>4</sup>

### 13.4 Types of storage

Ideal storage for sunflowers is a well-designed, cone-based, sealable silo fitted with aeration (Figure 1).

Ease of cleaning and hygiene maintenance for empty storages and suitability for effective use of aeration cooling is important. For seed-handling equipment (augers, etc.), the aim is to minimise damage to seed when moved.

If seed requires control of insect pests, the silo is then sealed (gas-tight) for the required period as stated on the label (usually 7–10 days) to enable an effective fumigation with phosphine.

For all storage types, extra caution should be taken to prevent storm rain or other water ingress into storages.<sup>5</sup> Also, take care to prevent mice, rats and birds from entering storages.



Figure 1: Aerated, sealable silo.

### 13.5 Hygiene—structural treatment

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

4 P Burrill (2010) Safe storage. Better Sunflowers Agronomy Training Package, Module 7. Australian Oilseeds Federation, <http://storedgrain.com.au/wp-content/uploads/2013/06/SUNFLOWER-storage-note-Nov-2010.pdf>

5 P Burrill (2010) Safe storage. Better Sunflowers Agronomy Training Package, Module 7. Australian Oilseeds Federation, <http://storedgrain.com.au/wp-content/uploads/2013/06/SUNFLOWER-storage-note-Nov-2010.pdf>



Inert dust or diatomaceous earth (DE, amorphous silica) 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 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.

Insects 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 pyrethrin + piperonyl butoxide based products (e.g. Rentokil's Pyrethrum Insecticide Spray Mill Special® or Webcot's 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. These are not to be applied as a grain treatment. Use only as labels direct.<sup>6</sup>

### MORE INFORMATION

GRDC Fact Sheet: [Safe storage of sunflower seed — aeration drying and cooling](#)

## 13.6 Aeration

Aeration should be considered an essential storage tool for sunflowers.

Correctly managed, it creates uniform, cool conditions in the seed bulk and slows most quality-deterioration processes.

Aeration provides storage benefits by:

- maintaining oil quality: free fatty acid, rancidity, colour and odour
- reducing the risk of 'hot spots', moisture migration and mould development
- slowing or stopping storage insect pest breeding cycles by maintaining grain temperatures <20°C (e.g. rust-red flour beetle breeding cycle ceases at 20°C)
- maintaining seed germination and vigour for longer when seed is kept cool and dry<sup>7</sup>

### VIDEOS

Specialist grain storage agronomist Philip Burrill commenting on aeration cooling of sunflower seed in on-farm storage. GCTV: [Stored Grain: Sunflower cooling](#)

### 13.6.1 Aeration cooling

Fan/s providing low airflow rates of ~2–4 litres per second per tonne (L/s.t) can cool seed and provide uniform seed temperature and moisture conditions in the storage. If managed correctly, aeration also allows safe storage of seed at moisture levels a little above receival standards for several weeks.

Well-managed cooling aeration typically sees seed temperature fall safely to ~20°C and below within a few days.

Regular checking of sunflowers in storage is essential. Make visual inspections, check seed moisture, use a temperature probe to monitor bulk seed temperature, and sieve for insects.<sup>8</sup>

### 13.6.2 Automatic controllers

Often 'aeration cooling' fans are simply turned on and off manually, or a timer clock is used.

However, there is a lot to be gained by investing \$5000–7000 in an automatic controller that selects the optimum run-times and ambient air conditions to have fans turned on. The controller continually monitors air temperatures and relative humidity (RH) 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.<sup>9</sup>

6 P Burrill (2010) Safe storage. Better Sunflowers Agronomy Training Package, Module 7. Australian Oilseeds Federation, <http://storedgrain.com.au/wp-content/uploads/2013/06/SUNFLOWER-storage-note-Nov-2010.pdf>

7 P Burrill (2010) Safe storage. Better Sunflowers Agronomy Training Package, Module 7. Australian Oilseeds Federation, <http://storedgrain.com.au/wp-content/uploads/2013/06/SUNFLOWER-storage-note-Nov-2010.pdf>

8 P Burrill (2010) Safe storage. Better Sunflowers Agronomy Training Package, Module 7. Australian Oilseeds Federation, <http://storedgrain.com.au/wp-content/uploads/2013/06/SUNFLOWER-storage-note-Nov-2010.pdf>

9 P Burrill (2010) Safe storage. Better Sunflowers Agronomy Training Package, Module 7. Australian Oilseeds Federation, <http://storedgrain.com.au/wp-content/uploads/2013/06/SUNFLOWER-storage-note-Nov-2010.pdf>

 VIDEOS

1 Specialist grain storage agronomist Philip Burrill commenting on the use of aeration drying of sunflower seed.  
GCTV: [Stored Grain: Sunflower drying](#)

### 13.6.3 Standard aeration fans operation

- Run fans continuously during the first 3–5 days when grain is 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 days. The first cooling front has moved through.
- For the next 5–7 days, set the controller to the ‘Rapid’ or ‘Purge’ setting. This turns fans on for the coolest 9–12 h of each day to further reduce the seed temperature.
- Finally, set the controller to the ‘Normal’ or ‘Protect’ mode. The fans are now turned on for approximately 100 h per month, selecting the coolest air temperatures and avoiding high humidity air.<sup>10</sup>

### 13.6.4 Aeration drying

Well-designed, purpose-built, high flow-rate aeration drying systems with airflow rates of 15–25 L/s.t can dry seed reliably. During aeration drying, fans should force large volumes of air through the grain bulk for longer periods. This ensures that drying fronts are pushed quickly through so seed at the top of the silo is not left sitting at excessive high moisture contents (Figure 2).

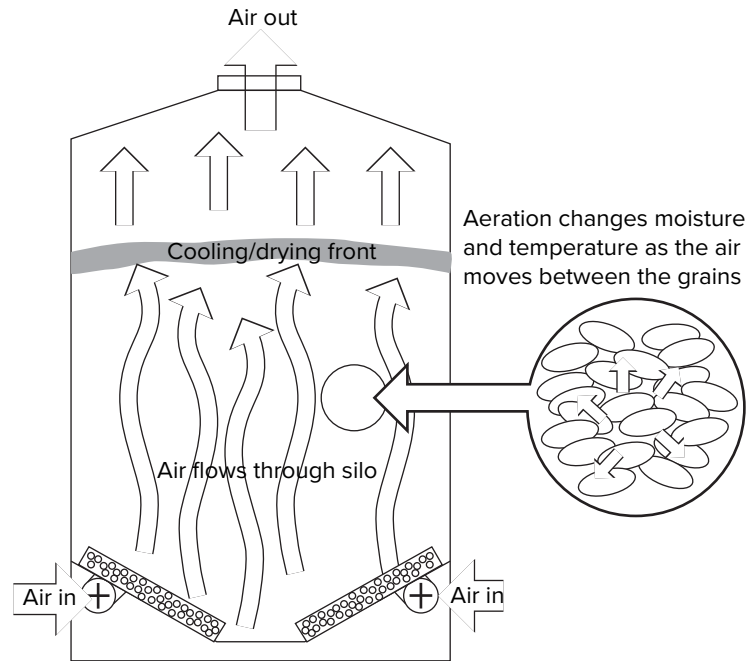
Sunflower seed is well suited to this form of drying, because air of moderate–low RH will reduce seed moisture content to safe storage levels over 5–9 days. It is, however, important to have long run-times for fans (17–22 h/day) in the first 3–5 days of aeration drying. Monitor regularly and take care that seed in the silo base is not over-dried. Seek advice on the appropriate equipment and procedures.

Do not rely on aeration-cooling equipment with small fan and low airflow rates of 2–3 L/s.t to dry high-moisture seed.

Automatic aeration-drying controllers are also available to run fans at optimum ambient air conditions. Some controller models provide the option to switch to either cooling or drying functions. Ensure that the controller is fitted with a good quality RH sensor.<sup>11</sup>

<sup>10</sup> P Burrill (2010) Safe storage. Better Sunflowers Agronomy Training Package, Module 7. Australian Oilseeds Federation, <http://storedgrain.com.au/wp-content/uploads/2013/06/SUNFLOWER-storage-note-Nov-2010.pdf>

<sup>11</sup> P Burrill (2010) Safe storage. Better Sunflowers Agronomy Training Package, Module 7. Australian Oilseeds Federation, <http://storedgrain.com.au/wp-content/uploads/2013/06/SUNFLOWER-storage-note-Nov-2010.pdf>



**Figure 2:** Cooling–drying fronts in the aeration process. (C. Newman, Department of Agriculture and Food, WA).

### 13.6.5 Drying with heated air

For hot-air-drying of sunflower seed, fixed batch, recirculating batch or continuous flow dryers are all suitable for reducing moisture content. Also, consider the seed-blending option with aeration if low-moisture sunflower seed is available.

Sunflower seed dries very rapidly compared with the cereal grains, so close attention must be given to temperature control and duration to ensure that the seed is not over-dried. A precaution is to use the minimum amount of additional heat.

- Use air temperatures in the range 40–50°C.
- Stay nearby and monitor moisture content every 15 min.
- Moisture content can fall from 11.5% to 9.0% in <1 h.
- For batch dryers when moisture content readings reach 10.5%, turn off the heat source and move to the seed-cooling phase with fan only. Retest once cooled.
- Over-dried sunflowers seeds split very easily when moved.
- Run the auger full when moving sunflower seed to reduce seed damage and dehulling, or use tubeveyors.
- Aim to make good use of cooling aeration fans, throughout storage and especially during the harvest period <sup>12</sup>

### 13.6.6 Fire risk

The dust and admixture associated with sunflower seed presents a serious fire risk. Harvesting and drying are high-risk operations where constant vigilance is required. Good housekeeping in and around equipment and keeping a close eye on problem sites reduces the threat.

<sup>12</sup> P Burrill (2010) Safe storage. Better Sunflowers Agronomy Training Package, Module 7. Australian Oilseeds Federation, <http://storedgrain.com.au/wp-content/uploads/2013/06/SUNFLOWER-storage-note-Nov-2010.pdf>

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[http://www.australianoilseeds.com/commodity\\_groups/australian\\_sunflower\\_association/](http://www.australianoilseeds.com/commodity_groups/australian_sunflower_association/)

[http://www.grdc.com.au/uploads/documents/aeration2004\\_2.pdf](http://www.grdc.com.au/uploads/documents/aeration2004_2.pdf)

Be prepared for fire; ensure that appropriate equipment is at hand and a plan of action understood by operators.

Without careful management, sunflower seeds with high moisture content and/or high levels of admixture pose a risk of mould formation, heating and fire through spontaneous combustion <sup>13</sup>

### 13.7 Insect pest control

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

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: phosphine, pyrethrins, DE, and ethyl formate as Vapormate®. Use of pyrethrins and DE is 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 a standard, 3-min pressure test, it demonstrates there are no gas leakage points. Given this, phosphine gas can be held at high enough concentrations in the silo for enough time to kill all of the life stages of the pest (eggs, larvae, pupae, adults).

Several manufacturers make aeratable, sealable silos that pass the Australian Standard (AS 2628–2010) for sealable silos.

Like most oilseeds, sunflower 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 the tablets are kept separate from the sunflower seed by using trays; the spent tablet dust can then 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 label for details. Follow all safety directions.

Once the fumigation exposure period is completed, release the seal by carefully opening the top silo lid. Vent the gas using the aeration fan for the required period, and return the stored sunflowers to aeration cooling management. <sup>14</sup>

<sup>13</sup> P Burrill (2010) Safe storage. Better Sunflowers Agronomy Training Package, Module 7. Australian Oilseeds Federation, <http://storedgrain.com.au/wp-content/uploads/2013/06/SUNFLOWER-storage-note-Nov-2010.pdf>

<sup>14</sup> P Burrill (2010) Safe storage. Better Sunflowers Agronomy Training Package, Module 7. Australian Oilseeds Federation, <http://storedgrain.com.au/wp-content/uploads/2013/06/SUNFLOWER-storage-note-Nov-2010.pdf>