

Storage of fertiliser in silos

These notes are designed to help fertiliser agents, dealers and farmers manage bulk fertiliser in silos.

Ideally, bulk fertilisers should be stored in properly constructed bays in closed sheds. But these facilities, and the equipment needed (e.g. front end-loaders), are not always available. Instead, many grain growers use silos and belt conveyors or augers to store and handle bulk fertiliser on farm.

Only certain fertilisers can be stored in silos, and then only for a short period of time. In order to minimise any problems, it is very important to only store the recommended kinds of fertiliser in the right kinds of silos and always take care in filling and emptying them.

CONVEYORS AND AUGERS

Fertilisers should be moved no more than is necessary. Handling, and the use of screw augers, can generate dust. The presence of dust, either in layers or throughout the product, may cause the fertiliser to set in storage. Dust has a greater surface area than granules and therefore absorbs atmospheric moisture more readily.

Ideally, bulk fertiliser should be moved with a belt conveyor rather than a screw auger. If a screw auger is used, make sure it is in good condition. Worn augers are more likely to damage (grind) the fertiliser by cracking granules and generating dust.

Excessive handling can also reduce the effectiveness of coating agents and oils used on some fertilisers to help prevent moisture absorption. Silos should be located well away from powerlines to ensure conveyors, augers and bulk tippers do not come in contact with live wires.

FERTILISER SILOS

Fertiliser should only be stored in silos designed for fertiliser (as opposed to grain silos) and in good condition.

Standards

Use silos that have been designed and constructed in accordance with the relevant Australian Standards.

Cone angles and design

Grain silos should not be used to store fertiliser. Fertilisers are typically denser than grain, requiring a silo of sturdier construction. Fertilisers do not flow as readily as grain, so a

steeper angle is required for the base cone. Grain silos have a 35–40° cone. It is recommended that fertiliser silos have a base cone of at least 45°.

Load

The design and capacity of the silo should be discussed with the manufacturer. The silo should be designed to handle the densest fertiliser that will be used. The indicative bulk density ranges of some commonly used fertilisers are given in Table 1. However, sometimes the actual density of a fertiliser may fall outside its indicative density range.

Table 1: Bulk density of some commonly used fertilisers.

IPF product	Bulk density (kg/m ³)
Granular Urea	730–780
Gran-Am®	800–900
MAP	950–1050
Granulock® Z	970–1010
SuPerfect®	1100–1400

Corrosivity

Fertilisers are corrosive. It is recommended that the internal surfaces of the silo receive two coats of epoxy paint to provide protection against corrosion. Silos constructed of stainless steel or fibreglass do not require internal protection.



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Operation

Always follow the silo manufacturer's safety and operational directions. Storage problems can be minimised by good management and housekeeping, keeping the following points in mind:

- Do not put damp or wet fertiliser into silos. It may not flow evenly when emptying, which can cause serious damage to the silo if product falls suddenly.
- Do not fill the silo so that fertiliser touches the silo roof. Moisture condensation off the roof can have a detrimental effect on the product.
- Keep silos locked when unattended or deny access.
- Ensure covers are tightly closed when not in use to prevent exposure to the elements.
- Do not store fertiliser in silos longer than necessary.
- Do not store fertiliser from one season to the next.

SILO SAFETY

Silos can be dangerous. Follow safe working practices and ensure the health and safety of yourself and others.

Silos are legally regarded as Confined Spaces and should not be entered under normal conditions. The atmosphere in confined spaces can be dangerous, with high internal temperatures. Guidance can be found in AS 2865:2009 – Confined Spaces.

Fertiliser 'hangs up' in a silo

Fertiliser setting or hanging up in a silo can result in serious injury or death. If, for instance, fertiliser hangs up on one side of the silo while it is being emptied, it can cause the silo to collapse on its side. Before taking any action, refer to the silo manufacturer's advice on how to deal with the situation

PRODUCT SELECTION

Not all fertilisers can be stored in silos. Those that can, should only be stored for a short period of time (Table 2). They should be ordered close to the time of intended use, and not stored from one season to the next.

Table 2: Silo storage guidelines for Incitec Pivot products

Products that may be stored in silos for a limited time	Products that should not be stored in silos
Straights Granular Urea Gran-Am (granulated ammonium sulphate) MAP Granulock Z	Cal-Am® Cal-Am blends DAP DAP blends Sugarcane NPK blends Blends containing zinc sulphate monohydrate
Blends Urea/Gran-Am blends Urea/MAP or Granulock Z blends Urea/Gran-Am/MAP or Granulock Z blends	SuPerfect SuPerfect/potash blends

Note: If a product is not listed in this table, it should be regarded as being unsuited to storage in silos.

Critical Relative Humidity (CRH)

Critical Relative Humidity is one of the factors that influence how well and for how long a fertiliser will store in a silo. CRH is the relative humidity above which the fertiliser readily absorbs moisture from the atmosphere, and below which it will not absorb atmospheric moisture. Fertilisers with a high CRH (greater than 70%) generally have good storage characteristics. Those with a low CRH don't.

The CRH of blends is usually at or lower than the ingredient with the lowest CRH. As a rule:

- Straights will store better than blends;
- MAP and MAP blends store better than DAP and DAP blends. DAP-based products are not recommended for storage in silos;
- Cal-Am, Cal-Am blends and blends containing zinc sulphate monohydrate should not be stored in silos.

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Table 3: Typical critical Relative Humidity of commonly used fertilisers

Critical relative humidity (%)	IPF product
80–85	SuPerfect (SSP)
70–75	Urea, Gran-Am, MAP
<70	DAP
55–60	Zinc sulphate monohydrate
50–60	Cal-Am

Other factors

While the CRH of a fertiliser is important, the other factors that influence how well a product will store in a silo include:

- Exposure of the fertiliser to the elements during its time in storage at the despatch point, whenever it has been handled, in transit, and at the time the silo was filled.
- Prevailing weather conditions (temperature, humidity) after being placed in the silo.
- The age and condition of the silo.
- The age and state of repair of augers used to handle the fertiliser.
- Excessive handling of the fertiliser resulting in granule breakdown.
- The presence of fines and dust, which increase absorption of atmospheric moisture, cause bridging between fertiliser granules and product setting.
- Use of coating agents. Many fertilisers are waxed or oiled to reduce moisture ingress and improve storage characteristics. Over- or under-oiling, however, can be detrimental.
- The moisture content of the fertiliser. In general, the higher the free moisture content of a fertiliser, the worse it will store. As an example, MAP is dried to a low moisture content. It can be placed in silos, whereas other fertilisers with higher moisture content cannot.
- The physical quality of the fertiliser. Fertiliser granules that have been physically degraded and/or contain fines will absorb moisture more quickly than non-degraded product. If the product is degraded or dusty, try to use it as quickly as possible.

Blends

Blends require very careful management. They should be ordered when required and only stored in silos as an interim measure. Blends should not be purchased and stored in advance of the season.

OTHER ISSUES

Grain storage

If a fertiliser silo is used out of season to store grain, ensure the silo is free of fertiliser before placing grain in it, and free of grain before placing fertiliser in it. Unwanted grain may constitute a weed threat in crops in which the fertiliser is used, while the dust from phosphorus fertilisers may add to grain cadmium concentrations. If the grain is used for human consumption, this may contribute to a violation of the cadmium food standards.



WARNING

Belt conveyors, augers and silos should be operated in strict accordance with the manufacturer's instructions.

Many factors can influence fertiliser quality, and its suitability for use and its storage life in silos. These factors extend from the manufacturer or supplier of the fertiliser, through the supply and distribution chain, to the type of equipment used on farm and the prevailing weather conditions. They include such factors as the source of raw materials, the manufacturing process and use of coating agents and oils, exposure to the elements, the conditions under which the product has been shipped if imported, stored in bulk, transported by land in Australia, and the climatic and seasonal conditions (temperature, humidity).

Problems may occasionally be encountered with fertiliser products that can usually be stored in silos without mishap.

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