

**General rules for
storing fertilizer
products** for
distributors and
customers

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Good storage practices will preserve the quality and facilitate the handling of your fertilizer; We also recommend that you follow the storage rules and guidance available from your supplier, grower, fertiliser association or relevant government department or ministry.

This document is intended to provide general recommendations and good practices on:

1. **Recommendations for the design and construction of warehouses for the storage of fertilizer products.**
2. **General Fertilizer Storage Rules and Precautions (with and without Ammonium Nitrate).**
3. **Compatibility Matrix.**
4. **Risks of improper storage.**
5. **Recommendations for indoor and outdoor storage.**
6. **Stacking Packages.**
7. **Rules and precautions for storing fertilizer products (with and without ammonium nitrate).**
8. **Potential consequences of incorrect storage of fertilizer products with Ammonium Nitrate.**
9. **Conservation of fertiliser products.**
10. **Personnel Training.**

01.

Recommendations for the design and construction of warehouses for the storage of fertilizer products

Recommendations for the design and construction of warehouses for the storage of fertilizer products

- The storage facilities will comply with current regulations on Fire Safety.
- The buildings will be designed on a single floor, without basements or cellars, except for those intended for the passage of extractor belts, if they are underground.
- The construction of moats, drains and canals will be avoided.
- The roof will be of light structure and no wood or other combustible materials will be used in its construction.
- Buildings must be reinstalled for lightning.
- Heating or electrical installations shall be designed in such a way that fertilizers can never come into contact with them.
- Light sources will always be cold and their components will not be combustible. Lamps must be placed and protected to prevent dust build-up.
- The electrical installation will be executed according to the Low Voltage Regulations.

02.

General Fertilizer Storage Rules and Precautions (with and without Ammonium Nitrate)

General security measures

- Whenever possible, fertilizer should be stored at least 10 meters away from a watercourse or field drain and well away from a water source (e.g., well) to avoid contamination. Keep fertilizers away from food and drinking water, as well as children and animals.
- Store fertilizers in dry, ventilated areas, away from sources of heat and moisture. Whenever possible, fertilizers should be stored inside an enclosed building. If this is not possible, they should be covered to provide protection from the weather (sun, heat, rain or humidity) and also to reduce the risk of theft.
- Use appropriate, closed, and properly labeled containers for storing fertilizer.
- Keep the instructions for use and Safety Data Sheets available.
- Follow good cleanup practices, clean up spills, and keep walls and floors and equipment clean.
- Prevent leakage of handling equipment, e.g. fuel, oil and hydraulic fluid. Avoid damaging the fertilizer during handling.
- Whenever possible, use pallets to avoid overloading the pile.
- The ideal storage temperature should be between 5 and 30 °C (some types of fertilizers are sensitive to high temperatures). Store fertilizers away from heating systems and other potential sources of heat, such as light bulbs. Do not allow smoking, welding, or fire.
- Do not store incompatible products (such as ammonium nitrate and urea) near each other (see compatibility matrix); Keep them well segregated. Materials that may react with ammonium nitrate-based fertilizers, such as chemicals (See compatibility matrix), organics, oils, pesticides, or combustible materials (e.g., wood, hay, and straw) should not be present or should be kept away from the fertilizer product.

- Make sure there is a distance of at least 5 meters between incompatible materials. Most nitrogen fertilizers contain nitrates that break down when heated, developing toxic nitrogen oxides from 150 °C. Some products can even release carbon oxides (CO, CO₂) and sulfur oxides.
- Organize fertilizers by category and avoid mixing different types of fertilizers.
- Preserve the containment of rodents and other intruders, as well as the cleanliness of the storage place so as not to attract them.
- The warehouses must be covered by lightning rods, means of detection and have means of fighting and extinguishing fires.
- Electrical panels, transformers and motors must be located outside the storage area.

03.

Compatibility Matrix

Compatibility Matrix

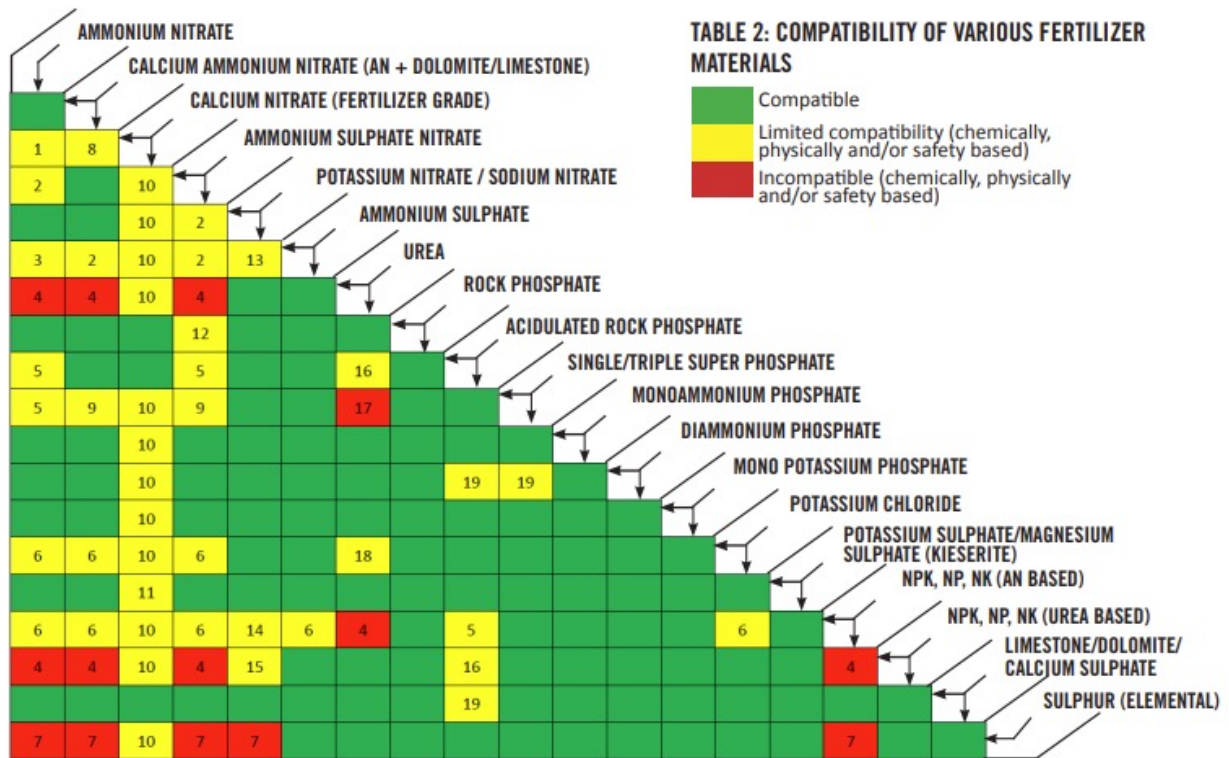


Figure 1 - Compatibility matrix (source: www.fertilizerseurope.com)

04.

Risks of improper storage

Risks of improper storage

- If stored incorrectly, fertilizers can undergo changes in its chemical or physical quality. As a consequence, their yield and mobility are also affected, which can lead to zero or even harmful effects on plants.
- In addition, improper contact between chemicals or minerals can lead to contamination, posing risks to the professionals handling them, as well as adverse reactions in the field.
- Another point to consider in relation to the way fertilizers are stored is the risks of collapse and damage to packaging, which can result in the loss of inputs. And, as a result, there is a loss of profitability of production.

05.

Recommendations for indoor and outdoor storage

Recommendations for indoor and outdoor storage

General rules for indoor storage

- The warehouse should preferably be located on the ground floor and made of a material that is not easily combustible (e.g. concrete, brick or steel). The storage area should be well ventilated, dry, and the floor should have an even surface and no holes.
- The warehouse should be ventilated and ideally equipped with ventilation equipment that helps dissipate heat and release fumes in the event of fire or decomposition.
- The warehouse must be cleaned before the product is delivered and must be kept tidy. They should be inspected regularly, and stocks checked so that stored quantities are known at any time when necessary.
- When there are local or national regulations that are applicable, depending on the type of fertilizer product, comply with the storage limit.
- The size of fertilizer piles should be limited in accordance with good material stacking practices, namely.
- Store at least 1 meter away from the eaves and beams and, in the case of packaged fertilizer, also from the walls. Keep a distance of 1 meter, ideally from other fertilizer piles.
- Do not store different packaged fertilizers in the same pile.

General rules for outdoor storage

Fertilizers, by their nature, should not be stored at the risk of climatological risks, even if they are protected by plastics. This conservation does not guarantee the physical stability of the fertilizing products. When the fertilizer is stored abroad, the responsibility for the quality of the fertilizer will be exclusively with the warehouseman.

If there is a need to store outside:

- Store on a raised, well-drained, dry and smooth surface (e.g. on pallets).
- Protect the bags from moisture and direct exposure to water, especially if they are stacked outdoors.
- Place a layer of empty pallets above the place where the material is to be placed to prevent deterioration of the product caused by the effects of temperature and humidity. Also follow the advice of the manufacturer/supplier in the SDS to preserve the quality of the product.
- Cover the piles, and the cover should be attached to the lower pallet to prevent damage, which can be caused by friction.

06.

General rules of stacking containers

General rules of stacking containers

Stacking of packaging:

- Stack the bags on a solid, level base to ensure stability.
- Avoid stacking more bags than the pallet or stacking rack can support, respecting the maximum recommended weight (on the pallet or per frame level).
- Align the bags evenly to prevent them from moving and becoming unstable.
- Use support structures to prevent the bags from moving or falling, if applicable.
- Maintain proper distance between bag stacks to allow air circulation and facilitate access for inspections.
- Do not stack more than 2 heights and if you need one more height, distribute the load in a pyramidal shape.

Big Bag Stacking


- Stack big bags on a sturdy, level base to ensure the stability of the goods. If it is stacked at more than one height, you should do it in a pyramidal shape.
- Evenly distribute the weight over the big bags to avoid excessive stresses at specific points.
- When necessary, use pallets or suitable support structures to facilitate the stacking and movement of big bags.
- When necessary, tie the big bags tightly to prevent them from moving or falling during stacking.
- Maintain proper distance between stacks of big bags to allow air circulation and facilitate access for inspections.
- If there is a storage of more than 500 tons, it is recommended that an access corridor for emergency vehicles is guaranteed.


07.

Tips for storing fertilizer products (with and without ammonium nitrate)

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Tips to ensure safe fertilizer storage


 DO	Follow all national regulations and recommendations in the Product Safety Data Sheets (where applicable).
	Have storage instructions available at all times.
	Have an emergency plan in place and rehearse it regularly.
	Train staff on product handling, associated risks, fertilizer storage rules, and emergency actions.
	Apply safety signage and use the appropriate PPE.
	Correctly identify fertilizer and bulk packaging.
	Maintain unobstructed access to emergency equipment and emergency exits.
	Motor vehicles must be equipped with non-sparking devices and must always be parked outside the storage area.
	Vehicles, shovels and scrapers must be equipped with fire extinguishers.
	Record the movements of products (inputs and outputs) and the use attributed to fertilizers, as applicable. Products that have been stored for a longer period of time must be shipped first (FIFO rule applies, First in – First Out).
	Store fertilizer products inside a building or enclosed area whenever possible, following the safety instructions.
	Keep the warehouse clean and tidy. Avoid storage in poorly ventilated, humid or outdoor spaces, protecting the fertilizer from sun exposure.
	In the case of storing fertilizers outdoors, check regularly to make sure that the pile has not been tampered with or has no apparent damage.
	Obtain permission from the warehouse manager before carrying out maintenance work.
	Carry out periodic safety inspections in storage premises.
Carry out regular stock checks and, if the fertilizer is based on ammonium nitrate, or other explosive precursor, immediately report any theft or loss of stock to the police or other competent authority in your country. Report suspicious behavior.	

 DON'T	Never store fertilizer in moist areas, exposed to direct sunlight, or subject to extreme temperature variations. They should be kept in cool, dry and well-ventilated places.
	Do not leave the product in the field at night or outdoors.
	Do not store fertilizers together with incompatible substances, such as chemicals, fuels, or flammable materials. This can lead to dangerous reactions or even explosions.
	Do not store fertilizer products in publicly accessible premises or visible from public roads.
	Do not use damaged or rusty containers to store fertilizer, as this can lead to soil and water contamination.
	Avoid storing fertilizers for longer periods of time than necessary, as they can lose effectiveness over time or even become dangerous due to decomposition or chemical reactions.
	Fertilizers that are precursors of restricted explosives shall not be made available to unlicensed individuals.

Tips to ensure the safe storage of Ammonium Nitrate-based fertilizers:

In addition to the general rules for the storage of fertilizers, the following should be considered:

 DO	Always keep a daily record of the stored product.
	Have storage instructions available at any time.
	Products that have been stored for a longer period of time must be shipped first (apply the FIFO, First in – First Out rule).
	Train workers for safe product handling and emergency response.
	Keeping the warehouse clean and packed.
	Maintain free access to exits and emergency equipment.
	Place warning and emergency signage.
	Conduct regular safety inspections.
	For maintenance work: obtain approval from the responsible person, follow the correct instructions and procedures and use only authorized electrical equipment.
	In the event of fire or self-sustaining decomposition, evacuate when you go and call the fire brigade. Keep only the people relevant to emergency management.
	Nitrogen fertilizers should be stored away from water and drains so that spills cannot cause contamination.
	Store these products separated by a physical barrier, from combustible materials, reducing agents, acids, sulfur, chlorates, chromates, nitrites, permanganates, substances containing metals, among other incompatible substances.
	Correctly identify and label products.
	Minimize dust generation.
	Keep the product away from organic matter in general (hay, straw, grain, seeds, agricultural chemicals, oils, fuels, among others).
	Make sure that they do not come into contact with urea or fertilizers with a risk of decomposition.

 DON'TS	Do not allow access to unauthorized people.
	Do not smoke or use fire.
	Immediately report any theft of stock or loss to the police or other competent authorities in your country. Report any suspicious behavior.
	Do not bring gas bottles, fuel drums or oil near fertilizers or store gas bottles, fuel drums or oil in close proximity.
	Do not use bare or incandescent portable lamps.
	Do not use organic substances, such as sawdust, to clean or dry wet floors.
	Do not use chemical fire extinguishers, foams, steam or sand on decomposing fertilizers.
	Do not exceed the amount of fertilizer allowed by law.

08.

Potential consequences of incorrect storage of Ammonium Nitrate fertilizer products

Potential consequences of incorrect storage of Ammonium Nitrate fertilizer products

Fire

- N.A.-based fertilizers are not combustible, so the risk of fire depends on the presence of other combustible materials:
 - Equipment lubricants.
 - Fuels or fluids used in handling equipment.
 - Fuels stored or used in the construction of the warehouse or compartments.
- Nitrogen oxides, which are very toxic are produced in fires with fertilizers.
- The size and intensity of the fire depend on the type of quantity of the fuels.

Detonation

- Since stored fertilizers are made of low porosity granules, they are also very resistant to detonation.
- For a fertilizer to detonate, it must be under conditions of high pressure and temperature, so to reduce this possibility, any risk of confinement of the fertilizer must be eliminated.
- Fertilizers with more than 80% ammonium nitrate in their composition (more than 28% nitrogen) must have been subjected to a detonability test, which certifies their high resistance to it.

Self-sustained decomposition

- The phenomenon of self-sustaining decomposition occurs with some NPK compounds that decompose when they are heated to high temperatures by a heat source, so that the decomposition advances even after the source is removed.
- During the decomposition of these fertilizers, and depending on their composition, a wide range of gases can be produced, some of which can be toxic and/or irritating.
- Only water should be used to combat this phenomenon.

Storage of fertilizer products

Storage of fertilizer products:

In order to achieve adequate conservation of the fertilizer during storage, the potential harmful effects of the following environmental agents must be known:

- Moisture absorption
- Exposure to solar radiation.
- Strong temperature variations on the same day.

Exposure to these environmental agents, without following the rules and good storage practices can affect the effectiveness of the fertilizer:

- **Change of properties or characteristics:** If fertilizers are not stored properly, the product can degrade and may lose its characteristics due to the loss of essential nutrients. This reduces the effectiveness of the fertilizer when applied.
- **Clumping or compaction:** Moisture absorption and exposure to air can cause clumping or compaction in granular fertilizers. This makes it difficult to apply evenly and can clog dispensing equipment.
- **Contamination:** If fertilizers are stored near incompatible chemicals, contamination can occur. This can affect the quality of crops and, depending on the composition of the fertilizer product, damage the environment.
- **Health and safety risks:** Improperly stored fertilizers can pose risks to the health of workers and the safety of the storage room. The impact on health or safety is associated with the physicochemical characteristics of the fertilizer product: For example, some fertilizers are oxidizing, corrosive or toxic.

10.

Recommendations for Staff Training:

Recommendations for Staff Training:

Storage personnel, or any other personnel related to it, must receive specific instructions on:

- Properties and characteristics of stored fertilizers.
- Function and correct use of safety elements and installations and personal protective equipment.
- Consequences of incorrect operation or use of safety elements and installations and personal protective equipment.
- Hazards that can arise from a fire.
- Accidents contemplated in the Self-Protection Plan and specific actions to control them.
- Protection Plan (ADR and Legal Requirements) where applicable.

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