FACT SHEET
JUNE 2024

GRAN-AM®

%N	%S
20.5	24

Gran-Am® is a high analysis compound fertiliser used as a source of nitrogen (N) and sulphur (S) otherwise known as ammonium sulphate. Ammonium sulphate is the most used sulphate fertiliser totalling 50% of the worlds sulphur fertiliser use. Ammonium sulphate has been produced domestically since the 1960s while globally ammonium sulphate has been produced for over one hundred years.

MANUFACTURE

Ammonium sulphate ($NH_4)2SO_4$) is produced by three different processes.

1. as a by-product of caprolactam ($CH_2)_5COHN$) used in the production of textiles,
    - Ammonium sulphate is produced as a by-product from the caprolactam oxidation process stream and the rearrangement reaction stream.
2. synthetic manufacture
    - Ammonia gas (NH_3) is directly neutralized with sulphuric acid (H2SO4) to produce $(NH_4)_2SO_4$. The reaction is $2NH_3 + H_2SO_4$ $(NH_4)2SO_4$.
3. as a coke oven by-product.
    - Coke oven by-product ammonium sulphate is produced by reacting the ammonia recovered from coke oven off gas with sulphuric acid.

Synthetic manufacture is the most common method used to produce ammonium sulphate. The neutralisation of sulphuric acid results in the production of slurry which is then cooled and fed into a rotary granulator, tumbling to form a solidified granule. The tumbling of this dried product results in spherically round and polished fertiliser granules which are then sized to 2 – 4 mm. Under and oversized granules are crushed and re-tumbled to form the correct size. The granules undergo a further drying and cooling to reduce caking in storage and produce a high crush strength to reduce degradation from product handling.

Analysis and Use

Gran-Am is a high analysis (20.5% N, 24% S) cost effective fertiliser used predominately in cropping and pasture systems.

Gran-Am is primarily used as a sulphur (S) source applied as a compound fertiliser or in fertiliser blends. Gran-Am contains sulphur in the sulphate form (SO_4^{2-}) which is readily available in the soil. The popularity of urea and ammonium phosphate fertilisers MAP and DAP means that often little or no sulphur is being applied. Sulphur deficiency has emerged and with it a need to incorporate sulphur

in fertiliser programs. This has been exacerbated by higher crop yields, the inclusion of high sulphur-demanding crops such as canola in crop rotations, and the adoption of reduced tillage practices meaning that less sulphur is mineralised from soil organic matter.

Blends and Storage

Ammonium sulphate is the preferred sulphur source is most fertiliser blends. It is used in horticulture, sugarcane, and nitrogen-fertilised grass pastures. SuPerfect® or single superphosphate (8.8% P, 11% S) is less commonly used in blends except for pasture systems.

Ammonium sulphate is preferred where:

- there is no need to apply phosphorus due to legislative or phosphorus requirements may be exceeded.
- If nitrogen is required ammonium sulphate is typically the best option.

Most fertiliser products cake in storage. The degree to which this occurs depends on the product, how and where it is stored and the length of time in storage, the product's moisture content, granule shape and hardness, the presence of fines and dust, atmospheric humidity, and the temperature. At the surface of granules, the fertiliser can dissolve, form chemical bridges with adjacent fertiliser particles and re-crystallise, cementing the granules together. Blends do not store as well as the ingredients from which they are made, and the more blend ingredients used, the worse the storage characteristics become. Blending fertilisers causes chemical reactions which may occur at the interface between granules, resulting in the formation of more troublesome fertiliser salts.

Fertiliser blends and storage are determined by the Critical Relative Humidity (CRH). CRH is the relative humidity (at a given temperature) above which a fertiliser readily absorbs moisture from the atmosphere, and below which it will not absorb atmospheric moisture. In general, the higher the CRH, the less likely the fertiliser is to absorb moisture and the better the storage characteristics.

Table 1: Critical Relative Humidity (%) of pure fertiliser salt ammonium sulphate at 30˚C:

Fertiliser Salt	Product	CRH
Ammonium Sulphate	Gran-Am®	79

Table 2: Critical Relative Humidity of urea in blends:

Salt	CRH	CRH in Blends with Urea
Gran-Am®	79	56

Table 3: Gran-Am® blend compatibilities.

Compatible with Gran-Am®	Limited Compatibility
Urea, Cal-Am®, DAP, MAP, Granulock® SS, Granulock® Z, SuPerfect®, Muriate of Potash, Sulfate of Potash, Granulock® Blue, Magnesium Oxide, Granubor, Copper Granules, Zinc Sulfate Monohydrate, Granulock® Big Z, Trigger, Manganese Sulfate, Iron Oxy Sulfate.	Kieserite

NOTE: If a product is not listed in this table, it should be regarded as being incompatible to Gran-Am.

Management

Gran-Am is used in many different, environments and soil types as a source of nitrogen and sulphur. Being an ammonia-based fertiliser Gran-Am® is prone to nitrogen losses via the volatilisation pathway where nitrogen is lost to the atmosphere as ammonia gas through various reactions on the soil surface. The risks associated with ammonia volatilisation when surface applying ammonia-based fertilisers are well known.

However, Gran-Am is particularly susceptible to loss where soil pH exceeds 7.0. Calcareous soils can also increase the risk of ammonia volatilisation where 'free lime' or calcium carbonate is present. Ammonium sulphate when surface applied reacts with calcium carbonate to form ammonium carbonate and calcium sulphate (1). The calcium sulphate precipitates, and the ammonium carbonates decomposes releasing ammonia and carbon dioxide to the atmosphere (2). The pH of the surrounding soil then decreases (3).

This reaction is summarised below:

$$(NH_4)_2SO_4 + CaCO_3 \leftrightarrow (NH_4)_2CO_3 + CaSO_4 \quad (1)$$

$$(NH_4)_2CO_3 + H_2O \leftrightarrow 2NH_3\uparrow + H_2O + CO_2\uparrow \leftrightarrow 2NH_4OH \quad (2)$$

$$NH_4^+ + OH^- \leftrightarrow NH_4OH \leftrightarrow NH_3\uparrow + H_2O \quad (3)$$

Gran-Am exists in the sulphate form (SO_4^{2-}) and being an anion is susceptible to leaching where sulphate is physically moves down the soil profile with water. If sulphate is not taken up roots or immobilised within the soil it is susceptible to leaching through excessive rainfall of irrigation. Leaching losses are typically higher in sandy or duplex soil types.

Livestock Supplementation

Livestock cannot always obtain the nutrients they need in sufficient quantities from the forage they consume or the diet they are fed. Direct mineral supplementation may be necessary.

Gran-Am is the only fertiliser product marketed by Incitec Pivot that may be used as a source of non-protein sulphur. Gran-Am granules are large which may increase the risk of ammonia toxicity in ruminants or result in refusal of dry mix supplements. This may be overcome by milling the product to reduce particle size.

The principal source of sulphur for livestock is protein in green feed and grain. As pasture matures and protein levels drop, sulphur intake diminishes. The nitrogen: sulphur (N:S) ratio in pasture remains constant as the pasture declines in quality. A target N:S ratio of 10:1 is recommended in the diet and supplements for ruminants. This can be achieved by adding 1 kg of Gran-Am to every 5 kg of urea in the supplement; or where elemental sulphur is used, 1 kg of elemental sulphur to every 20 kg of urea.

SAFETY DIRECTIONS

Refer to the Safety Data Sheet (SDS) for more detailed safety advice. Before use, read the Product Label and the SDS. Use safe work practices and avoid contact with the eyes and skin. Avoid ingestion and inhaling dust. Protective clothing, eyewear and dust masks should always be used when dealing with this product. Observe good personal hygiene, including washing hands after use. Avoid loss of fertiliser to waterways.

WARNING

This document contains information of a general nature. Before using fertiliser seek independent agronomic advice. Fertiliser programs may need to be varied depending on the plants being grown, climatic and soil conditions, application methods, irrigation, agricultural and livestock management practices, the soil's fertility, and cultural practices. ('Unforeseen Elements')

Fertiliser may burn and/or damage crop roots or foliage. Foliar burn to the leaves, fruit or other plant parts is most likely to occur when fertilisers are foliar applied at high concentrations and/or on a regular basis, different products are mixed and sprayed together at cumulatively high rates, the water is of poor quality, or the spray is applied under hot dry conditions, e.g. in the heat of the day.

Fertiliser and supplements may affect animal health. Seek independent advice before using any supplements in livestock rations.

DISCLAIMER

As Unforeseen Elements are beyond the control of Incitec Pivot Limited, in no event Incitec Pivot Limited and its related bodies corporate be liable or accept any responsibility whatsoever for any direct, indirect, punitive, incidental, special or consequential damages (including but not limited to loss of revenue, crops and livestock), in respect of the illness, injury or death of a person, damage to property (including of a third party), or any other loss whatsoever arising out of or connected with the use or misuse of this fertiliser, or its transport, storage, handling or application. Where Incitec Pivot Limited and its related bodies corporate's liability cannot be lawfully excused, it and its related bodies corporate's liability shall be limited to the replacement of, or cost of the fertiliser supplied. The buyer accepts and uses this product subject to these conditions.

COPYRIGHT