AGRITOPIC

July 2010

Ammonium Nitrate Fertilisers

Cal-Am
Cal-Gran

1. AMMONIUM NITRATE FERTILISERS

Incitec Pivot Fertilisers no longer markets fertilisers comprised entirely of ammonium nitrate, e.g. Nitram. Such fertilisers are classified as Dangerous Goods, i.e. Class 5.1 Oxidizing Agents.

In place of Nitram, Incitec Pivot Fertilisers markets an imported ammonium nitrate based fertiliser, known as **Cal-Am**.

Cal-Am is Calcium Ammonium Nitrate (CAN). It is a uniformly granulated fertiliser comprised of 80% ammonium nitrate and 20% calcium carbonate.

The calcium carbonate (lime) makes Cal-Am an inherently safer product to work with than Nitram. Decomposition reactions involving ammonium nitrate are enhanced under acid conditions, and are suppressed under alkaline conditions (high pH).

On its own, Cal-Am can not be detonated and exploded. It is not classified as being a Dangerous Good.

The reactivity of ammonium nitrate products can change when mixed with other materials. For this reason, and as it may be misused in acts of terrorism, Cal-Am is treated as a Security Sensitive fertiliser. Farmers wishing to purchase and use Cal-Am must be licensed to do so. These regulations apply to any fertiliser containing more than 45% ammonium nitrate (55% Cal-Am).

Cal-Am is only available on the Australian mainland. Security Sensitive Ammonium Nitrate fertilisers have been banned in Tasmania.

Incitec Pivot Fertilisers markets a blended fertiliser known as **Cal-Gran**, which is comprised of 55% Cal-Am and 45% Gran-am (granulated ammonium sulfate), so that farmers who don't want to go to the trouble of obtaining and complying with the necessary licensing requirements can continue to have access to an ammonium nitrate based fertiliser.

The analyses of Cal-Am and Cal-Gran are shown in the following table.

Analyses of Incitec Pivot Fertilisers Ammonium Nitrate Based Fertilisers

Product	% N			% S	% Ca
	Ammonium	Nitrate	Total		
Cal-Am	13.5	13.5	27		8
Cal-Gran	16.8	7.4	23.9	10.8	4.4

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2. SECURITY SENSITIVE AMMONIUM NITRATE (SSAN)

In Australia, fertilisers containing more than 45% ammonium nitrate are classified as Security Sensitive Ammonium Nitrate (SSAN).

Anyone who is responsible for or is involved in the unsupervised transport, storage, handling or application of SSAN must be licensed. These people will require a:

- police check, and a
- politically motivated violence (PMV) check.

Organisations and individuals who transport or store SSAN will need to provide a Security Plan to the regulatory authority. It will have three main elements:

- personnel management;
- site security; and
- procedures.

Only people with a legitimate need, such as farmers, are permitted to purchase and use SSAN products on the Australian mainland. Home gardeners are not allowed to buy SSAN fertilisers.

SSAN fertilisers have been banned in Tasmania.

The only product on the Incitec Pivot Fertilisers Product Range that is classified as SSAN is Cal-Am.

Very little Cal-Am is sold as a straight. It is mostly used in blends containing up to 55 % Cal-Am (equivalent to 45% ammonium nitrate), so that the resultant blend does not have to be treated as SSAN.

Farmers who wish to apply ammonium nitrate are encouraged to use Cal-Am and Cal-Gran Blends, applying other nutrients such as phosphorus (P), potassium (K) and sulphur (S) at the same time.

This is convenient, and avoids the need for a Security Sensitive licence and the associated compliance costs.

Farmers who wish to obtain a licence to use Security Sensitive Ammonium Nitrate fertilisers will need to contact the relevant State regulatory body.

They should also check with their local Incitec Pivot Fertilisers fertiliser reseller, as they may not have sought the necessary licence to supply and resell SSAN.

It may be necessary for the farmer to open a direct account with Incitec Pivot, and take delivery of the product directly from an Incitec Pivot Fertilisers Primary Distribution Centre at one of the major ports, i.e. Cairns, Townsville, Mackay, Pinkenba (Brisbane), Newcastle, Geelong and Adelaide.

If farmers can not take delivery of the SSAN themselves, they will need to arrange for a SSAN licensed transport operator to pick it up and deliver it for them.

The State and Territory agencies administering the licensing system, their contact details and the words used to describe security sensitive fertilisers, are listed in the table on the next page.

Go to the website, and search under the descriptive product name listed.

Security Sensitive Ammonium Nitrate fertilisers are banned in the State of Tasmania.

QLD: Security Sensitive Ammonium Nitrate (SSAN) Explosives Inspectorate Department of Mines and Energy Web: www.dme.qld.gov.au Phone: 07 3224 7512, 1800 657 567 Email: explosives@dme.qld.gov.au
NSW: Security Sensitive Dangerous Substances WorkCover NSW Web: www.workcover.nsw.gov.au Phone:13 10 50 Email contact@workcover.nsw.gov.au
ACT: Security Sensitive Substances Office of Regulatory Services Dangerous Substances, Gas and Plant Web: www.ors.act.gov.au Phone: 02 6205 0200, 02 6207 3000 Email: workcover@act.gov.au
VIC: High Consequence Dangerous Goods WorkSafe Victoria Web: www.worksafe.vic.gov.au Phone: 03 9641 1444, 1800 136 089 Email info@worksafe.vic.gov.au
SA:Security Sensitive Ammonium Nitrate (SSAN) SafeWork SA Web: www.safework.sa.gov.au Phone: 08 8226 4885, 1300 365 255 Email: clifford.ray@saugov.sa.gov.au
WA: Security Risk Substances Department of Mines and Petroleum Web: www.dmp.wa.gov.au Phone: 08 9358 8001 Email: rsdclientservices@dmp.wa.gov.au
NT: Security Sensitive Substances, Security Sensitive Ammonium Nitrate (SSAN) NT WorkSafe Web: www.worksafe.nt.gov.au Phone: 1800 019 115 Email: ntworksafe@nt.gov.au
TAS: Security-sensitive Dangerous Substances Workplace Standards Tasmania Web: www.wst.tas.gov.au Phone: 1300 366 322 (inside Tasmania) 03 6233 7657 (from outside Tasmania) Email: wstinfo@justice.tas.gov.au Note. SSAN fertilisers are banned in Tasmania.

3. STORAGE AND HANDLING CHARACTERISTICS

In addition to the Dangerous Goods and Security considerations, there are other characteristics of ammonium nitrate fertilisers to consider.

They do not have as good storage and handling characteristics as most other fertilisers. Consequently, they are more likely to sett in storage, which may lead to application difficulties.

Critical Relative Humidity

Compared to many other fertilisers, ammonium nitrate has a low Critical Relative Humidity (CRH).

The Critical Relative Humidity 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.

The CRH of blends containing ammonium nitrate will be lower than for ammonium nitrate itself.

Ammonium nitrate fertilisers and blends should be ordered as required and used quickly. They should not be stored for any length of time.

Once bagged, the product may set quickly.

NOTE. Ammonium Nitrate fertilisers, including Cal-Am, are incompatible in dry blends with Urea.

Heat Cycling

Ammonium nitrate fertilisers are subject to heat cycling.

If fertilisers containing ammonium nitrate are subjected to diurnal changes during which the temperature exceeds 33^{o} C, phase changes in the crystal structure of the ammonium nitrate will occur. In the evening or night, when the temperature falls, the ammonium nitrate reverts to its original crystal structure. This results in gradual and irreversible breakdown of the fertiliser particles. Eventually the granules shatter.

The degradation will be most evident towards the edges of the packs which have been exposed to more heating.

Ammonium nitrate fertilisers and blends should not be stored in the open, placed in sheds so that they are exposed to direct sunlight, or against the walls or rooves of buildings where extreme and fluctuating temperatures are experienced.

4. AMMONIUM NITRATE IN THE SOIL

The nitrogen in ammonium nitrate is present in two forms, half as ammonium, and half as nitrate.

Nitrate

Nitrate nitrogen in immediately available for plant uptake, once the fertiliser dissolves in moisture (water) present in the soil.

Nitrate is mobile in the soil and moves with soil water. It is not strongly attracted to clay particles, and can be lost through leaching on well-drained light-textured sandy soils, should heavy rain fall or excess irrigation water be applied.

On heavy clay soils in inland cropping areas, such as the Wimmera and Darling Downs, nitrate is unlikely to be leached below the root zone of crops in most seasons.

In high rainfall areas, nitrate that is not utilised by plants may be washed into the soil below the root zone. Ultimately, it may reach and contaminate groundwater.

Nitrate can also be lost through denitrification (gaseous loss of nitrous oxide to the atmosphere) should the soil become waterlogged. For this reason, ammonium nitrate is not suitable for use in flood irrigated rice.

Ammonium

While most plants preferentially take up nitrate nitrogen, they may also take up ammonium nitrogen.

Once incorporated (or washed into the soil by rain or irrigation), ammonium nitrogen is adsorbed (attracted to and held tightly) on the surface of clay particles and soil organic matter (humus). It is not subject to leaching.

Ammonium is converted to nitrate by soil bacteria, usually within a few weeks of application. Being a biological process, the conversion occurs more slowly under cold temperatures and if the soil is dry.

Volatilization

When fertilisers containing ammonium nitrogen are applied to the soil surface without incorporation in rain grown crops and pastures, or at times of the year when irrigation water is unavailable, some nitrogen can be lost to the atmosphere through the volatilisation of ammonia gas. Such losses are lower for ammonium nitrate than for other fertiliser containing all their nitrogen in the amide form (urea) or ammonium form, e.g. ammonium sulfate. Half the nitrogen in ammonium nitrate, that present as nitrate, is not subject to volatilisation.

When top-dressing with any nitrogen fertiliser, follow-up rain is needed to carry the fertiliser into the root-zone. However, should it remain dry for some time after application, plant recovery of applied nitrogen as ammonium nitrate is likely to be higher than for fertilisers containing all their nitrogen as amide or in the ammonium form.

Applying nitrogen fertiliser just before or with irrigation water will largely eliminate the potential for volatilisation losses, by carrying the fertiliser into the soil.

Volatilisation losses are higher on alkaline (high pH) soils than on acid soils.

Ammonia volatilisation losses from urea can be high in ratoon sugarcane when it is harvested green, the trash is retained as a blanket, and the fertiliser is broadcast over the trash without incorporation into the soil. Cal-Am is often used instead of urea where nitrogen fertiliser is surface-applied over sugarcane trash to minimise volatilisation losses.

5. APPLICATION

Ammonium nitrate fertilisers, including Cal-Am, are not used to anywhere near the same extent as Urea in fertiliser programs.

Urea is the most commonly used nitrogen fertiliser and offers a number of advantages over ammonium nitrate:

- Urea is more economical, costing less per kg of nitrogen (N);
- It is concentrated (46% N), providing savings in freight, storage and application costs;
- It is not classified as a Dangerous Good, and is therefore not subject to the same storage and transport regulations as ammonium nitrate;
- It is not Security Sensitive. Customers do not have to be licensed to but it.
- Urea stores better. It has a higher Critical Relative Humidity than ammonium nitrate and is not subject to heat cycling.

Chief among these is its lower price.

The premium paid for ammonium nitrate may be justified:

- Where a quick response to nitrogen (as nitrate) is required. Ammonium nitrate fertilisers are often used for side-dressing short season vegetable crops, and in winter when the conversion of ammonium nitrogen to nitrate is slowed.

- Where volatilisation of ammonia is likely; i.e. where fertiliser is top-dressed onto the soil surface of rain-grown pasture and crops without incorporation, particularly during drier times of the year, when rain is less reliable. This also applies to irrigated crops and pastures in southern Australia at times of the year when Water Resources do not supply water. Volatilisation losses are higher on alkaline soils than on acid soils. In sugarcane, volatilisation losses can be high when urea is applied over the top of trash blankets in ratoons.

Cal-Am can only be applied dry to the soil. The calcium carbonate that it contains is insoluble. This makes Cal-Am unsuitable for use in the preparation of fertiliser solutions, e.g. for use in fertigation programs.

The calcium in Cal-Am is usually of little nutritional value. Being insoluble, it will not provide a quick response to calcium when needed, e.g. if applied during the growing season.

The calcium in Cal-Am does make it less acidifying per kg of nitrogen than straight nitrogen fertilisers such as Urea or Nitram. However, this is not a reason to use Cal-Am in preference to Urea where soil acidification is of concern. It is better to use urea as intended, and to broadcast lime on a periodic basis to ameliorate the soil.

The calcium carbonate in Cal-Am is of little value on alkaline soils, where any soil reactions involving calcium carbonate are slowed or completely blocked.

Where to use Cal-Am

While Cal-Am may be applied at many times, its higher price (per kg of nitrogen) compared to urea and anhydrous ammonia dictates how and when it is applied.

Unless the presence of nitrate nitrogen is likely to provide a better response, ammonium nitrate fertilisers are unlikely to be used.

Ammonium nitrate fertilisers are mostly used after crops and pasture have been established, i.e. during the growing season:

✔ Horticultural Crops

Ammonium nitrate is popular for side-dressing vegetables where a quick response is required; and in tree and plantation crops, particularly where volatilisation losses are possible, e.g. where the fertiliser cannot be irrigated into the soil. In bananas, rain or overhead irrigation water may be deflected by the leaves, resulting in uneven wetting of the soil. Volatilisation losses are possible from those areas of soil that are not properly wetted.

As with any other fertiliser that is spun over vegetable crops; i.e. applied by a spreader (spinner-broadcaster), ammonium nitrate fertilisers should be applied when the leaves are dry, so that as few granules as possible remain on the leaves. Ideally, the crop should be irrigated immediately afterwards to wash off any fertiliser that lodges on the leaves. This reduces the likelihood of leaf burn.

✔ Top-dressing Pasture, Forage and Grain Crops

When urea or ammonium-containing nitrogen fertiliser are surface-applied and cannot be incorporated, gaseous atmospheric losses (volatilisation) can occur. Such losses are greatest on alkaline soils, i.e. at high pH.

Volatilisation losses can be prevented when the fertiliser is irrigated in after application, or applied with the irrigation water. In these situations, urea will normally be used.

Where irrigation is not possible, it may be better to use an ammonium nitrate fertiliser instead of urea, as it is less subject to volatilisation, particularly during the drier months of the year.

Ammonium nitrate may also give a quicker response than urea in cold weather, e.g. to provide quicker feed in winter forage crops and pasture.

✔ Ratoon Sugarcane

Urea is the product of choice if nitrogen fertiliser is to be applied into or covered with soil, e.g. when side-dressing plant sugarcane, when applied split-stool or into the soil beside the crop row in ratoons, or when irrigated in immediately after surface application.

Where urea is surface-applied over a trash blanket without incorporation, volatilisation losses can be appreciable. Cal-Am is often preferred in this situation.

NOTE: A range of non-SSAN Blends, based on Cal-Am, are available for use in ratoon sugarcane, and in other crops and pasture.

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When NOT to use Cal-Am

Ammonium nitrate fertilisers are not commonly used before planting, or at planting.

✖ Pre-plant

Urea or Big N (anhydrous ammonia) is normally used in preference to ammonium nitrate where nitrogen is applied pre-plant into the soil. As the fertiliser is placed into the soil (eliminating the potential for volatilisation losses), and there is time for the ammonium to be converted to nitrate in advance of the main growing season, there is no advantage to be gained from using ammonium nitrate.

Indeed, nutrient recovery may be poorer where ammonium nitrate fertiliser is used, as the nitrate component is subject to leaching and denitrification losses should heavy rain fall and water-logging occur.

✖ Planting

Ammonium nitrate compounds are not generally recommended for use in blended NP and NPK fertilisers for use at planting:

- Firstly, the blends have poor physical attributes, and do not store well.

- Secondly, there are limits to how much nitrogen can be applied safely at planting without affecting germination and emergence. The use of an ammonium phosphate fertilisers (MAP or DAP) to supply phosphorus will usually provide sufficient starter nitrogen. The balance of the crop's nitrogen requirement can be applied pre or post-planting. If additional nitrogen is required in the basal planting fertilisers for vegetable crops, e.g. where single or triple superphosphate is used as the phosphorus source, it is normally recommended that Gran-am (granulated ammonium sulfate) be used, as the resultant blends have a better physical quality and store better. Urea is usually used in planting blends for grain and cotton where there is a need for extra nitrogen, as it is a more economical source of nitrogen.

WARNING:
The information contained in this publication is for use as a guide only. The use of fertilisers is not the only factor involved in producing a top yielding pasture or crop. Local soil, climatic and other conditions should also be taken into account, as these could affect pasture or crop responses to applied fertiliser.

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