FACT SHEET
JUNE 2024

ANHYDROUS AMMONIA

Most concentrated nitrogen fertiliser (82% N)

Stored, transported, and applied directly into the soil as a liquefied gas.

AMMONIA MANUFACTURE AND USE

In Germany in 1909, Fritz Haber and Carl Bosch developed a large-scale economic method for synthesising ammonia (NH_3). This event marks the birth of the modern nitrogen fertiliser industry, even though it took close to 50 years for the process to be used on a significant scale.

Up to the Second World War, the demand for nitrogen fertilisers was largely met from industrial by-product sulphate of ammonia from the coking of coal and naturally occurring Chilean Nitrate of Soda. The demand for nitrogen fertilisers increased rapidly from this time in line with world population growth, meaning that supply from traditional sources had to be supplemented with synthetically produced nitrogen fertilisers. Ammonia is the starting point for most of these fertilisers.

Sulfuric acid and ammonia are produced and traded in greater quantity than any other chemicals, with approximately 85% of the world's ammonia production being used as a fertiliser or for fertiliser production.

While ammonia may be applied directly to the soil as a nitrogen fertiliser, most is converted to solids by reacting it with carbon dioxide to produce urea, or with nitric acid, sulfuric acid or phosphoric acid to produce ammonium nitrate, ammonium sulphate, monoammonium phosphate (MAP) and dioammonium phosphate (DAP). These synthetically produced fertilisers account for the greater part of the nitrogen applied in world agriculture, urea making up about 50% of the total. In Australia, ammonium nitrate is mostly used in the preparation of explosives. Relatively little is used as a fertiliser.

Incitec Pivot operates an ammonia plant at Phosphate Hill in northwest Queensland where MAP and DAP are produced. The feedstocks for this ammonia plant are natural gas, steam and air (from which the nitrogen is derived).

Incitec Pivot closed its ammonia plant at Gibson Island, Brisbane after 59 years in December 2022. It manufactured granulated urea and granulated ammonium sulphate (Gran-am®).

USE OF ANHYDROUS AMMONIA AS A FERTILISER

Anhydrous Ammonia is injected directly into the soil as a nitrogen fertiliser. It is mostly applied pre-plant while the land is being fallowed.

Anhydrous Ammonia is used in both summer and winter broadacre crops, e.g. grain and cotton mainly in the states of New South Wales and Queensland.

Specialised equipment is used to transport, store, supply and apply Anhydrous Ammonia.

AMMONIA IN THE SOIL

Ammonia is a gas at normal temperatures and pressure. It is stored and transported as a liquefied gas in pressurized tanks. Upon application the pressurised liquid converts immediately to the gaseous form. The ammonia then combines with water in the soil to form ammonium (NH_4^+) ions as depicted in the following equation:

$$NH_3 + H_2O \rightarrow NH_4^+ + OH^-$$

The ammonium ions are attracted to and are tightly held on the surface of clay and organic colloids in the soil. As such, ammonium is resistant to loss to the atmosphere by reversion to ammonia gas, or by leaching deeper into the soil in the event of heavy rainfall.

This affinity of ammonia for water and the strong adsorption of ammonium ions in the soil are the reasons why anhydrous ammonia can be injected directly into the soil as a fertiliser. There will always be enough moisture in the soil for the above reaction to occur provided the soil flows freely back around the tines to prevent the loss of ammonia as a gas to the atmosphere before it has a chance to react with water in the soil.

Anhydrous ammonia has been successfully applied into fully cultivated prepared seedbeds using conventional application equipment in Australia since the 1960s. The adoption of reduced tillage practices initially stifled demand for anhydrous ammonia. With minimal soil disturbance in the field and poor soil cover behind the tines, conditions were conducive to ammonia gas being lost to the atmosphere.

This constraint was overcome by using **Cold-Flo®** application technology which allows Anhydrous Ammonia to be applied under soil conditions in which it could not be applied using conventional application equipment. This requires fitting Anhydrous Ammonia application equipment with Cold-Flo® converters, in which pressurised ammonia expands from the liquid to the gaseous phase, chilling the gas and converting about 85% of it to a liquid. The chilled liquid and remaining gas is applied at normal atmospheric pressure. This allows greater opportunity for the adsorption of the ammonia by the soil and reduces atmospheric loss. Application equipment (meters, flow controllers etc) run and meter more efficiency when a large proportion of the N applied is liquid using Cold-Flo® application technology.

Anhydrous Ammonia is mostly applied pre-plant. If applied at planting or as a side-dressing in row crops, Anhydrous Ammonia must be placed away from seeds and crop roots, due to its toxicity to plant tissue. The toxic effects in the soil are localised and short-lived, being confined to the soil around the point of application. With time, the ammonium is converted to nitrate by soil microbes, and moves with soil moisture away from the site of application.

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.

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