FERTFACTS

UREA
FACT SHEET

- **Most concentrated solid nitrogen fertiliser – 46% N;**
- **Economical;**
- **Suitable for soil and foliar application.**

MANUFACTURE

Urea [$CO(NH_2)_2$] is a soluble organic compound containing 46% nitrogen. It occurs naturally in urine and some moulds and fungi.

Urea is manufactured synthetically by reacting natural gas, atmospheric nitrogen and water together at high temperature and pressure to produce ammonia and carbon dioxide. These gases are then reacted at high temperature and pressure to produce molten (liquid) urea. This is then cooled and granulated to produce a white granular product for use in industry and agriculture.

One of the main industrial uses of urea is in the manufacture of urea formaldehyde resins and glues for the production of particle board and other timber products for the building industry.

In agriculture, urea (46% N) is the most concentrated solid form of nitrogen fertiliser. Over the last 40 years, it has rapidly gained in popularity and market share, and it is now the world's most commonly used nitrogen fertiliser.

Urea may be applied as a solid or in solution form to the soil or as a foliar spray. It can also be blended with products such as the ammonium phosphates (MAP and DAP) and muriate of potash, but must not be blended with superphosphate as urea absorbs moisture from the superphosphate.

As a non-protein nitrogen supplement for sheep and cattle, urea allows these ruminants to make better use of low protein roughages, e.g. dry grass, during dry weather and the onset of drought.

Australia's only urea plant is operated by Incitec Pivot Limited in Brisbane, using natural gas from south-west Qld. Australia is not self-sufficient in urea, and a considerable quantity is also imported

UREA IN THE SOIL

Although urea can be taken up directly by some plants, the nitrogen in urea is more readily available to plants after mineralisation in the soil to nitrate (NO_3^-).

Firstly, urea is converted to ammonium (NH_4^+) compounds by the action of urease, an enzyme present in the soil. This process is known as ammonification and is usually completed within a few days of urea application.

Soil bacteria then convert the ammonium to nitrate (NO_3^-). This process is called nitrification and is usually completed within a few weeks of application depending on soil temperature. Nitrate nitrogen, unlike ammonium nitrogen, is not strongly adsorbed onto soil particles and can be leached by heavy rainfall or excessive irrigation. Losses by leaching are most likely to occur on light textured, sandy soils. Urea is also prone to leaching prior to conversion to ammonium as Urea is non-ionic (no charge).

Nitrate nitrogen may also be lost to the atmosphere through denitrification if the soil becomes water-logged. Soil micro-organisms, deprived of their usual source of oxygen (O_2), will reduce nitrate (NO_3^-) to gaseous forms, e.g. nitrous oxides.

Some gaseous losses to the atmosphere may also occur due to the volatilisation of ammonia if the urea is applied to the soil surface. These losses can be suppressed by soil coverings of 3 cm or by irrigating immediately after application. In the soil, ammonium (NH_4^+) ions are attracted and tightly held (adsorbed) on the surface of clay and humus particles. Some ammonium remains in solution, but as most is adsorbed, it is not easily leached from the root zone.

Nitrogen losses through leaching and to the atmosphere are not confined to urea. Nitrogen from other nitrogen fertilisers, and that present naturally in the soil (mineralised from soil organic matter), is also subject to loss.

In choosing appropriate fertiliser management practices, the likely mechanisms of loss should be determined, and steps taken to minimise such losses.

USE AS A FERTILISER

In common with other nitrogen fertilisers, there are limits to how much nitrogen can be safely applied at planting and in foliar sprays.

In grain and cotton crops, urea is often applied at the time of the last cultivation before planting. It should be applied into, or be incorporated into the soil.

In high rainfall areas and on sandy soils (where nitrogen can be lost through leaching) and where good in-season rainfall is expected, urea can be side or top-dressed during the growing season.

Top-dressing is also popular on pasture and forage crops.

In sugarcane, urea is side-dressed after planting, and applied to each ratoon crop.

In irrigated crops, urea can be applied dry to the soil, or dissolved and applied through the irrigation water. Urea will dissolve in its own weight in water, but it becomes increasingly difficult to dissolve as the concentration increases. Urea is endothermic, causing the temperature of the solution to fall as it dissolves. As a practical guide, when preparing urea solutions for fertigation (injection into irrigation lines), dissolve no more than 30 kg urea per 100 L water.

In foliar sprays, urea concentrations of 0.5 – 2.0 % are often used in horticultural crops. As urea sprays may damage crop foliage, specific advice should be sought before use. Low biuret grades of urea should be used if urea sprays are to be applied regularly or to sensitive horticultural crops.

WARNING

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

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