



NITROGEN

NITROGEN IN SOILS

Nearly all the nitrogen (N) present in the soil originates from the atmosphere, which is made up of about 80 % nitrogen. The rocks and minerals from which soils are formed do not contain nitrogen.

Most of the nitrogen present in the soil is in the form of organic matter. Organic nitrogen, however, is not available for plant uptake. It must first be converted to simple inorganic forms, i.e. ammonium (NH_4^+) and nitrate (NO_3^-).

Nitrogen can be lost from the soil in various ways, through volatilization and denitrification to the atmosphere, and leaching below the root zone following heavy rain.

NITROGEN IN PLANTS

Apart from carbon (C), hydrogen (H) and oxygen (O), which are derived from air and water, nitrogen is required by plants in greater quantity than any other nutrient. It is one of the most commonly limiting nutrients in agricultural production systems. Legumes are able to fix nitrogen from the air, but other plants are reliant on the soil and/or fertiliser for nitrogen.

Plant uptake from the soil is mainly as nitrate (NO_3^-), although ammonium (NH_4^+) is also taken up.

Nitrogen is essential in the formation of chlorophyll (the green pigment in plants) which converts sunlight into carbohydrate. A shortage of nitrogen inhibits plants in the basic function of trapping energy. Nitrogen is a major constituent of protein. Therefore, a shortage of nitrogen not only affects yield, but also the quality of forage, grain, vegetables, fruit and nuts.

DEFICIENCY SYMPTOMS

The main symptoms of nitrogen deficiency are:

- Stunted growth and reduced tillering in grasses and cereals;
- Pale green or yellow colour, with the older leaves being the first affected;
- Low protein content of grain and herbage.

Legumes display similar symptoms, and root nodules will be absent or poorly developed.

NITROGEN FERTILISERS

Big N: (82% N)

Anhydrous ammonia (NH_3) is manufactured in Brisbane by reacting natural gas with atmospheric nitrogen. Ammonia is used as a fertiliser in grain and cotton (Big N), and for the manufacture of other nitrogen fertilisers, e.g. urea and Gran-am. Big N is the most concentrated nitrogen fertiliser available. It is stored, transported and applied directly into the soil as a liquefied gas.

Urea: (46% N)

Urea [$\text{CO}(\text{NH}_2)_2$] is manufactured by reacting ammonia (NH_3) with carbon dioxide (CO_2). It is manufactured in Brisbane and imported. At 46% N, urea is the most concentrated solid nitrogen fertiliser, thereby reducing freight and application costs. Urea has become the most commonly used nitrogen fertiliser in the world, accounting for around 50% of the total global fertiliser N use. Urea has good storage and handling characteristics, and can be blended with many other fertilisers, including DAP, MAP and Muriate of Potash.

Granular grades of Urea, which are applied dry to the soil, are the most commonly used. Other grades of urea with a smaller particle size so that they dissolve more readily in water are available for application in solution, e.g. in fertigation programs and in the preparation of livestock supplements. These include Tech Grade forms (formerly **Liquifert N** and **Stockfeed Urea**). A low biuret grade of urea, (formerly **Liquifert Lo-Bi**), is used where foliar sprays of urea are applied on a regular basis in horticultural crops.

Cal-Am

Ammonium nitrate (NH_4NO_3) contains half its nitrogen in the ammonium form and half as nitrate. It is used for topdressing purposes where the fertiliser cannot be incorporated into the soil, as it is less subject to volatilisation than urea and other fertilisers that contain all their nitrogen in the ammonium form, and in situations where a quick response to nitrogen may be required, e.g. vegetables. The nitrate component is immediately available for plant uptake.

Incitec Pivot does not market straight ammonium nitrate which is classified as a Dangerous Good (Oxidising Agent), and must be transported and stored accordingly. Calcium Ammonium Nitrate (CAN) is imported and marketed as Cal-Am instead. Cal-Am is comprised of 80% ammonium nitrate and 20% calcium carbonate (CaCO_3) and is not classified as a DG.

Cal-Am is classified as a Security Sensitive product. Farmers wishing to purchase and use it must be licensed to do so. Cal-Am is mainly sold and used in blends with other fertilisers, at concentrations up to 55% (45% ammonium, nitrate), that are not classified as Security Sensitive. Ammonium nitrate fertilisers are less popular than urea on account of these restrictions on their use and their higher price per kg of nitrogen. They do not store and handle as well as urea.

Gran-am: (20.2% N - 24% S)

Gran-am, a granulated ammonium sulfate [$(\text{NH}_4)_2\text{SO}_4$] fertiliser is manufactured in Brisbane by reacting sulfuric acid with ammonia. Gran-am is popular in fertiliser programs where both nitrogen and sulfur (S) are required. It is often used in blends with other nitrogen fertilisers to provide a better balance of N:S (nitrogen:sulfur) than provided by straight Gran-am. Plants take up about ten times more nitrogen than sulfur.

EASY N (42.5 % w/v N)

A concentrated solution of Urea and Ammonium Nitrate. EASY N is used where liquids offer convenience or provide easier or more uniform coverage than solids, e.g. fertigation (injection into irrigation water) or spray application through a boom.

APPLICATION

In field crops, nitrogen can be applied pre-plant, at planting, or during the growing season (side or top-dressings), or a combination of these times can be used. There are limits to how much nitrogen can be safely applied with the seed or planting material, without harming germinating seeds or transplants.

In pastures, nitrogen is normally top-dressed after grazing and before regrowth occurs. In tree crops, nitrogen is normally applied on several occasions during the main growing season. It should be spread evenly over the entire root zone so as to avoid root burn.

If practical, nitrogen fertilisers should be applied into, or incorporated into the soil shortly after application, e.g. by mechanical means or irrigation, rather than left on the soil surface. In rain grown situations where fertiliser is broadcast on the soil surface, it should be applied when the prospects for rain are good.

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