

NITROGEN FACTSHEET

March 2005

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) or Big N is made at Brisbane and Newcastle by reacting natural gas with atmospheric nitrogen. It is used as a fertiliser in grain and cotton, 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). At 46% N, it is the most concentrated solid nitrogen fertiliser, thereby reducing freight and application costs. Urea is convenient to store and handle, and can be blended with many other fertilisers, such as DAP, MAP and Muriate of Potash. It has become the most commonly used nitrogen fertiliser in the world.

Urea is also available as **Liquifert N** and **Liquifert Lo-Bi**, for application in solution (dissolved in water), e.g. fertigation programs. Liquifert Lo-Bi is a low biuret grade of urea, for use where foliar sprays are used on a regular basis in horticultural crops.

Ammonium Nitrate - To produce ammonium nitrate (NH_4NO_3), nitric acid is manufactured from ammonia and then reacted with ammonia. Half the nitrogen is in the ammonium form, half as nitrate. Ammonium



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nitrate is popular for topdressing purposes, 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. Instead, two ammonium nitrate based fertilisers are marketed. These are:

- **Cal-am** (27% N - 8% Ca) - Calcium ammonium nitrate (CAN) is comprised of approximately 80% ammonium nitrate and 20% calcium carbonate (CaCO_3).
- **N-Sure** (26%N - 14% S) - Ammonium sulfate nitrate (ASN) is comprised of approximately 40% ammonium nitrate and 60% ammonium sulfate.

Gran-am (20.2% N - 24% S) – a granulated ammonium sulfate $[(\text{NH}_4)_2\text{SO}_4]$ manufactured by reacting sulfuric acid with ammonia. It is popular in fertiliser programs where both nitrogen and sulfur are required. It is often used in blends with other nitrogen fertilisers to provide a better balance of N:S (nitrogen:sulfur). 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.

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 at planting, without harming the 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.

FURTHER READING - An Agritopic on “Nitrogen” is available if more detailed information is required.

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