SoilWealth
NURTURING CROPS

Quick guide to farm nitrogen

At the beginning of a season, soils usually contain varying levels of available nitrogen in the form of nitrate or ammonium. The level of available N in the root zone should be measured as the basis for the nitrogen fertiliser program. N-check® or Deep Soil N are suitable analyses for plant available soil nitrogen.

Sources of nitrogen on farm

Nitrogen (N) inputs to crops come from several sources, including soil bacteria, legumes, amendments, fertilisers and inputs directly from the atmosphere. Nitrogen is released by soil organic matter, but also bound up in new organic matter eg from crop residues or dead soil organisms.

Carbon-rich inputs like manures, composts and crop wastes usually have low nitrogen concentrations (2–5%), so are usually applied in large volumes which means the N contained in them needs to be included in nutrient budgets. Amendments can increase nitrogen cycling and availability to crops, but if they are high in carbon, nitrogen availability may be reduced for some time after application.

Legumes build soil nitrogen in varying amounts, depending on dry matter production and existing soil nitrogen levels. They can provide large nitrogen inputs in a year (>300 kg/ha). This means additional fertilisers may not be required.

Free-living soil bacteria and atmospheric deposition deliver modest inputs, around 10–40 kg/ha per year.

Nitrogen in fertilisers

Fertilisers have the highest concentration of nitrogen, and come in different chemical formulations. They interact with soils and plants in different ways, and understanding this is key to achieving the most profitable use of nitrogen fertilisers. Some fertilisers have more than one source of N, including products like UAN (urea ammonium nitrate). Ask your supplier or nutrition adviser about details.

Fertiliser use – What to do and what to avoid

Prepare a nitrogen budget based on crop removal for N and account for N left in the soil from previous crops (can be estimated, but best done through testing [N-check® or Deep Soil N]).

Consider using nitrogen fertilisers with low volatilisation loss potential (eg calcium nitrate, potassium nitrate, compound fertilisers).

Apply N fertiliser in a band near the seed or transplants at reduced rates.

Use split applications, especially when soils have a high leaching potential (sandy texture, well drained soils).

Use a nitrification inhibitor with early season side- dressed N especially when applied to soils with high leaching potential.

Limit application rates to max 40-50 kg N per hectare per application depending on conditions. Consider replacing a granular fertiliser with a foliar N application.

For split applications, match the rate per application to plant needs eg young plants have low nitrogen use, rapidly growing plants that are setting flowers and fruit have a higher N use, maturing plants have a lower N use.

In irrigated crops, especially those with leaching, run-off or erosion risk, at least 40% of the total N applied should be top-dressed during the season.

Do not apply N, especially as nitrate, to water logged soils; nitrogen will be lost as nitrogen oxide gas.

Do not apply N in autumn or winter if long periods of rain are forecast. Use nitrification inhibitors with autumn or winter applied N on all soils.

Avoid surface run-off from irrigation or rain.

Match irrigation applications to plant water uptake to avoid N leaching from the root zone. Monitor soil moisture via evaporation pan values, visual assessments or probes.

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Quick guide to the main nitrogen sources in fertilisers

	UREA $CO(NH_2)_2$	AMMONIUM NH_4	NITRATE NO_3
Common sources (many others, including in blends)	Urea (46% N) (also livestock urine)	MAP (12% N) DAP (18% N) Ammonium sulphate (21% N)	Calcium nitrate (15.5% N) Potassium nitrate (13% N) Magnesium nitrate (11% N)
Uptake by plants	Minor foliar uptake if applied as foliar No uptake by roots until conversion to ammonium and then nitrate	Minor foliar uptake as gaseous ammonia following ammonia gas loss Major plant root uptake but many crops prefer nitrate	Minor foliar uptake Major plant root uptake
Movement in soil	No charge, highly soluble, moves with soil water until conversion to ammonium, but less mobile than nitrate	Positive charge, held relatively strongly by soil but can compete with other cations like Ca, K, Mg	Negative charge, poor bond with soil, moves with soil water
Speed of plant availability	Not available to plant roots	Available for direct uptake	Available for direct uptake
Plant uptake efficiency	N/A	Medium – ammonia is the form used by plants to create proteins	High – but plants must expend energy converting nitrate to ammonia
Transformation in soil	Soil enzymes convert urea into ammonium, losing carbon dioxide Conversion fastest in warm, moist topsoil	Soil bacteria convert ammonium into nitrate Occurs fastest in good growing conditions	Nitrate rapidly converted to gases in wet soil conditions
Acidifying potential	Yes, loss of hydrogen lowers soil pH	Yes, loss of hydrogen lowers soil pH	Minor acidification during nitrate leaching
Loss potential	Moderate – high Large amounts can be lost as ammonia gas following surface application Ammonium remaining is again subject to losses after conversion to nitrate	Moderate Ammonia can be lost as gas following surface application Ammonium remaining is again subject to losses after conversion to nitrate	High Nitrate is easily lost to drainage, runoff or gaseous emissions under moist and waterlogged conditions
Ways to reduce losses	Use controlled-release formula or use urease inhibitor Cultivate into soil within one day to 10 cm depth If surface applied, irrigate within a few hours of application to quickly wash fertiliser into the soil, unless rain is imminent	Use controlled-release formula or nitrification inhibitor Cultivate into soil within one day to 10 cm depth If surface applied, ensure sufficient rain or irrigation to quickly wash fertiliser into the soil Avoid applying with lime or on recently limed soils	Apply in small amounts often to match plant uptake To avoid leaching do not apply just before heavy rain or heavy surface irrigation Good irrigation scheduling

Information compiled by Adrian James, NRM North

Root nodules on Morgan Field peas which are converting nitrogen from the air into a form plants can use

Do not oversupply nitrogen

Excess nitrogen applied to soils can render crops susceptible to disease.

Use the **4R principle**:
right source, right amount,
right place, right time