Good Fertiliser Decisions – Nitrogen (N) for Crops in Tasmania

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Please note there is a significant amount of documentation, references and corresponding research results that support the following suggestions. This document has been prepared to help reduce nitrogen losses via emissions as well as from leaching, runoff or erosion.

Please discuss these suggestions and your nitrogen fertiliser plan with your agronomist!

N fertiliser needs: Develop a plan

Develop a yearly N management plan for each field and crop. The plan should include, as a minimum:

Calculation of total N needed:

- Calculate the total N needed based on crop type and target yield.
- Establish realistic crop yield expectations for each crop / field based on soil properties (including soil structure condition), available moisture/water, yield history, and management level. You can also allow a reasonable increase (e.g. 5%) for good management and growing conditions.
- Allow for a N 'buffer' to remain in the soil: Include N 'buffer' to remain in the soil after harvest. This should not be greater than 50 kg N / ha for vegetables, 30 kg N /ha for grains or poppies.

Estimation of the total N available to the crop:

- Account for any N applied in a pre-plant fertiliser, contributions from phosphorus fertilisers such as MAP and DAP or other mixed or composite fertilisers containing N.
- Take appropriate credit for previous legume crops and manure or compost used in the rotation (see 'Organic N sources' on following page).
- Base total rate of N supplied to the crop from all sources on expected yield (N removal by crop and variety), with some general consideration of soil organic matter content and previous crop.
- **Account for residual soil N:** Use a soil nitrate test (N-check) pre-planting, collecting soil samples to rooting depth (0-30cm and 30-60cm for deeper rooting crops). You may need to convert the results to kg N/ha.
- **Account for nitrate N in water** (if elevated levels are expected): Test irrigation water for nitrate content and account for N accordingly if you expect elevated levels

Calculation of 'top dressing' N requirement:

- To calculate the N requirement from top-dressing, subtract total N available form total N needed.

N fertiliser use: What to do

- Account for N left in the soil from previous crops (this can be estimated - but is best done through testing (N-check or deep soil N).
- Consider the use of alternative N fertilisers to minimise N losses from volatilisation (e.g. Calcium Nitrate, Potassium Nitrate, Compound fertilisers).

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- Apply N fertiliser in a band near the seed when an air seeder is used for planting. Avoid nitrate fertilisers in high amounts, especially for slow growing crops.
- Limit application rates to 30-50 kg N per hectare per application depending on conditions.
- Consider replacing granular fertiliser with a foliar N application when row crops are close to full cover, grains close to booting, poppies close to running up.
- For split applications, match the rate per application to plant uptake e.g. young plants have a low N use, plants that are running up, booting, setting flowers and fruit have a higher N use, maturing plants have a lower N use.
- Avoid applications late in the growing season, e.g. after hook stage of poppies, during late tuber bulking of potatoes or when growth is declining in pastures due to temperature and day lengths (or dry conditions).
- Match irrigation applications to plant water uptake to avoid N leaching from the rootzone (and water losses). Monitor via evaporation pan values, visual assessments or probes.
- Follow shallow-rooted crops with low N use efficiency (e.g. potatoes) with deep-rooted, preferably high N use crops that scavenge excess N (such as corn, lucerne, brassica crops).
- Analyse subsoil samples for residual N to determine carryover to the subsequent crop.
- Use cover crops such as oats or biofumigation crops (e.g. mustard) to scavenge excess N in areas where autumn growth is sufficient for establishment.
- Use petiole and or soil nitrate analyses to help making decisions on N top-dressing.

How to avoid nitrous oxide (N_2O) losses

- Incorporate urea (46-0-0) and UAN (28-0-0) within 1 day to a minimum depth of 10 cm or water it in ASAP.
- Do not apply N, especially as nitrate, to waterlogged soils – N will be lost as nitrous oxide gas.
- Use split applications, especially when soils have a high leaching potential (sandy texture, well drained Ferrosols – red soils). Use a nitrification inhibitor with early season side dressed N applied to these soils.
- In irrigated crops, especially those with leaching or run-off / erosion hazard, at least 40% of the total N applied should be top-dressed in season.
- Do not apply N in autumn or winter if long periods of rain are forecasted. Use nitrification inhibitors with autumn or winter applied N on all soils.
- Avoid direct movement of surface run-off water from irrigation or rain.

Organic N sources: What to do and what to avoid

- Apply composts, manures, recycled and other organic N sources close to the time of crop need, unless they need time to break down.
- Ensure uniform spread patterns.
- Do not apply organic nitrogen sources to fallow paddocks in autumn.
- Get test results (for % nutrients) from your supplier!

Remember that organic nitrogen sources can be a source of phosphorus, potassium, sulphur, zinc and other nutrients or may introduce weeds or contaminants. Adjust fertilisers accordingly.

Glossary

Term	Definition
Atmospheric Nitrogen (N_2)	An inert, harmless gas not usable by most life forms.
Reactive Nitrogen (N_r)	All forms of nitrogen, other than N_2. An essential nutrient for all life and also reactive in the atmosphere. Produced naturally by biological N fixation and lightning. Also produced through fertiliser manufacturing and the burning of fossil fuels.
Nitrous Oxide (N_2O)	A potent greenhouse gas and a reactant that destroys stratospheric ozone. Produced mostly by bacteria in soils, sediments and water bodies.
Ammonia (NH_3)	A gas emitted from soil and manure, and also used as a fertiliser.
Ammonium (NH_4^+)	A soluble form of ammonia found in fertilisers, soils, water bodies, and in the atmosphere. Can contribute to creation of algal blooms and soil acidification.
Nitrite (NO_2^-)	A soluble form of nitrogen found in low concentrations in soils and water bodies. Generally toxic to most organisms when present at high concentrations.
Nitrate (NO_3^-)	A soluble form of nitrogen found in fertilisers, soils, water bodies, and in the atmosphere.
Inorganic N	Generally refers to ammonium and nitrate but also includes any form of reactive N that is not bound to carbon in an organic molecule.
Dissolved Organic Nitrogen (DON)	Soluble forms of N that occur in soils, groundwater and water bodies.
Synthetic N	Reactive N created by the process of reducing atmospheric N to ammonia under high temperature and pressure. This includes fertilisers.
Biological Nitrogen Fixation	The process of converting atmospheric nitrogen by bacteria, fungi and bluegreen algae into reactive forms that are useable by plants and animals.
N deposition	Reactive nitrogen, mostly as ammonium, nitrate and DON, that falls onto water and land from the atmosphere.
Nitrification	A two-step process, carried out mostly by microorganisms in soils and water bodies, involving the oxidation of ammonium to nitrite, which is then further oxidised to nitrate.
Denitrification	The multistep conversion of reactive nitrate to nitrate, nitric oxide, nitrous oxide and ultimately to unreactive atmospheric nitrogen carried out by bacteria in soils, sediments and water bodies. Typically occurs in low oxygen situations.
Volatilisation	Process by which nitrogen is lost to the atmosphere as ammonia gas. It is driven by urease enzymes, which are found in soils and plants. Broadcast urea can be subject to volatilisation, with degradation occurring in the first 48 hours after application.

Nitrogen management planning and record sheet (N-balance)

Paddock name: _____

Crop:_____Variety_____

Soil type: _____ Leaching potential: high-medium-low

Previous crop: _____Runoff potential (slope >10%): high-medium-low

Yield: _____ Soil tested:_____

Manure tested: _____Water tested: _____

1. Expected yield: _____

2. Total N needed to achieve expected yield: _____kg/ha

(allow for buffer to remain after harvest)

3. Residual soil N (nitrate and ammonium in the rootzone at planting)
_____kg/ha

4. Irrigation water N (if applicable): _____kg/ha

5. Soil organic matter (credit 10 – 30 kg/ha N per % Organic Carbon): _____ kg/ha

6. Manure or other organic amendment: _____kg/ha
(this varies with type, C/N ratio, conditions and decomposition of material used)

7. Nitrogen available from a previous legume crop: _____kg/ha

8. Nitrogen available from crop residues or cover crop_____ kg/ha

Total N available to crop (sum of lines 3, 4, 5, 6, 7 & 8):_____ kg/ha

'Top-up' Nitrogen fertiliser requirement: _____kg/ha

Notes / comments: _____

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