Optimising Inorganic Nitrogen

Farming for a Better Climate

Practical Guide

The impacts of nutrient application, whether slurries and manures or inorganic fertilisers, on climate change are principally:

- emissions from organic or inorganic fertilisers during and after application
- the "lifecycle" emissions involved in manufacturing inorganic fertilisers, transporting them to the farm and applying them

Greenhouse Gas (GHG) emissions from fertilisers are mainly methane (CH_4), nitrous oxide (N_2O) and carbon dioxide (CO_2).

Methane gas is **21x** more potent than CO_2. This is produced as the fertilisers react with the soil and air

Nitrous Oxide is **312x** more potent than CO_2. It comes in part from the use of nitrogen fertilisers and from soil disturbance and is produced by soil microbes. The application of slurry and manure is a significant source.

Carbon Dioxide is released through burning all types of fuel and through soil disturbance. It is, however, essential for plant growth.

Ammonia (NH_3) is released by livestock and fertilisers - it isn't a GHG itself but it accelerates the greenhouse effect.

This Practical Guide concentrates on how you can manage nutrient application and help reduce GHG emissions.

Top tips...

- have a nutrient budget for each field and each crop. Know what your crop requires and apply the **right amount at the right time**
- apply when the crop requires it - when it is **actively growing**
- avoid windy days when ammonia losses are likely to be higher
- incorporate manures or slurries as soon as practical - you may need to apply less
- Don't applying in wet or frozen weather or onto saturated soils

Maximise nutrient uptake by:

When planning N applications for each crop in each field take account of:

- soil type
- previous crop management
- crop and market requirements
- timing of applications
- winter rainfall and soil wetness
- organic manure application to crop to be grown and to previous crop

Understand the nitrogen dynamics of your farming system through the development of **nutrient and grazing management plans.** Computer based tools such as **PLANET Scotland** can help you to plan and maximise both inorganic and organic nutrient use on the farm.

Our Practical Guides cover five useful topics:

1. Use energy and fuels efficiently
2. Renewable energy
3. Lock carbon into soils and vegetation
4. Making the best use of nutrients
5. Optimise livestock management

For more Practical Guides, Case Studies, information on our Focus Farms and ideas to benefit your farm, visit www.farmingforabetterclimate.org

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www.farmingandwaterscotland.org

SRDP Farm Advisory Service
The European Agricultural Fund for Rural Development Europe investing in rural areas
SAC CONSULTING
The Scottish Government Riaghaltas na h-Alba

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Key Facts...

When soils become waterlogged, soil organisms take the oxygen they need from nitrates through a process known as denitrification.

This leaves the nitrogen in the form of N_2O, which is lost to the atmosphere.

The application of fertilisers to wet and waterlogged soils wastes money and results in increased greenhouse gas emissions.

Try to avoid these conditions.

N_2O Risk Factors

- warm soils
- high clay content soils
- compacted soils
- wet soils
- grazed grass
- potatoes + vegetables
- poor irrigation practice
- poor drainage

Timing of Applications

- **Autumn nitrogen is NOT recommended** for winter cereals, as profitable responses are not normally attained and the practice will increase N losses to the atmosphere and watercourses.
- Nitrogen recommendations should be **reduced** for spring crops, which are sown ten days or more after the optimum sowing period.
- Pressure of spring work and adverse weather can often account for **delays in excess of ten days**. In these circumstances the N recommendation should be reduced for crops, which are sown ten days or more after the optimum sowing period by approximately 1.5 kg/ha/day for each day of delay for feed or high N malting and 2.25 kg/ha/day for low N malting.
- For intensive grass and some arable crops a **split application** approach should be considered since the nitrogen demand will be spread across the growing season.
- The development of a comprehensive **grazing and nutrient management** scheme can help you understand where reductions in fertiliser use (and savings) or improvements in nitrogen utilisation can be made.
- If making several applications in the season, for instance for grazed or cut grass, apply ammonium fertilisers in spring (e.g. urea or ammonium sulphate) and nitrate fertilisers later (e.g. ammonium nitrate or calcium nitrate) although this might not be the best option for grass growth in a cold spring.
- Most N_2O is produced at or near the soil surface immediately after top-dressing. Rainfall just before or just after makes emissions much higher. **Cool, dry weather with light winds is best.**

Nitrogen Residues

- Residual available N in the soil following harvest will vary depending on the crop type grown.
- Residues following cereals are generally lower than those following break crops.
- The management and performance of the previous crop can have a significant effect on the level of N residues.
- Residues are expected to be lower in a high yielding season or where N application has been lower than normal, but may be higher than average if the crop has performed badly due to problems such as disease or drought.
- Residues are typically higher following long-term grass, brassicas and grazed fodder and lower following harvested fodder, OSR, potatoes and cereals.

Soil Type

- Where more than one soil type occurs within a field it may be practical to alter the rate of fertiliser N to suit the different soil types.
- If this is not practical and the field is to be treated uniformly, select the soil type that covers the largest part of the field.
- In mineral soils of low organic matter content, the amount of available N residue is relatively small, whereas in humose and peaty sites low N malting barley is not encouraged as N release occurs late in the season and ends up in the grain.