Applying Nutrients

Practical Guide

Although required for crop growth, nutrient manufacture transport and application can increase greenhouse gas (GHG) emissions, contributing to Climate Change. The main impacts include:

- "lifecycle" emissions involved in inorganic fertiliser manufacture, transport and application
- Direct emissions from organic or inorganic fertilisers during and after application

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 can be a significant source.

Carbon Dioxide is released through burning all types of fuel and through soil disturbance (yet essential for plant growth).

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

This Practical Guide gives ideas on managing nutrient applications differently to help reduce GHG emissions.

Top tips ...

- Carry out a nutrient budget. Apply N fertilisers to **meet but not exceed** crop requirement.
- Grow grass and other high N-demand crops on your driest soils.
- Maintain drains to minimise soil wetness.
- Minimise tillage operations to reduce soil microbe stimulation.
- **Optimise soil pH** to encourage nutrient uptake - around 6.3 for arable crops and a minimum of 5.8 for grass.
- **Calibrate spreaders** for an even spread pattern as well as a known rate of application.

Maximise nutrient uptake by...

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

Farming for a Better Climate

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

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Key Facts...

Most emission reduction strategies for fertiliser application are aimed at reducing loss of N_2O. However, in terms of N, the losses of N_2 are often much higher than those of N_2O. N_2 isn't itself environmentally damaging but large losses of N_2 will mean big fertiliser inefficiencies.

So, tackling overall N efficiency will:

- reduce damaging N_2O emissions
- Make best use of inorganic fertilisers
- help keep your fertiliser bills down

N_2O Risk Factors

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

Application practices

Timing

Most GHG emissions following N application are in the first 2-3 weeks after application.

Wet or compacted soils are likely to release most N_2O because of increased denitrification processes in those soils. Warmer weather encourages bacterial activity.

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.**

Very high N_2O emissions will result from applying slurry and mineral fertiliser close together. If making several applications ensure that the nitrogen value of slurry is fully accounted for.

Grass

Precision application methods such as trailing shoe and dribble bars will reduce nitrogen loss and reduce harmful N_20 emissions.

Check soil and slurry pH before applying slurries as alkaline slurries and/or soils will lead to higher N losses costing you money and increasing N_2O emissions.

Use of a trailing shoe or dribble bars can help grass growth by placing fertiliser at the roots and can also improve palatability relative to band spreading.

Nitrification inhibitors can be used with ammonium-N fertilisers to reduce N_2O emissions and may be worthwhile on grass due to grassland's high emission potential.

Grazed grass emissions are higher than cut grass - compaction by livestock and the deposition of urine and dung are partly responsible.

Cereals

Consider precision farming to match application to requirements accurately.

In winter sown crops, consider using GPS to establish tramlines accurately when they are needed in springtime. The timing helps to reduce soil erosion risk and the improved accuracy will help you to **place the fertiliser exactly where it is needed** without overlaps or missed bits.

Potatoes and Vegetables

Potatoes and vegetables emit more N_2O because fertilisers are typically applied later on to warmer soils.

In potatoes, most emissions are from the furrows rather than the ridges because the furrows are likely to be wetter and more compacted. Where possible, **use precision methods to apply fertiliser only to the ridges.**

Nitrification inhibitors can be used with ammonium-N fertilisers to reduce N_2O emissions. They are most worthwhile on high-emission crops like vegetables and potatoes.

Particularly in horticulture, applying N along with or closely followed by heavy irrigation leads to major losses. **Use good irrigation practice at all times.**