

Making better use of urea

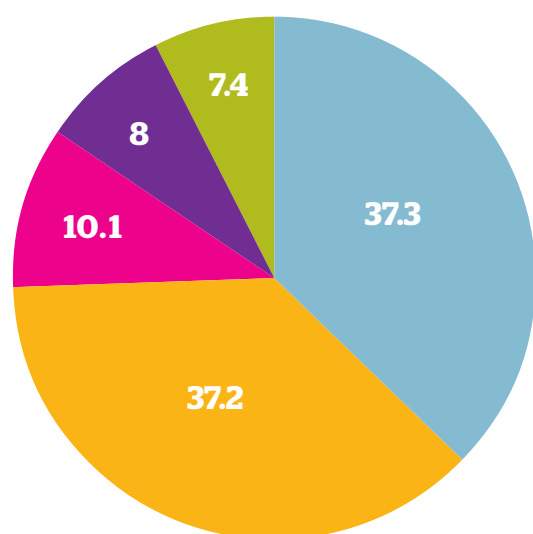
Traditionally, the early part of the year sees the sowing of urea fertiliser to encourage and maximise fresh growth. Historically this is done to coincide with the typically cooler temperatures of this period. Urea is less vulnerable to the loss of ammonia under these cooler, damper conditions. However, ammoniacal nitrogen loss is still a significant issue in both the spring and summer seasons. Average losses of 32.3% and 14.5% are reported for these seasons respectively in Northern Ireland.

To safeguard against this significant loss, it is recommended that farmers more widely adopt stabilised urea. Stabilised urea reduces ammonia emissions compared to conventional urea whilst maintaining yields and quality equivalent to similar nitrogen applications from other products. Additionally, urea fertilisers have less nitrous oxide emissions compared to CAN.

What is stabilised urea?

Stabilised urea has been coated or mixed with a urease inhibitor. The most common and widely researched is N-(n-butyl) thiophosphoric triamide, or NBPT. Other urease inhibitors are available and in commercial use.

Sources of Agriculture Sector Ammonia emissions 2021 (%)



Why use it?

- Ammonia is a major issue facing Northern Ireland agriculture with 8% emissions coming from the application of artificial fertilisers (Figure 1).
- Stabilised urea reduces ammonia emissions by 78.5% compared to conventional urea whilst maintaining yields and quality equivalent to Calcium Ammonium Nitrate (CAN).
- A switch to stabilised urea from CAN will also reduce nitrous oxide (N₂O) emissions. N₂O is an extremely potent greenhouse gas - 1kg of N₂O is equivalent to 298kgs of CO₂.
- Urea fertilisers have 69% less N₂O emissions compared to CAN.
- Stabilised urea costs less per unit of nitrogen than CAN.

- Cattle manure management
- Manure applied to soils
- Other manure management
- Inorganic fertilisers
- Grazing animal excreta

Adapted from - Air Pollutant Inventories for England, Scotland, Wales, and Northern Ireland: 2005-2021

How does stabilised urea work?

- The inhibitor bonds to the urease enzyme and slows the hydrolysis of urea to ammonia/ammonium ($\text{NH}_3/\text{NH}_4^+$) in the soil.
- This better balances the rate of nutrient availability to the rate of uptake by the plant.
- Slowing urea conversion prevents high concentrations of ammonia/ammonium forming in pockets on the soil surface. Urea is more soluble than ammonium so can disperse within the soil solution more readily avoiding the creation of these pockets.

Effectiveness of stabilised urea - relative to unstabilised urea and CAN

Grass yield under grazing

Grazing studies using cattle/sheep grazing have been carried out so farmers and industry can have confidence that stabilised urea will reliably deliver herbage yields and nutritive value that matches CAN. The main points to take away include:

Similar herbage production was observed for CAN and stabilised urea where similar overall N was applied.

- A switch from conventional urea to stabilised urea will give the same herbage production with a 12% reduction in application of fertiliser.
- The benefit of using stabilised urea over conventional urea is that more of the nitrogen is readily available for the plant whilst being grazed.



Grass quality

- There was no significant difference in grass swards produced from plots fertilised with CAN and stabilised urea.
- Quality parameters investigated included dry matter, crude protein, nitrogen, ash, water-soluble carbohydrate and buffering capacity.
- Stabilised urea can be confidently adopted by farmers without impacting on sward productivity or quality.



Grass yield under cutting

- No significant differences in total yield kgDM/ha between CAN and stabilised urea.
 - average dry matter yields were 15,513 (CAN) and 16,132 kg DM/ha (Stabilised urea).
- These findings are supported by earlier Forrester *et al.*, (2017) work, which also found no difference in herbage production between CAN, conventional urea and stabilised urea under a cutting regime.



Silage quality

- Replacing CAN fertiliser products with stabilised urea will not impact production or quality parameters of grass silage under Northern Ireland grass growing conditions.
- There was no significant difference in quality measures for grass silage produced from plots fertilised with CAN and stabilised urea.
- The major silage quality parameters measured included dry matter, metabolisable energy, crude protein, nitrate, water soluble carbohydrate and buffering capacity.
- Stabilised urea can be confidently adopted by farmers to reduce gaseous nitrogen emissions without impacting on silage yield or quality.

Some things to be aware of

- Stabilised urea should be used within a year of manufacture as the urease inhibitor will eventually breakdown during storage.
- Historically, stabilised urea products have not been manufactured in formulations which include phosphate. The acidity of the phosphate would breakdown the urease inhibitor. However, products are now appearing on the market which have additives and pH buffers included to counteract these effects.

Improve your carbon footprint with stabilised urea.

Your carbon footprint can be improved by switching from CAN or conventional urea to stabilised urea mainly via reductions in nitrous oxide emissions (See Table 1 below).



Table 1: Carbon savings possible by switching to stabilised urea (figures taken from AgreCalc June 2024)

Product	Kg of product needed to supply 150Kg N Ha	Emission breakdown by gas measured in Kg CO ₂ e	Kg CO ₂ e for 150Kg N Ha	Emission savings moving from CAN (Kg CO ₂ e)
CAN 27% N	560	Carbon dioxide (532Kg) Nitrous oxide (890Kg)	1422	-
Urea 46% N	330	Carbon dioxide (535Kg) Nitrous oxide (574Kg)	1109	313
Stabilised urea 46% N	330	Carbon dioxide (535Kg) Nitrous oxide (446Kg)	981	441

Summary

1

Significant emissions reductions are possible by switching from CAN and conventional urea to stabilised urea.

2

No differences in dry matter yield or quality parameters have been found under grazing or cutting conditions throughout Ireland when switching from CAN to stabilised urea.

3

With the growth matched, significant cost savings become possible with a switch from CAN to stabilised urea.