

Choosing to save money

Nitrogen is one of the largest farm costs and savings are there to be made

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Every year, there is debate around the most suitable type of nitrogen (N) fertiliser to apply, be it calcium ammonium-nitrate (CAN) or urea in terms of effectiveness and cost at different times during the year.

This debate has widened in recent years to include the effect of N fertiliser type on greenhouse gas (GHG) emissions, ammonia emissions and the sustainability of Irish agriculture. We now regularly read about increasing carbon taxes on fossil fuels as we strive to use cleaner forms of energy and to reduce GHG emissions and help minimise the effects of climate change in the future.

Ireland has committed to reducing national GHG's and ammonia emissions from agriculture by 30% and 5%, respectively, by 2030.

CAN 27% N

CAN is the most widely used N source in Ireland and has dominated the market for decades. This is despite the fact that it is the most expensive source of N. CAN is generally a good-quality fertiliser product with good granule size and excellent spreadability characteristics.

It's the preferred N source for till-

age farmers due to the wide spread widths pursued in crops. CAN contains a small quantity of calcium carbonate (lime) which helps to control the soil acidity generated during N transformations in the soil.

The N supplied in CAN is in two readily plant-available forms – ammonium (50%) and nitrate (50%). Once applied to the crop these N forms are available for plant uptake and growth.

The downside to CAN is that it may be very prone to loss to either air or water where conditions are less than ideal at time of application or thereafter. For example, N may be lost to air as nitrous oxide (N₂O), during the conversion of ammonium to nitrate or when the soil is very wet through a process known as denitrification.

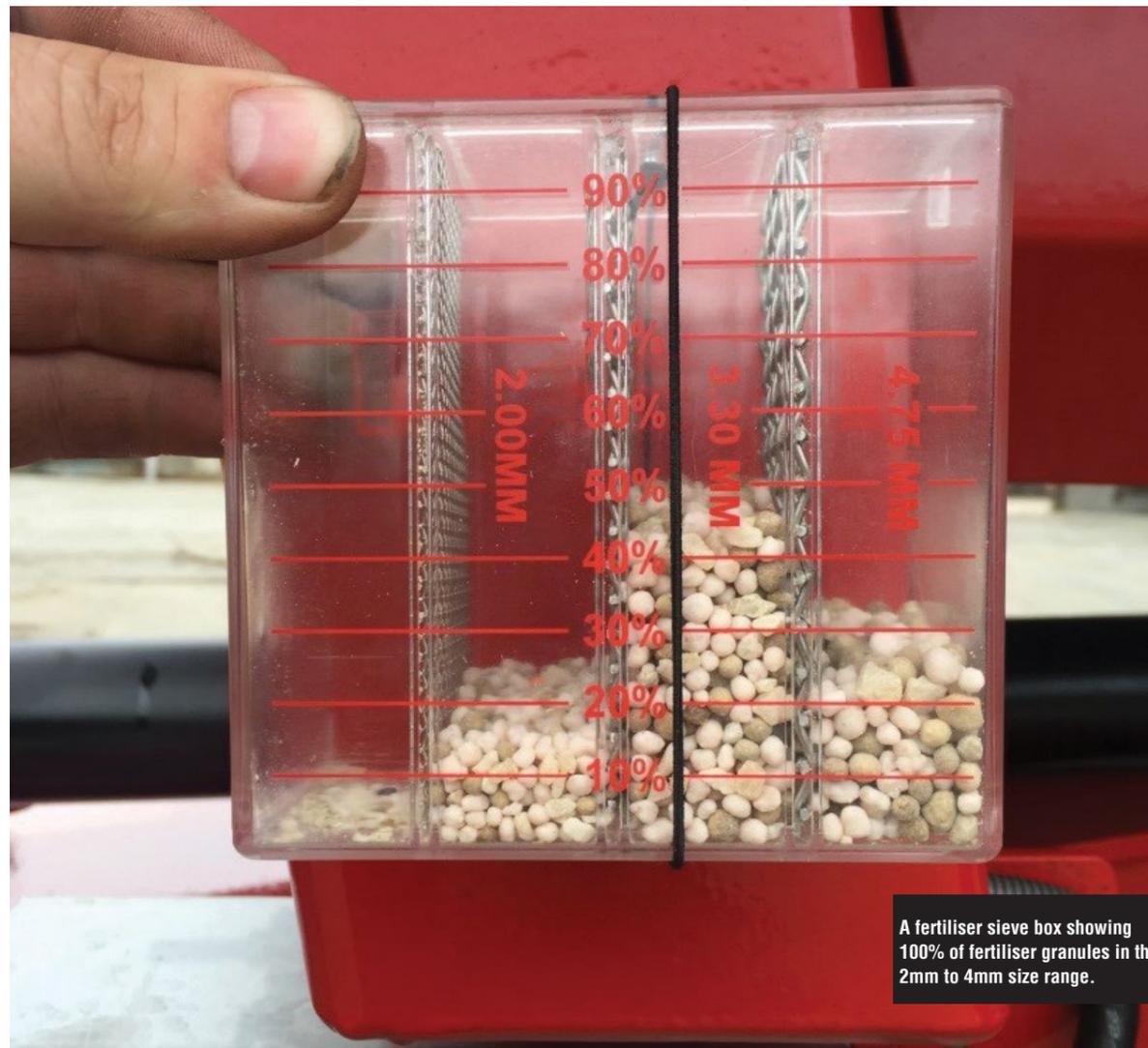
Nitrous oxide is a powerful GHG, 300 times more damaging than CO₂ and 12 times more damaging than the methane produced by livestock. In free-draining soils the nitrate component of the fertiliser can be leached to ground water if there is persistent heavy rain fall following application.

Urea (46% N)

Urea is the most widely used source of N globally and is traded on world markets. Urea occupies between 8% and 12% of the Irish N fertiliser market annually. Urea fertiliser is traditionally applied as an N source early in the season (January to March) as it has a lower cost per unit of N. Secondly, urea is a safer source of N when soils are cold and wet as it is less prone to loss through leaching compared with CAN.

Once urea is applied to the soil it has to be converted to ammonium for plant uptake. During this conversion process N loss, through volatilisation of ammonia gas, can occur if there is insufficient moisture available to wash the urea into the soil.

For example, where urea is applied



to bare soils or in drying conditions there is an increased risk of ammonia volatilisation, which can sometimes lead to lower crop yields compared with CAN.

Urea fertiliser granules are less dense than CAN making it more difficult to spread evenly across wide bout widths. Historically, there was more prilled urea (50% <2mm) available on the market and it was particularly difficult to spread on bout widths (>10m).

The majority of urea on the market today is granular with larger particle sizes (80% of granules are 2mm to 4mm) and are more suitable for wider spread widths. When calibrating and setting your fertiliser spreader for urea it is important to know the particle size distribution which can be determined with a handheld sieve box.

A tray test can also be used to check spread pattern of urea once the fertiliser spreader has been adjusted to the manufacturer's specifications for the particular fertiliser. However,

urea fertilisers have significant transport and work-rate advantages over CAN because of its higher N content.

Protected urea (urea plus NBPT)

Protected urea is urea fertiliser with a urease inhibitor (NBPT) coated on the urea granule. Protected urea is now widely available on the Irish market. Recent research on grassland and spring barley has shown that protected urea reduced ammonia volatilisation losses by up to 80% compared with urea and consistently produced similar yields of grass and spring barley to CAN. In these studies, the protected urea often had slightly higher fertiliser N recovery indicating that it is a very efficient N fertiliser source. There were reduced N₂O emissions using protected urea compared with CAN.

In terms of cost protected urea is currently 10% cheaper per unit of N than CAN and 10% more expensive than urea. Where protected urea is being used, consider fertiliser granule size and density with regards

to achieving an even and consistent spread pattern, as you would for urea.

Research findings

•**Grassland:** research conducted at Johnstown Castle at three sites over three years show that CAN, urea and urea + NBPT frequently give similar yields in grassland as shown above in Figure 1.

•**Spring barley:** grain yields were similar regardless of the N fertiliser type used (Figure 2), but N uptake was higher, on average 13 kg/ha over the three years, with protected urea compared with CAN. All N fertiliser types also produced similar grain protein levels.

Although urea produced similar yields to CAN in these studies, on some occasions the N uptake from urea was lower. Therefore, farmers should be cautious when spreading urea. Only apply when weather and soil conditions are suitable, due to increased potential for N losses through ammonia (NH₃) volatilisation which could result in reduced crop yields.

Figure 1: Average relative grass yields for CAN, urea and urea + NBPT across six grassland sites with five N application rates and a total of 30 fertiliser application dates

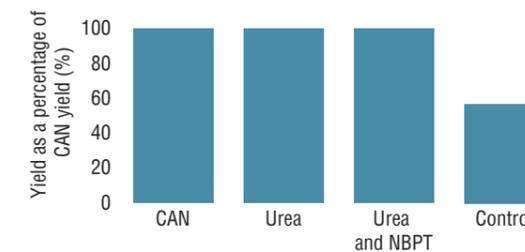
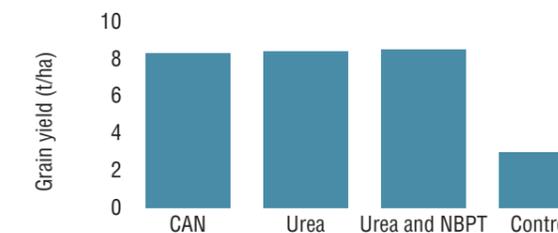


Figure 2: Average grain yield for spring barley across three years for CAN, urea and urea + NBPT applied at 150kg N/ha



Relative star rating of the different N fertilisers

	CAN	UREA	Protected UREA
€ Cost of N	★★★★★	★★★★★	★★★★★
Crop Yield	★★★★★	★★★★★	★★★★★
N Uptake	★★★★★	★★★★★	★★★★★
N ₂ O (GHG) loss	★★★	★★★★★	★★★★★
Ammonia loss	★★★	★★★	★★★★★
Leaching loss	★★★	★★★★★	★★★★★
Spreadability	★★★★★	★★★★★	★★★★★

Based on research conducted by Teagasc Johnstown Castle



Key messages

- Protected urea has a number of advantages as an N source compared to CAN and urea fertilisers. Protected urea will reduce N losses through ammonia volatilisation compared to urea and consistently produced similar yields to CAN with slightly higher N uptake.
- Protected urea also reduces nitrous oxide (N₂O) emissions. Overall protected urea is a good N source for the main growing season in grassland and spring cereal crops for achieving consistent crop yields and high levels of N efficiency.
- Protected urea is a proven technology which can help Irish farmers to reduce GHG and ammonia emissions.
- For best results with protected urea calibrate the fertiliser spreader to deliver the correct rate and check fertiliser quality for even application.