

Innovative technology using protected urea

Seamus Kearney
Teagasc, Signpost Programme.



Seamus Nolan
Teagasc Roscommon Longford



Martina Harrington
Teagasc Future Beef Programme



Why change to protected urea now?

As part of the Climate Action Plan for 2021, the agricultural sector has been set a target of reducing greenhouse gas (GHG) emissions by between 22% and 30% by 2030.

To reach this target without cutting stock numbers, new technologies will have to be adopted by farmers. Protected urea is the technology that has the potential to give the largest and quickest reductions in GHG and ammonia emissions within agriculture.

What is protected urea?

Protected urea is a urea nitrogen (N) fertiliser made safe from ammonia loss through the addition of a urease inhibitor. There are over 20 protected urea products available from at least six companies. There are straight N options, N and sulfur (S) options as well as N, K and S options. If in doubt, check <https://www.teagasc.ie/crops/soil-soil-fertility>.

When do you use protected urea?

The major advantage of protected urea is that farmers can use it from late January to early September.

It will work as effectively as urea in spring in damp conditions and, due to the use of the urease inhibitor, it releases N slower and more effectively than CAN in the summer.

How does it affect grass growth?

While the quantity of grass grown by using CAN, protected urea and urea was similar across all fertiliser types in short-term Teagasc trials, in a long-term trial at Johnstown Castle, the grass grown by the fertiliser (i.e net of the zero N control) for protected urea was greater than straight urea in six out of seven years, 2018 being the exception due to drought when water was the limiting factor not nitrogen.

Protected urea grew 13% more grass on average compared to straight urea.

How much does it cost?

Protected urea is cheaper than CAN per kg of N, and, while it may appear slightly more expensive than straight urea, it will give the same effective N for the plant as straight urea, at a 12.0% lower application rate.

For example, assuming a rate of 50kg N/ha spread as protected urea, or 50kg N/ha spread as CAN in March 2022, the equivalent quantity of N as straight urea that would need to be

spread is 57kg/ha, allowing for the extra losses from straight urea.

If we assume costs of urea are €950/t, protected urea are €1,000/t and CAN are €750/t, Table 1 highlights the difference in cost, with protected urea being the cheapest option.

The value of retaining N (in protected urea) that had previously been lost as ammonia has increased dramatically in line with the increased fertiliser cost.

Also, in a situation where N application rate is limited, it makes sense to use less of a more effective product.

What does it do for farm emissions?

By switching to 100% protected urea, a dairy farm's total emissions have the potential to be reduced by 7-8%, at a spreading rate of between 200-250kg N/ha. The equivalent savings on total emissions on suckler farms is 1-2%, at a spreading rate of 60-80kg N / ha.

Straight P and K fertilisers or blends such as 0-7-30 or 0-10-20 would be needed to achieve a 100% switch. Alternatively, the use of a split or two of high P/K products such as 18-6-12 and S, based on nutrient need, opens the opportunity for more straight N slots where protected urea, with or without S, is a good fit.

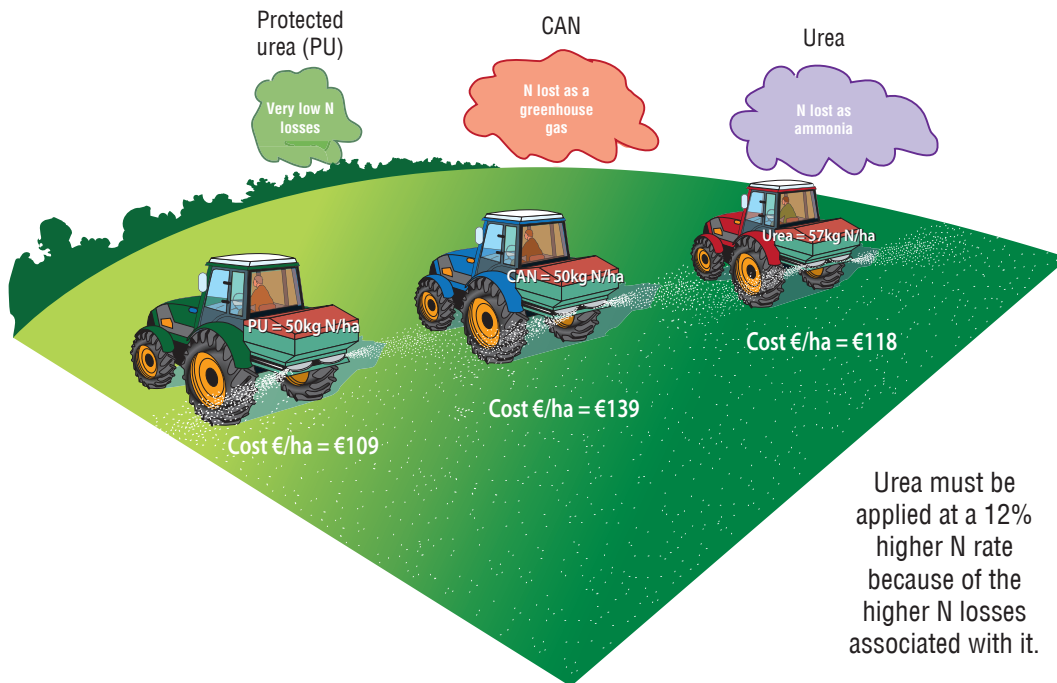
Table 1: The relative cost of applying N from different fertiliser N sources.

	CAN	NBPT Protected urea	Urea
kg N/ha	50kg	50kg	57kg
€/tonne	€750	€1,000	€950
Cost of the application	€139	€109	€118

Summary

	Protected urea	CAN	Urea
Grass grown	√	√	
Lowest ammonia emissions	√	√	
Lowest GHG emissions	√		√
Lowest GHG and ammonia emissions	√		
Lowest cost € / kg of nitrogen			√
Lowest cost € / kg of effective N	√		

Protected urea delivers lower emissions at a lower cost



Field experience

"I used the Goulding protected urea product (KAN)," says Sam Pierce of Bannow, Co Wexford.

"I spread a lot of my straight N this way in 2020. It was probably one of the easiest fertilisers to calibrate in the spreader, and that is taking into account that my machine can be hard to get right.

"I got a lot further with a spreader-full. I have a 2t spreader. If I was spreading 20 units, I could spread almost 80ac in one go with 38% KAN, as opposed to 50ac using CAN, which as we know is only 27% N. When you are working mostly on your own, this is a huge saving in time.

"It is also cheaper per unit of nitrogen than CAN. In 2020, a tonne of CAN was costing me €287 and it has 270kg of N per tonne, so that is a cost of 1.06c per kg of nitrogen.

"The KAN cost €370 per tonne with 380kg of N per tonne and so it cost me 0.97c per kg of nitrogen. That difference is even bigger for 2022.

"I didn't do a tray test, but I had no stripes in grass or tillage crops (spread at 18m tramlines).

"I knew the protected urea had less GHG emissions associated with it than CAN, but only recently realised it has 71% less. This seems worthwhile to me."



Cathal and Des McHugh

Cathal and Des McHugh milk 110 cows near Strokestown in Co Roscommon. They are focus farmers under the Teagasc/Aurivo joint dairy programme and participants in the Signpost programme.

"In 2021, 45% of all chemical N we spread was in the form of protected urea," says Cathal.

"The remaining 55% of nitrogen was applied in the form of NPK compounds.

"After hearing about protected urea at discussion group meetings, we decided to try it out and we have been happy with the results."

As recorders of grass covers, they say there was no obvious difference between protected urea and CAN in relation to grass growth.

One thing Cathal did observe was its tendency to readily absorb moisture from the atmosphere and they avoid

leaving product in the spreader for any extended period.

"A tonne of protected urea (46% N) contains 920 units of N, whereas a tonne of CAN (27% N) only contains 540 units of N," says Cathal.

"A unit of each will grow the same amount of grass, so it's important that products are compared on a cost per unit basis."

Switching to 100% protected urea has the potential to reduce total GHG emissions by 7% on the farm and every tonne purchased counts towards the national GHG inventory for agriculture.

"Protected urea, LESS and reducing chemical N use are the low hanging fruit when it comes to GHG emissions," says Cathal.

"These tools are a great initial step in reducing our carbon footprint as an industry."