Stabilized nitrogen products are starting to gain momentum in the European marketplace. Larger merchants are backing the products and farmers are becoming persuaded of the role stabilized fertilizers can play in reducing nitrogen losses from volatilization and leaching.

Keeping more nutrients where they are needed enables plants to exploit more, improving yields and quality and benefiting the environment.

Urea fertilizers tend to be more prone to these losses than other forms of nitrogen fertilizer, especially at warmer temperatures and/or high levels of moisture.

Why do these losses occur?

Once fertilization has taken place, the urea in the soil is converted into ammonium through a process called hydrolysis. This is carried out by an enzyme called urease, which is present in many soil-borne bacteria.

Ammonium is a readily available source of nitrogen for plants. However, when temperatures are high, on light soils or where pH values in the soil are higher than 7.5, it is possible that the speed of conversion from urea to ammonium can exceed the ability of soil particles to take up ammonium. This excess ammonium is at risk of being lost to the environment through volatilization, where ammonium is converted to ammonia gas and lost to the atmosphere. However, ammonium is relatively short-lived in the soil. It is readily converted by Nitrosomonas bacteria to nitrite, which is subsequently converted to nitrate by another group of bacteria, Nitrobacter. This process is known as nitrification.

Nitrate is readily available to plants but is also highly mobile. If the rate of nitrification is too high, large quantities of nitrate can build up, resulting in luxury uptake by plants, which can be damaging and wasteful. Such quantities can also easily be leached through the soil profile and out of reach of the plants. They are also readily converted by denitrifying bacteria into gaseous nitrogen or nitrous oxide, which can also be lost to the atmosphere.

Most stabilized ureas are coated with a urease inhibitor to delay conversion of urea to ammonium. However, while these products have been shown to have useful effects in reducing ammonia emissions in warm climates like the US, or on very light sandy or alkaline soils, the effect is usually short-lived and only lasts one to three weeks.

SKW Piesteritz, based near Wittenberg in eastern Germany, took the process a step further when it developed Alzon 46, incorporating a nitrification inhibitor into urea fertilizer.

High efficiency

This inhibitor reduces the rate of conversion of ammonium, which is relatively stable, to nitrate. It also means smaller amounts of nitrate are released over a given period, which evens out supply and leads to a high efficiency of nitrogen (N) use by the crop.
Alzon neo-N: how it works

The product maintains ammonium-based plant nutrition for several weeks. The overall effect encourages root growth, reduces luxury uptake and excess green matter production and improves the availability of phosphorous and trace elements. This better efficiency is most marked in damp spring conditions when growers could potentially reduce rates.

As well as improving nutrition, the nitrification inhibitor also benefits the environment by reducing both nitrate leaching and gaseous N losses. Unlike many other products, the inhibitor is incorporated throughout the whole granule at manufacture, rather than being applied as a coat. This means it carries on working, even when granules or prills are in the advanced stages of breakdown.

Depending on the weather and local conditions, the effect can last from four to 10 weeks.

This creates an additional advantage on-farm in that more fertilizer can be applied at any one time without fear of excess losses to the environment, potentially reducing the number of passes required to one for oilseed rape and one to two for cereals.

This year, SKW Piesteritz has taken the principle a step further. It has combined both urease and nitrification inhibitors into a second-generation stabilized nitrogen fertilizer, called Alzon neo-N.

The manufacture of Alzon neo-N began in early summer 2017. Sales have, and will, remain mainly focused on Germany, but Gleadell is one of a small number of selected partners in a few other countries where the new product will be marketed.

The first cargo into the UK was unloaded at the end of October. The 3,200t shipment is the first of five booked to the end of January 2018 to meet rising demand for stabilized urea in the UK.

Trials have shown the product can reduce nitrate leaching by up to 50% and nitrous oxide emissions by up to 75%, and prevent ammonia losses almost completely.

Climate change and legislation

Stabilized products have been around for some years, especially in the US. However, they are making inroads to parts of Europe, notably Germany and now the UK.

Although the UK continues to be a more favourable location in terms of climate, temperatures are increasing, while drought and extreme rainfall are becoming more commonplace during the growing season in particular.

These changes mean that losses to the environment, plus the reduced availability of fertilizing nitrogen, are becoming an ever-greater problem in relation to nitrogen efficiency and adherence to legal regulations on air and water quality.

Efficient nitrogen use is a major objective to ensure both economical
SKW Piesteritz has combined both urease and nitrification inhibitors into a second-generation stabilized nitrogen fertilizer

and environmentally sound food production. Crops require an adequate supply of nitrogen, but any surplus constitutes a potential emission into the environment.

Global greenhouse gas emission targets are off track, so further attention to address this is likely. Emerging technologies must be part of any national solution.

The UK has made its own commitments to tackling climate change, and the carbon budgets that have been set require steady progress in reducing greenhouse gas emissions.

**EU directive**

It is possible that even stronger policies are required to meet the ambitious targets set by the UK. A government package due to be introduced in April 2018 to help farmers look after the environment will reportedly include a GBP12 mn farm ammonia reduction grant to help tackle agricultural emissions, suggesting the topic is firmly on Whitehall’s radar.

Future policy could link agricultural area support even more closely towards best fertilizer practice through improvements to nutrient management, the type of fertilizer used and application techniques.

Under the EU’s National Emissions Ceiling Directive, updated in December 2016, the UK has signed up to reducing five key pollutants, including ammonia. Detailed within this, the Air Pollution Action Plan, due to be published in 2019, will include an ammonia code, which will contain advice on how farmers can reduce emissions.

Although voluntary, it will be important that high levels of take-up are seen to help the UK meet its commitments to avoid enforced regulation. In Germany, legislation is already in place, where from 2020 farmers must either inject urea-based fertilizers or use ones that include an inhibitor to reduce ammonia emissions.

Unlike Germany, UK growers can use ammonium nitrate as an alternative nitrogen source and the potential losses due to ammonia volatilization are minimal.

However, UK produced AN can supply only 40% of domestic nitrogen fertilizer requirements, so as a farming nation the UK relies on a considerable volume of imported product to satisfy demand.

The industry needs to ensure that these products are used responsibly and includes minimising losses to the environment, for which stabilized ureas offer an obvious solution.

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**Gleadell Agriculture** is an independent major trader of grain, seed and fertilizer based in Lincolnshire, UK. As well as being a significant supplier of grains to UK and overseas grain consumers, the company has a seed portfolio that covers market-leading varieties and is a growing force in the sourcing and delivery of home-produced and imported fertilizer.

Gleadell Agriculture has been working closely with SKW Piesteritz for the past 10 years and is sole agent for its products in the UK.