

Real Results Pioneers

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Reducing ammonia pollution

New urea fertiliser regulations are finally set to be finally implemented in the coming season, but there are still some grey areas that need clarifying.

By Mike Abram

After a year's delay the industry's new stewardship programme governing the use of urea fertilisers is set to be implemented in 2024.

The programme is not legislation, stresses BASF business development manager Jared Bonner. "It's a new stewardship programme to prevent future government legislation, so it's not legislation as so much regulation and rules."

The background to these requirements goes back to the government's Clean Air Strategy policy put in place in 2019, which committed to reducing ammonia emissions by 16% (48,000t) by 2030 compared with a 2005 baseline.

Ammonia damages sensitive environments and contributes to particulate pollution in urban areas, with agriculture accounting for 87% (230,500t in 2021) of UK's total ammonia emissions, with 16% derived from inorganic fertiliser applications, according to research conducted by Rothamsted Research.

"A significant part of that is from the volatilisation of ammonia into the atmosphere when urea fertilisers are applied," Jared notes.

Industry consultation

That led to a government consultation where originally three options were presented: to ban solid urea fertilisers outright; to limit the times of year when solid urea could be applied to land to between 15 January and 31 March; and to limit applications of solid urea to only being possible with the addition of a urease inhibitor.

After consultation with the wider industry including fertiliser manufacturers, port authorities and haulage companies, where the knock-on impacts on storage, haulage, competition and availability were considered, an option 4 was proposed by various stakeholders, such as AIC and NFU, and ultimately accepted by government.

Ian Lutey

“It's a new stewardship programme to prevent future government legislation”

Option 4, which only applies to English farmers, is a non-regulated approach and effectively combines the option to restrict the dates untreated urea can be used, and the requirement to treat urea with urease inhibitors outside of those dates.

It will be monitored as a new Red Tractor farm assurance standard (see panel), limited applications of uninhibited / unprotected fertiliser containing over 1% urea — both solid and liquid — to between 15 January and 31 March each year. Protected / inhibited solid and liquid urea fertilisers can be



The same products were used for the three splits, after an initial ammonium sulphate application.

applied outside of these dates.

In total, the change is expected to reduce ammonia emissions by 11,000t/year. Government figures suggest the spreading of inorganic fertilisers contributed 36,200t/year of ammonia emissions in 2021.

There are some grey areas in the interpretation of the new regulations that need to be clarified before next January, Jared acknowledges. That includes the caveat that says unprotected / uninhibited liquid fertilisers containing urea can be applied after 1 April if agronomic justification is provided by a FACTS-qualified farmer or adviser.

“In practice, they are saying if it is a foliar liquid feed then there is a case for that to be applied without an inhibitor,” Jared suggests. The grey area is what the agronomic justification for leaving it out is.”

Framework needed

“Currently what has been floated is that it should have the same environmental benefit from having it in, but it is a bit woolly and companies writing recommendations will need a good framework to use. Hopefully by the end of the year we get an explanation of what it means in practice.”

A second area requiring clarification is whether urea-based slow-release fertilisers with protected coatings can be applied outside of the closed period, Jared adds. “These are referred to as protected, which is creating confusion. But these don’t contain a urease inhibitor.”

Urease inhibitors help slow down the breakdown of urea into ammonia, Jared explains. “The plant needs ammonia because it can’t use urea. But we want that process to happen in the soil because when it happens on the surface there’s the potential for volatilisation.”

Volatilisation happens when, usually in dry conditions, the urea prill, which is hygroscopic, pulls in moisture creating a ▶

What are the new restrictions on application of urea fertilisers?

Fertiliser containing urea must only be applied where the following requirements are met:

- protected/inhibited fertilisers containing solid urea can be applied within any product use by/best before dates
- protected/inhibited fertilisers containing liquid urea can be applied with the prescribed rate of protector/inhibitor for the application, and within any product use by/best before dates
- in England, unprotected/uninhibited solid fertiliser containing urea can only be applied between 15 January and 31 March
- in England, unprotected/uninhibited liquid fertiliser containing urea can be applied between 15 January and 31 March
- in England, unprotected/uninhibited liquid fertiliser containing urea can be applied between 1 April and last application in autumn only if agronomic justification is provided by
 - FACTS-qualified farm personnel or
 - advice specific for the crop has been provided by a FACTS- Qualified Adviser and been followed
- in Northern Ireland, Scotland and Wales fertiliser containing urea (solid and liquid) can be applied as per relevant legislation

Source: DEFRA consultation response, March 2022



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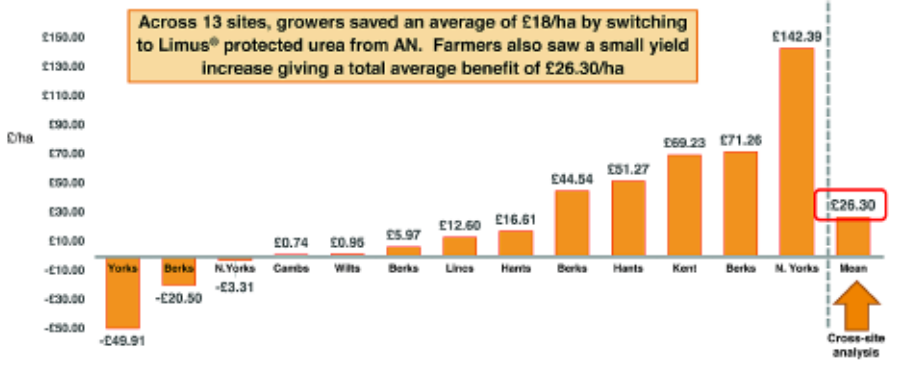
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► water halo around it. “What that water is doing is creating a pH spike, and it is that pH that causes ammonia gas to be formed and released [when the urea is broken down by the urease enzyme].

“So when farmers use urea there needs to be some moisture to get it into the soil, which can be tricky at some points of the year. What the urease inhibitor does is inhibit the urease enzyme, which gives time for the urea prill to get wetted down and taken into the soil.”

There are three recognised urease inhibitors available in the UK, all with very similar names: NBPT (N-(n-butyl) thiophosphoric triamide); NPPT (N-(n-propyl) thiophosphoric triamide); and

Mixed fertiliser purchasing provides Cambridgeshire farmer with flexibility

Buying a mix of different fertiliser types should help Cambridgeshire farm manager Ian Lutey manage the new regulations without too much change.

Farming 1400ha of combinable crops for RH Topham & Sons near St Neots, 50% of Ian’s current fertiliser purchases have been unprotected urea, with 40% ammonium nitrate and 10% liquid UAN.

“We’ve still got more to buy,” he says. “And I’ve still got some urea to be delivered so I’ve got the option to add Limus to that.”

Historically he has been an earlier purchaser of fertiliser, which two years ago worked out very positively, last year less so although supply concerns still made it a good decision, he says. But he is considering buying less forward in future so he can judge how much treated urea he will require nearer the use date.

The split of different fertiliser types helps him spread risk, he says. “I can manage my options, adjust to the weather and use the appropriate option.”

In wheat, historically he’d apply around 220kgN/ha to winter wheat, although in the past two seasons that’s been cut back to 180-200kgN/ha given the high prices and changes in break even ratio. Grain nutrient analysis through ADAS YEN has highlighted that last year he cut back too far.

“My learning was that our

historical nitrogen levels were about the right level, so I think this year, depending on grain prices we might be back up again. I’m interested in minimising costs of production per tonne, not how little nitrogen I can use, as long as it is economic. At the moment the market is not paying huge prices for carbon offsetting.”

Around 60-70% of his N will be applied to wheat before 1 April in a typical year, but he thinks the new regulations might incentivise farmers to put more on earlier, even if that’s not the right thing to do. He also points to the uncertainty about how to interpret the regulations around FACTS qualified advisers providing agronomic justification for not using inhibited products.

“If you’re FACTS qualified, my grey area of understanding is that you don’t necessarily need to use inhibited product if you’ve got the justification for doing it without — the right weather or you’re going to incorporate it, etc, etc,” he says.

“Any good farmer wants to get the maximum out of his fertiliser — it’s not cheap — so why would you put it on in conditions when you are going to lose a percentage of it? It’s in our own interests to use it as efficiently as we can.”

His experience of Limus protected urea in trials, so far, has supported his opinion that it’s not needed all the time if uninhibited product is applied in the right conditions. “Limus has a place, but I’m still learning how and

where to use it, where you do and don’t need it.”

Two years ago the trials as part of BASF Real Results programme compared liquid UAN with and without Limus Perform in a tramline trial analysed by ADAS Agronomics. The same products were used for the three splits, after an initial ammonium sulphate application, rather than Ian’s usual policy of applying different fertiliser types during the season.

“There was no measurable difference in yield,” he says. “There was a hint of slightly higher grain protein with the Limus Perform, but it was only a hint.”

He puts the lack of the yield improvement — on average BASF trials suggest Limus Perform increases yield by 4% over liquid UAN — down to application timing. “I actually questioned whether we should carry on with the trial because of the [wet] weather at time of application. My educated guess at the time of application was that we didn’t need it, which, with the benefit of hindsight was probably proved correct.”

The trial harvested this summer

compared ammonium nitrate and solid Limus-protected urea. This time, despite no differences evident between treatments when analysed by NDVI imagery, the Limus protected urea gave an estimated 0.41t/ha higher yield than the ammonium nitrate, according to ADAS Agronomics analysis, with a less than 1% likelihood was the result of underlying field variation.

Ian says the second application was delayed to April, which impacted yields, and he wonders whether some of the ammonium nitrate was lost as nitrous oxide as it was wet when applied.

“Grain analysis results might help further in explanation of the results.”

The result has given him more confidence in using protected urea in future, he says. “If it’s better for nitrogen use efficiency, for the environment and for my pocket, it’s a win: win for everyone.

“But the more you get to know a product, the more you are in an educated position to make the call where you need it — you just need to have the right stuff in the shed at the right time.”

Real Results Fertiliser trial treatments at RH Topham & Sons

Farm standard		Limus
9th February	56 kg N/ha as urea	
5th April	70 kg N/ha as AN	70 kg N/ha as Limus
26th April	90 kg/ha Polysulphate	
2nd May	70 kg N/ha as AN	70 kg N/ha as Limus

2-NPT (N-(2-nitrophenyl) phosphoric triamide).

There are several products available containing NBPT, which is now off-patent, while German manufactured 2-NPT is less commonly-found in the UK market. The third active, NPPT, is an in-house BASF product. Sold as Limus for solid urea fertilisers, and Limus Perform for liquid urea it contains both NBPT and NPPT.

More efficacy

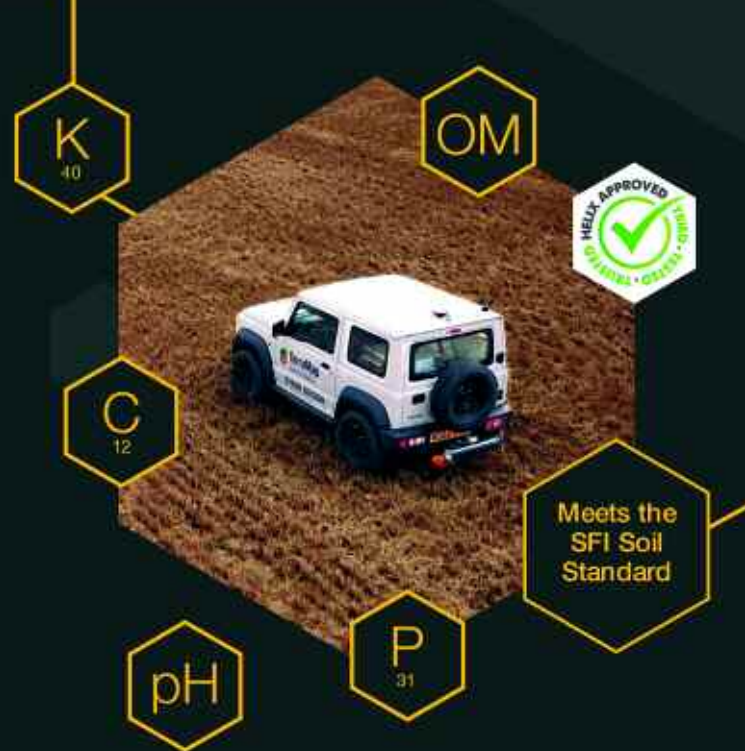
“That’s important because urease enzymes are ubiquitous, and there are a lot of different enzymes that fall under that umbrella,” Jared says. “So the NBPT and NPPT are slightly different sized molecules so they can inhibit a larger part of the urease enzyme population. In tests we see about 5% more efficacy compared with NBPT alone.”

In lab tests under various different soil types volatilisation can be reduced up to 98%, and on average 83%. “In the field, from 93 trials, the average reduction is 70% so obviously a few more environmental factors come in, and in some cases nearly a 100% reduction. It’s a consistently big reduction,” Jared stresses.

Obviously, there is an increased cost to adding an inhibitor to fertiliser. At the height of the fertiliser price increase, Limus was costing around £50/t extra. That’s dropped a bit to around £40/t premium with the generic NBPT products slightly cheaper. Limus protected urea is still on a per kilo N basis cheaper than ammonium nitrate, Jared adds. “So there is an upfront saving.”

As importantly, according to BASF trials, while usually you would expect ammonium nitrate to give a higher yield than using the equivalent unprotected urea, there is no yield penalty from using Limus protected urea, Jared says. “That’s because you’re not losing ammonia to volatilisation. You’re keeping it in the ground in the place where the plant can use it.”

In 13 winter wheat and winter barley Real Results trials, analysed by ADAS Agronomics across England, growers gained an extra £26.30/ha on average from using Limus protected urea rather than ammonium nitrate, he adds. Around £18/ha was saved through the lower cost of fertiliser, with a small yield increase pushing that to £26.30/ha (see chart). ■



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The Real Results Circle

BASF’s Real Results Circle farmer-led trials are now in their sixth year. The initiative is focused on working with more than 50 farmers to conduct field-scale trials on their own farms using their own kit and management systems. The trials are assessed using ADAS’ Agronomics tool which delivers statistical confidence to tramline, or field-wide treatment comparisons

— an important part of Real Results. The features also look at related topics, such as environmental stewardship and return on investment. We want farmers to share their knowledge and conduct on-farm trials. By coming together to face challenges as one, we can find out what really works and shape the future of UK agriculture.



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