

Best Practice for Fertiliser Use Efficiency

Overview

With fertiliser prices rising to unprecedented levels, getting the most out of what you have has never been more important. On average, only 60% of applied fertiliser is utilised and 40% lost* - these losses can equate to over £330 per tonne*. Nitrogen loss from fertiliser application is a given, however, timing it correctly and following the best practices will help you maximise your fertiliser use efficiency.

By adopting the following practices, you could halve your losses and improve your fertiliser use efficiency by 20%, benefitting both the economics and environmental impact of the farm.

Nitrogen

The first question is: what does your soil and crop need? Regularly testing your soils and undertaking tissue analysis is a great way to monitor nutrient and pH levels and will offer insight into how nitrogen is being taken up by the plant.

Nitrogen will almost certainly exist in your soils, be it from naturally occurring biological nitrogen fixation or as reserves from historic crop residues. Adjusting application rates to complement the existing reserves is important to reduce direct nitrogen losses from oversupply and also to financially benefit.

Uptake of nitrogen is strongly governed by soil pH and the availability of other nutrients in the soil. For example:

- A pH that is too high or too low will reduce effectiveness of fertiliser application, target pH 6.0-7.0 depending on the rotation
- Carbon provides a crucial energy source for the soil microorganisms responsible for nitrogen cycling, co-applying carbon with nitrogen may see utilisation benefits
- Phosphorus will promote an extensive root network that will increase the area plants are capable of scavenging nitrogen, testing of soils can identify this as a deficiency
- Sulphur aids nitrogen uptake within the plant, using blends with both elements can benefit growth and protein synthesis
- Calcium enhances the resilience and development of root systems, using blends with both elements can benefit rooting and plant health

Consideration should be given when applying fertiliser as to what other nutrients are needed – do you need to apply the fertiliser alongside a carbon source, phosphates or trace elements to reap the best rewards?

*Reference:

<https://www.fwi.co.uk/arable/crop-management/nutrition-and-fertiliser/6-steps-to-improve-your-fertiliser-use-efficiency>

<https://ahdb.org.uk/GB-fertiliser-prices>

Timing

Timing is another key factor to improve fertiliser use efficiency, by reducing nitrogen losses and enhancing uptake. Applying urea fertiliser when the soil is warm and dry will increase ammonia volatilization leading to significant losses. Equally, applying fertiliser before a forecast of heavy rain will increase chances of leaching. Ideal conditions are when the soil has moisture, but the upcoming weather forecast is dry.

Note: To avoid ammonia volatilization, consider swapping urea fertiliser for ammonium nitrate. Alternatively, urease inhibitors are a useful addition to convert urea to ammonium thereby reducing losses as ammonia.

Alongside weather, timing applications to coincide with crop growth stage is crucial to gain the most benefits. Only apply fertiliser when it is required by the plant. Fertiliser should be applied when there is sufficient crop growth to optimise uptake. In general, uptake matches growth i.e. smaller plants need less fertiliser. Adjust your nutrient management plan to avoid waste, this may mean utilising a three or four split system.

Note: Consider cover crops or catch crops to scavenge residual nitrogen applied to the previous cropping. Nitrogen will be utilised and stored in these crops until they break down, at which point the nitrogen will be released back into the soil. This will benefit the following crop and can reduce the overall requirement for as much nitrogen fertiliser going forward. This is particularly beneficial where crops are undersown or when the crop has been drilled into standing cover as bare ground and the potential for loss is limited.

Looking after the Soil

Improving soil structure will improve fertiliser use efficiency by providing optimum conditions for nutrient cycling and plant uptake as well as potentially reducing the need for so much fertiliser in the first place. Well-developed soil aggregates provide the right conditions for root development and extension whilst enabling the soil biology to thrive, providing microsites to support the consumption and release of essential plant nutrients. Perhaps most crucially, good soil structure also improves the soil's ability to hold onto water. As a result, the soil has greater resilience against extreme weather conditions and nitrogen is less likely to be leached from the system.

Technology

Testing application equipment and utilising current technologies on farm is a good way to ensure accuracy and efficacy when applying fertiliser as well as reducing losses. Examples of these practices to consider are:

- Calibrate your fertiliser spreader to improve accuracy, remembering that this should be done for each different product that is used
- Consider the use of in-furrow or placed fertiliser rather than broadcast application at drilling so the nutrition is close to the seed and more available for uptake when plants are small
- Use remote sensing by satellite to monitor surface temperature and climate to help plan applications around soil moisture and weather conditions
- "Bioprime" seeds with a carbon source or trace elements to boost plant growth and fertiliser uptake
- AutoShut-Off when applying liquid products to stop double applications on headlands/field corners and prevent spraying environmentally sensitive areas

Diversify your Leys and Rotations

Diversifying the species within the rotation through incorporating legumes, herbs and deep rooting plants can improve fertiliser use efficiency by enhancing soil fertility and improving soil health. They do this by:

- Improving soil structure with extensive root systems
- Providing organic matter for the soil through the break down of aboveground residues and plant roots
- Feeding soil biology with diverse root exudates and supporting a diverse range of beneficial soil microorganisms
- Fixing nitrogen (by legumes) from the atmosphere providing a biological, plant-available source of nitrogen reduces the reliance upon artificial fertilisers

Policy: Fertiliser in NVZ Areas

It is important that you follow the government rules when applying nitrogen fertiliser, and be aware of specific guidelines in nitrate vulnerable zones (NVZ). You must not spread manufactured fertiliser on or between the following dates (closed periods):

- Grassland: from 15th September to 15th January
- Tillage Land: from 1st September to 15th January

If you grow winter oilseed rape you are permitted to spread fertiliser up to 30kgN/ha in the autumn closed period.

More information is found on the Government website:

<https://www.gov.uk/government/publications/applying-the-farming-rules-for-water/applying-the-farming-rules-for-water>
<https://www.gov.uk/guidance/using-nitrogen-fertilisers-in-nitrate-vulnerable-zones>

Fertiliser Cost Benefit Analysis

Working out the cost benefit of applying fertiliser is a good way to ensure total fertiliser use does not exceed the yield benefit. There are many tools available that cover grassland and combinables that calculate the cost benefit of applying N fertiliser.

For grasslands, fertiliser and feed prices are taken into account, and application is compared with the feed value of grass - this should help inform the choice between applying nitrogen fertiliser or buying in feed instead. <https://ahdb.org.uk/knowledge-library/cost-benefit-calculator-for-nitrogen-fertiliser-use-on-grassland>

For cereal grains and oilseeds, fertiliser and grain prices are taken into account. The calculator then adjusts the amount of N you should apply so that the extra cost of fertiliser is covered within the value of extra grain produced. <https://ahdb.org.uk/knowledge-library/nitrogen-fertiliser-adjustment-calculator-for-cereals-and-oilseeds>

Policy: Planning Fertiliser Applications

Ensure you have an up-to-date written nutrient management plan, in accordance with the farming rules for water, to demonstrate when, where and at what rate you plan to apply fertiliser. The plan should be unique to your farm and include:

- An assessment showing crop requirements for each cultivated land parcel
- Results for each field from soil sampling and analysis
- The nutrient content of applied fertilisers

Avoid risk of agricultural pollution by planning to:

- Meet and not exceed the needs of the soil and crop;
- Have established green cover by 15th October (e.g. green manure, commercial crop or cover crop). Reasons for exemptions: to control persistent weeds and/or to allow medium and heavy soils to weather before spring cropping
- Incorporate organic manures unless there is an appropriate agronomic or environmental reason not to. For example, applying into growing crop or grassland, or if precision application methods are used

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