FOCUS

Fertilizer Association of Ireland

FERTILISERS

INTRODUCTION

Using fertilisers efficiently

Welcome to the 2021 fertilisers Focus, which is put together by the Fertilizer Association of Ireland in association with the *Irish Farmers Journal*. This year's supplement brings a number of informative articles to guide fertiliser use, from fertiliser choices to clover nitrogen (N) savings.

Mark Plunkett
Fertilizer Association of Ireland president

Fertiliser is a key input on Irish farms and when applied at the right rate at the correct time, it delivers a very good return on investment. Irish soils are very responsive to the application of fertilisers due to our damp climate.

Farmers continue to evolve and adopt new technologies on their farms to use applied N, P and K more efficiently, eg safer types of nitrogen fertilisers (protected urea) and low-emission slurry application techniques. Adoption of these technologies will significantly reduce N losses as either ammonia or nitrous oxide at least cost.

One of the largest challenges that we face now and in the years ahead will be climate change.

The effects of climate change are very real, especially with our changing weather patterns and its impacts on how we manage our farms. How we manage applied nitrogen will play a key role in slowing down future climate change.

Improving N efficiency starts with improving soil fertility.

Up-to-date soil analysis and preparation of a fertiliser plan will be the starting point to managing applied nutrients efficiently.

Correcting soil acidity and maintaining optimum soil pH will be the first step to improving soil N supply and increasing the efficiency of applied N in manures or fertilisers.

This year's supplement provides guidance on many aspects of managing nutrients efficiently, from buffer margins to selecting the most suitable fertiliser types.

On page 51, Jack Nolan from the Department of Agriculture gives an insight into future changes to fertiliser use under the Green Deal and Farm to Fork.

On page 50, William Burchill discusses a number avenues to explore to improve N supply and efficiency on farms, while on page 60 Donal Sheehan outlines how he is reducing N usage on his farm in Cork.

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Maximising all nutrients on the farm

Dr William Burchill from Teagasc outlines how farmers can get the best out of all nitrogen sources on the farm

The average nitrogen use efficiency on dairy farms is 25%. The target is 35%.

In short

Maintaining current grass production levels using less chemical N fertiliser is going to be one of the major challenges facing dairy farming in Ireland in the near future. Applying the appropriate rates of chemical N fertiliser during the year for your stocking rate, improving soil fertility, spreading slurry with LESS techniques in spring and sowing/promoting clover will all help to meet this future challenge.

The EU Green Deal proposes a 20% reduction in chemical nitrogen (N) fertiliser usage.

If this proposed 20% reduction were to be applied to our current N fertiliser limits, it would reduce our maximum chemical N fertiliser allowances by between 40 and 44 units N/acre.

This raises some serious challenges. Can we reduce our reliance on chemical N fertiliser and maintain current production levels? Could we fill this gap in chemical N fertiliser with other sources of N on our farms? If these changes come into effect, we will have to focus on:

- Improving farm N use efficiency.
- Increasing the N coming from the soil, slurry and clover.
- Maximising the efficiency of chemical N fertiliser.

Improving farm N use efficiency

Nitrogen use efficiency (NUE) is a relatively new concept that will be a key metric. To determine how efficient a farm is at using N, we have to look at how N enters and leaves it.

A farm's NUE is the proportion of N that enters the farm which leaves the farm in sales, eg milk and calf sales (N outputs ÷ N inputs × 100). Currently, the average NUE on dairy farms is 25% and the industry target is 35%.

Good management of chemical N fertiliser, maximising the use of slurry N, improving soil fertility and having high genetic merit cows that efficiently convert grass to milk solids are some of the main areas that improve NUE.

Increasing the N coming from the soil, slurry and clover

- **Soil N:** nitrogen released from soil organic matter (SOM) can contribute between 50 and 200 units N/acre/year, with an average of 120 units N/acre/year recorded on permanent grassland soils in Ireland. To maximise soil N release on your farm, it is important that soils are at optimal soil pH (6.3pH to 6.5pH for mineral soil) and index 3 for P and K. This will create a soil environment that allows the soil microbes to work efficiently to release N from SOM for grass growth.
- **Slurry N:** there are two practical things that can be done on farms to get more value from the N in slurry:
  - Shift slurry spreading from summer to spring.
  - Change from splash plate to using a dribble bar or trailing shoe (LESS).

Spreading slurry with a splash plate in the summer time delivers three units N/1,000 gals of cattle slurry. This can be increased three-fold (nine units N/1,000 gallons) if we change the timing to spring and application method to LESS.

- **Clover N:** white clover can fix between 80 and 120 units N/acre/year. Measurements of white clover N fixation at Teagasc Solohead research farm have found that annual sward clover content is a major driver of the amount of N that clover will supply to the sward.

The amount of N supplied by clover fixation is low in spring but increases during early summer and reaches a maximum around July and August, which coincides with increasing sward clover contents.

For this reason, it is recommended to apply chemical N fertiliser to grass/white clover swards in spring to supply N for herbage growth. Chemical N fertiliser applications can be reduced or removed from May/June on, depending on your stocking rate and demand for grass.

Maximising the efficiency of chemical N fertiliser

Know the right fertiliser N allowances for your stocking rate to maximise chemical fertiliser N efficiency.

Spring

On intensive dairy farms, the target for spring is 23 units N/acre in late January/February and 46 units N/acre in March. In many cases, the 70 units N/acre spread by 1 April should not be a blanket approach across the whole farm or on wetter farms. It's more designed for drier paddocks with good perennial ryegrass content, good soil fertility, good grass covers (>400 kg DM/ha) and warmer/drier ground.

Nitrogen from slurry application should be included in the 70 units N/acre target.

Summer

The aim is to apply a unit of N/day, ie 30 units N/month. The easiest way to do this is match the units N/acre you are spreading to your rotation length. Sulphur application will increase fertiliser N use efficiency. The targets for sulphur are:

- 15 units S/acre on grazing ground (apply from April to June, eg five units S/rotation).
- 15 units S/acre on first-cut silage ground.
- 10 units S/acre on second-cut silage ground (only required on lighter soil types).

Autumn

Apply the final chemical N fertiliser in the last week of August instead of waiting until the last few days before the 15 September closing date. This will give a better grass growth response. Apply 25 units N/acre depending on grass supply at the time and check your fertiliser N allowance.

Table 1: Maximum chemical N fertiliser allowances based on whole farm organic N/ha

Whole farm kg organic N/ha	LU/ha @ 85kg N/cow	LU/ha @ 89kg N/cow	Fertiliser N units/ acre
			(kg N/ha)
<170	<2	<1.91	165 (206)
171-210	2-2.5	1.91-2.36	225 (282)
210-250	2.5-2.95	2.36-2.8	200 (250)
>250	>2.95	>2.8	200 (250)

Nitrogen sales increase in 2020

Barry O'Reilly from the Department of Agriculture looks at trends in fertiliser and soil fertility in Ireland

While fertiliser sales in Ireland have been steadily increasing over the last decade, there are continuing signs of a levelling off in recent years.

Excluding 2018, when the fodder shortage caused by drought conditions led to increased fertiliser use, growth in fertiliser sales has been relatively modest in the last four years.

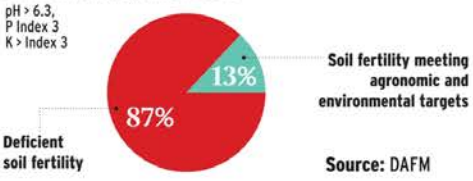
In 2020, sales of nitrogen (N) increased by 3.3% compared to 2019, while sales of phosphorus (P) and potassium (K) increased by 3.7% and 3.3%, respectively, over the same period.

Analyses of soil testing results from across all of the main soil-testing laboratories indicate a continuing positive trend with regard to improvement in overall soil fertility levels.

Soil pH has been improving over time, and results show less highly acidic soils, with more soils within the optimal agronomic range of = 6.3. The proportion of soils at the agronomic optimum of P Index =3 has been increasing since 2016. The change is that K levels have been less during this period, with the highest proportion of soils tested still at the suboptimal Index 2.

Both from an agronomic and environmental perspective, the proportions of soils meeting the optimum criteria has increased since 2016. Across all soils sampled in 2019, 23% had soil fertility levels capable of supplying nutrients for high levels of grass and crop production (pH =6.3 and P & K index =3), up from 14% in 2017. However, excluding soils at P Index 4, which have higher risk for P loss to water, the proportion of soils at both the agronomic and environmental optimum accounted for 13% of all soils sampled in 2019, up from 4.7% in 2017.

Figure 1: Soils with fertility meeting both agronomic and environmental optimum levels



Source: DAFM

Fertiliser nutrient sales in Ireland

Year	Nitrogen (N)	Phosphorus (P)	Potash (K)
2016	339,104	37,075	95,558
2017	369,089	41,893	108,694
2018	408,495	46,387	120,267
2019	367,364	42,672	114,288
2020	379,519	44,259	118,016

Source: Department of Agriculture

www.fertilizer-assoc.ie

How to align Green Deal reduction targets with our needs

There are different sources of fertiliser but sometimes we only think of what comes into the farmyard in pallets and don't pay enough attention to what we have in our slurry tanks or dungsteads.

Jack Nolan, senior inspector with the Department of Agriculture, looks at the implications for Irish agriculture in light of the EU Green Deal

Can we reduce fertiliser use and maintain farm profitability? The environmental credentials of Irish agriculture are being challenged like never before. We know that there are many ways farmers can build on improvements already made.

Grass measurement, animal breeding, clover and multispecies grassland offer opportunities for livestock farmers to reduce their impact on the environment, while crop rotation and cover crops have a key role to play for tillage farmers.

Ag Climatise, the agriculture sector's policy for climate change targets, identifies and supports these measures.

There is an urgent need for change as under the EU's Green Deal and Farm to Fork strategies, there is a target to reduce nutrient losses to water by 50% by 2030 and fertiliser use by 20%.

These objectives are a tremendous opportunity for us here in Ireland to show we can protect and improve our environment while producing top-quality food. Research and soil analysis have shown that there is great scope for us to make better use of fertiliser on farms.

In reality, there are three sources of fertiliser but sometimes we only think of what comes into the farmyard in pallets and don't pay enough attention to what we have in our slurry tanks or our dungsteads and we have ground to make up on what occurs naturally in the soil itself.

Chemical fertiliser

Starting with chemical fertiliser, we already know that unless we have lime status, phosphorus and potassium at the right levels, nitrogen can't work effectively.

Also, there are many other elements such as boron and sulphur which maximise the efficiency of applied fertiliser. Based on soil test results, there is plenty of room for improvement here.

Slurry and farmyard manure, and indeed all organic fertilisers, are valuable sources of nutrients that are often undervalued and still treated as a waste to be dumped rather than a nutrient that will actually help improve soil structure.

Simple steps that we can take start with having sufficient slurry storage capacity so that slurry can be spread during the growing season.

Dribble bars and trailing shoes maximise the use of nitrogen in slurry and, in an ideal world, all slurry in Ireland would be spread using this equipment.

50% target to reduce nutrient losses to water by 2030.

20% target to reduce fertiliser usage by 2030.

Spreading slurry on fields that need phosphorus and potassium makes best use of these expensive nutrients.

The final source of fertiliser and, most important of all, is the soil itself.

We need to focus on increasing microbiological activity in the soil and improving soil health and structure. We need soil to store and release nutrients, filter water, sequester carbon and act as a growth medium.

You can't build a great building on a weak foundation. Having the soil healthy and active is the foundation for us to have a strong vibrant agricultural industry.

The target to reduce fertiliser should be seen as an opportunity for Irish agriculture. We can start making changes this year which will benefit the environment, allow us to be credible in our environmental claims and, ultimately, keep money in farmers' pockets.

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Lots of choice when it comes to fertiliser

Gavin McGowan from Target Fertilisers and **Tim Sheil** from J. Bolger & Co, Wexford, outline some fertilisers on the market

Before you go out buying your fertiliser this spring, take the time to consider the following questions:

➲ What nutrients (N, P, K, S, etc) are required on the farm as indicated by your nutrient management plan or soil test results?

➲ Is the traditional compound fertiliser that you used last year the correct one for your farm this season? Discuss this with your adviser or local agronomist.

➲ What is the most suitable fertiliser compound for different parts of the farm? There are a range of different fertiliser blends on the market with various amounts of N, P or K and S.

Traditionally, when farmers were choosing a fertiliser product they made a relatively straightforward choice between an N-only product such as CAN (with or without S) or a compound fertiliser when P and K was required for grazing, eg N-P-K, 18-6-12 or 27-2.5-5; or for silage, eg 24-2.5-10. These four or five products would have met the fertiliser requirements for many farmers.

However, with factors and influences such as nutrient management planning, better understanding of soil fertility, higher levels of production and better yielding varieties leading to higher nutrient offtake and the need to be more environmentally sustainable, the list of fertiliser products required by farmers has expanded.

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Fertilisers for grazing

Farmers have never had so many fertiliser products to choose from. The typical maintenance nutrient requirement for grazed swards at 2LU/ha is 14kg/ha P and 30kg/ha K. This is a P-K ratio of 1:2, as a lot of nutrients are recycled back to the grassland soil by the grazing animal.

Maintenance fertiliser products suitable for grazing fields such as N-P-K 27-2.5-5 would be suitable. However, if P and K levels are low (Index 1 or 2) consider products such as N-P-K, 18-6-12 or 10-10-20, to build up soil fertility indices.

Care and consideration should be taken with K applications on the grazing platform, as excessive applications may cause magnesium levels in the grass to diminish, leading to grass tetany. The best advice to replenish large soil K requirements (K Index 1) is to use products such as muriate of potash (50% MOP) from late summer onwards. Where P and K levels are adequate, alternative straight N fertiliser choices, such as protected urea, are now widely available in the marketplace. Alternatively, you can use a protected urea N-K product such as 29-0-14+S where K is required. If P is required but not K, then use a product such as N-P: 25-4-0(+S).

Table 1: Example of fertiliser compounds available to all farmers

Fertiliser nutrients	Products		
Nitrogen	CAN(+S)	Urea (+S)	Protected urea (+S)
Nitrogen and phosphorus	23-10-0		
Nitrogen and potassium	29-0-14(+S)		
Phosphorus	0-16-0		
Phosphorus and potassium	0-10-20	0-7-30	
Potassium	0-0-50		
Compounds N-P-K(+S)	27-2.5-5+S	24-2.2-4.5 +S	15-10-10
	10-10-20	10-5-25(+S)	14-7-14
	13-6-20(+S)	18-6-12	11-7-23(+S)
	10-7-25(+S)	24-2.5-10	12-8-20

Table 2: P and K advice for 7.5t/ha[1] spring barley and suggested fertiliser programmes

Soil index	P[1] (kg/ha)	K[1,2] (kg/ha)	N-P-K product	Rate (kg/ha)	Rate bags/ac
1	49	115	10-10-20	480	3.9
2	39	100	10-10-20	480	3.9
3	29	85	10-10-20	480	3.9
4	0	0	-	-	-

[1]Adjust P by 3.8kg/t, K by 11.4kg/t for lower or higher grain yields
[2] Additional K is required at Index 1 & 2 at 40kg/ha and 190kg/ha as 50% K (MOP) once every five years (for soil K build-up). Source Teagasc

Fertiliser choices for silage

Silage will remove a large amount of P and especially K from the soil. Traditionally, slurry and farmyard manure were reserved for the silage ground and helped to offset some of the fertiliser P and K requirements. However, we need to account for high grass silage yields (5t to 6t dry matter/ ha) and to assess the slurry N-P-K values depending on how diluted or thick the slurry is.

This will ensure that the correct fertiliser is selected to meet the full crop requirements, eg N-P-K, 13-6-20 or 14-7-14.

In the absence of slurry, use higher K fertiliser blends on silage fields and go back to top up your N requirement, eg use 10-5-25+S or 13-6-20 +S. You can top up your N requirement with straight CAN or CAN +S or protected urea + S.

Fertiliser for cereals

Tillage farmers have led the change towards using different N-P-K compounds. Higher cereal yields and higher-yielding varieties, higher crop offtakes, low K status observed using extensive soil testing and better agronomic advice have driven this requirement for more specific fertilisers. This is especially true for compounds with high K, with demand increasing over recent seasons. To meet this demand, many compound fertilisers developed by Irish fertiliser blenders have evolved and contain over 50% K. Most of them have added sulphur.

Keep health and safety in mind when handling fertiliser

Teagasc health and safety specialist **Francis Bligh** looks at the actions to prevent injury when handling fertiliser

Thorough planning when making decisions about the type of fertiliser to use, the application rate and timing of application is very important. Planning how fertiliser will be spread in a safe way must also be a high priority.

Health and Safety Authority (HSA) data tells us that, sadly, over the past 10 years accidents related to tractors, vehicles and machinery accounted for 50% of farm fatalities. Spreading fertiliser is highly mechanised and can be a high-risk activity.

Time

Firstly, think about how busy you will be and if a contractor could help spread some or all of the fertiliser for you. It is also important to consider in what form the fertiliser will be delivered. The bulk or big-bag option minimises the need for manual lifting if you have appropriate equipment.

Maintenance

If you are carrying out the job yourself, it is important to carry out a thorough check of your fertiliser spreader. Follow the operator's manual and make sure the PTO shaft, PTO cover, safety chains and O guard are in good condition. Check for cracks, rust, loose components and the general structural integrity of the machine. Make sure oils are checked and the machine is fully greased.

Mounting a spreader

When attaching a fertiliser spreader to a tractor's three-point linkage, it is very important to be aware of the places where a body part could get crushed. HSA data shows that 54% of the fatal accidents with tractors and farm vehicles were due to crush injuries. The area between the fertiliser spreader and the tractor is high-risk for crush injuries. The fertiliser spreader should be positioned on a stable base, with quick-attach mechanisms used where present and the tractor handbrake should be engaged before leaving the cab. Tractor controls should only be used when people are known to be safely outside crush zones.

Protection

Take steps to avoid direct contact of fertiliser products with the skin and eyes.

The corrosive nature of fertiliser can irritate skin, especially where there are cuts or grazes. Always use protective gloves.

It is also good practice to wear a dust mask as the dust from fertilisers can also be a problem.

Sloping ground

Tractors can overturn when spreading fertiliser on sloping ground. Driver competence and experience is very important. Drivers should make sure that they are familiar with the slope by walking it before driving it.

Avoid dangerously steep slopes and make sure that the tractor is in good mechanical condition.

Capital allowances for farm safety equipment

When purchasing eligible farm safety equipment, farmers can claim an accelerated capital allowances of 50% per annum over two years. This eligible equipment includes systems to enable the hitching of implements to an agricultural tractor three-point linkage without having to descend from the tractor, as well as equipment to assist farmers with disabilities. Lifting systems for bags of fertiliser or seed of 500kg or greater are also included. Contact your agricultural adviser for more information.

LESS technique delivers more nitrogen

Mark Plunkett and **David Wall** from Teagasc Johnstown Castle outline how low-emission slurry spreading can deliver more nitrogen to soils

The way we spread slurry here in Ireland is changing and will change even further in the coming years.

To reduce the loss of nitrogen (N) from slurry, a move away from the splash plate to low-emission slurry spreading (LESS) techniques, such as trailing shoe/hose or band spreader is happening on farms. These methods reduce ammonia–N losses during application, resulting in extra N availability from spring or summer slurry applications.

Retaining more slurry N results in a larger proportion of N from slurry to grow grass, while providing opportunities to reduce chemical fertiliser N inputs.

The use of LESS is one of the key tools available to meet our national ammonia gas reduction target between now and 2030.

N, P K and S values

We now must look at cattle slurry in a different light and focus on utilising all of the major nutrients as efficiently as possible.

LESS techniques help to supply a larger proportion of the crop's total N requirements than ever before. This change delivers a double dividend in that it helps to reduce agricultural emissions and our overall farm fertiliser bill annually.

The first step to utilising the nutrients in slurry is to know how much N, P and K is in each 1,000 gallons of slurry.

On farms where dirty water/parlour washings are entering the slurry tank, a more dilute slurry is available.

Table 1 shows the available fertiliser values (N, P and K) for a range of cattle slurries at different dry matters(DM) applied by LESS.

Typical cattle slurry has a dry matter (DM) of 6% and a nutrient profile shown in Table 1. More dilute slurry (2% to 4 % DM) will have reduced N, P and K values, which may result in the under-fertilisation of crops such as grass or maize silage if the slurry is assumed to have more typical nutrient content. These crops generally receive a large proportion of their N, P and K in the form of slurry.

Take slurry DM percentage into account and make adjustments to application rates to ensure sufficient nutrients are applied to meet crop requirements during the growing season.

The DM percentage of slurry can be measured on a farm with a slurry hydrometer or, alternatively, by sending a sample of agitated slurry for nutrient analysis to a laboratory (N, P, K and DM percentage).

Timing of applications

The second step to increasing slurry N efficiency is optimising the timing of slurry applications.

Spring applications of cattle slurry typically have higher recovery of N by up to 50% compared to summer applications (Table 2).

Weather conditions in spring will be more favourable to improving the recovery of N from the slurry, eg cool (< 13°C), damp, overcast cast days when N loss through ammonia emissions are lowest.

Spring application using LESS further increases N availability by 65% compared to summer application.

For example, where a grass silage crop receives 33m³/ha (3,000 gallons/ac) in springtime, this will supply 33kg/ha N (~25 to 30% of the crop's N requirement). However, when applied in summertime, it will only supply 20kg/ha N.

Other benefits of LESS

- Improved flexibility with applications as a result of reduced contamination of herbage leading to a quicker return to grazing.
- Opportunity to apply slurry into larger grass covers which creates a wider window for application in better soil conditions, particularly in spring.
- More even application of slurry across the spread width.
- Smells released during and after application are reduced.

Table 1: Available N, P and K values of cattle at different dry matter (DM)% in spring by LESS application techniques

Dry matter %	N kg/m² (units/ 1,000 gals)	P kg/m² (units/ 1,000 gals)	K kg/m² (units/ 1,000 gals)
2	0.4 (4)	0.21 (2)	1.4 (13)
4	0.7 (6)	0.35 (3)	2.1 (21)
6	1.0 (9)	0.5 (5)	3.5 (32)
7	1.1 (10)	0.6 (6)	4.0 (36)

Note: On index 1 and 2 soils reduce slurry P availability by 50% and reduce K availability by 10%

Table 2: Available N, P and K values kg/m² for slurry applied by LESS in spring and summer

Time of application	N kg/m² (units/ 1,000 gal)	P kg/m² (units/ 1,000 gal)	K kg/m² (units/ 1,000 gal)
Spring	1.0 (9)	0.5 (5)	3.5 (32)
Summer	0.6 (5)	0.5 (5)	3.5 (32)

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Four Rs to achieving efficient nitrogen use

Mark Plunkett, president of the Fertilizer Association of Ireland, outlines four ways farmers can get more efficiency from nitrogen

Agriculture is a key part of the Irish landscape and has helped in the recovery of the economy over the last decade. Ireland exports the majority of its agricultural produce, with exports valued at over 14.5bn in 2020.

With world population projected to grow between now and 2050, Ireland is well positioned due to our productive soils and damp climate to produce food sustainably for an expanding world population. Agriculture is continuously evolving and will have to continue to evolve over the next number decades to match world food demands.

Currently one of biggest challenges along this road of evolution is climate change and cutting agricultural emissions to reduce such impacts as global warming in the years ahead. Climate change brings many changes to how we farm, eg adapting to changing weather patterns, such extremes as droughts and more frequent heavy rainfall events.

The recently published report, *Ag Climatise – A Road Map Towards Climate Neutrality*, outlines key steps for the industry to take in order to reduce nitrogen (N) emissions (nitrous oxide and ammonia) to the air and loss of nitrates to water.

The first steps to take will be better utilisation of applied N sources, eg more efficient use of N in organic manures while selecting safer forms of fertiliser N, eg protected urea, to reduce N losses while improving the carbon footprint of the farm and food we produce.

> The right product must be applied at the right rate, at the right time and in the right place

Nutrient efficiency

Nutrients such as, N, P and K are the building blocks of food production, akin to carbohydrate, protein and fat for humans. Plants, much like humans, rely on balanced nutrition to grow and maintain their health.

Nutrients such as, N, P and K are the building blocks of food production, akin to carbohydrate, protein and fat for humans.

The sustainable use of applied nutrients on farms is essential to protect the environment that we live in and we must account for factors such as weather, soil type, local conditions, etc, when applying these nutrients to ensure that we use nutrients as efficiently as possible.

Four key aspects need to be considered to help ensure that nutrients are applied and used efficiently are the 4Rs – right product applied at the right rate, at the right time and in the right place.

Right product

To ensure the correct nutrient balance is available in the soil for grass and crop uptake, it is important that we apply the right source of nutrients. On livestock farms, cattle slurry/farmyard manure is a valuable source of nutrients. Cattle slurry contains available N and when applied at the right time of the year can supply a proportion of the crop's N requirements.

An application of 25m³/ha cattle slurry (2,500 gals/ac) by LESS methods will supply 25kg/ha N which can replace a round of fertiliser N (first or second round) and supply valuable P and K, especially on silage fields.

Right rate

Applying the right rate of nutrients involves assessing the soil nutrient supply and the plant demand and then applying the correct rate of fertiliser or organic manure to help the soils reach the target crop yield.

Soil analysis will provide a very accurate estimate of soil P and K supply. This will provide the basis for selecting a fertiliser with the right balance of N, P, K and S. For example, in a grazing situation, a fertiliser blend such as 18-6-12 +S provides a very good balance of nutrients to maintain soil P and K while supplying sufficient N.

Right timing

The timing of nutrient applications will very much depend on soil conditions such as soil type (light/heavy), soil temperature (>6°C), soil moisture (wet/dry), weather forecast in the next 48 hours and grass growth rates. Taking these factors into account will help when making the decision on when to start the fertiliser programme in spring. In practice, target the warmer/drier soils which will be more responsive to the application of N, for example.

Taking this approach will help minimise the loss of excess nutrients at a risky times of the year, for example either early (January/February) or late (September/October) in the growing season.

Right place

Efficient application of nutrients is critical, eg calibrating the fertiliser spreader to deliver the correct application rate and using boundary spreading mechanisms to eliminate the application of fertilisers into field margins or watercourses. With the application of organic or chemical fertilisers, it is important adhere to recommended buffer strips to protect farm biodiversity and water quality.

By following the four Rs, nutrients can be applied very efficiently to meet crop demands during the growing season and will reduce the loss of nutrients to the environment and loss of your investment.

The role of sulphur

This year, the Fertilizer Association of Ireland will launch its sixth technical bulletin in the current series – this one focusing on sulphur (S), an essential element for both animals and crops. It is a constituent of amino acids, which are the building blocks of proteins and vitamins. In plants, S is required for photosynthesis and is closely associated with nitrogen in many plant processes. Traditionally, this element was often overlooked as atmospheric deposition (pollution) was considered to be providing sufficient S to meet plants needs. However, nowadays both grassland and cereals are frequently diagnosed as S-deficient, especially in areas of light or sandy soils and soils with low organic matter.

For grassland, an application of 20kg/ha or 16 units/ acre of S applied little and often throughout the year will be sufficient S for plant needs. In grass swards that are cut for silage, the advice is 20kg/ha or 16 units/acre which needs to be applied per cut. For cereals, an application of 15kg/ha or 12 units/acre of S should ensure S will not limiting.

– TIM SHEILS

Fertilising clover swards in pasture systems

James Humphreys and **Dan Barrett** from Teagasc Solohead Research Farm share their approach to fertilising grass clover swards

Cows at Solohead grazing a grass and clover sward.

The use of clover in grassland to replace nitrogen (N) can substantially lower greenhouse gas and ammonia emissions from pasture-based production.

Averaged over 12 years at Solohead Research Farm, we have found similar pasture production from grass-clover swards receiving of 95kg/ha of N applied in spring compared with swards receiving 245kg/ha applied across the growing season (Figure 1).

Clover has a higher temperature requirement for growth than grass and therefore we apply N in February, March and April to compensate for this.

Most of the N fixation by clover takes place during the summer and autumn and we have found little or no benefit from applying N to well-managed grass-clover swards from May onwards.

Stopping applying N can mean that P and K can be neglected during the summer and autumn. Clover is a shallow-rooted species with around 15% of the root density of perennial ryegrass, making it much less competitive for soil nutrients.

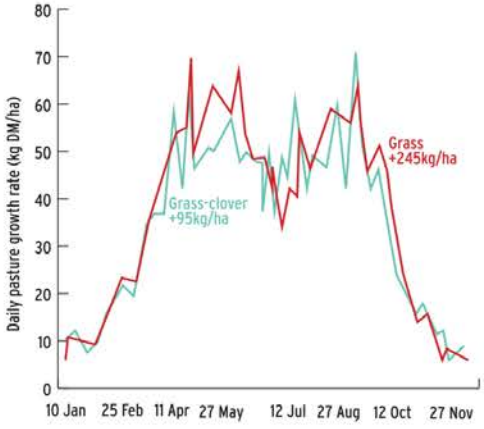
Regular applications of a P and K compound fertiliser throughout the growing season are necessary for high levels of clover productivity and biological N fixation. This can be achieved by applying an N-containing compound fertilizer in spring, such as 24:2.5:10 or 18:6:12.

Sulphur should be included in these compounds in sulphur-deficient areas, particularly in April. Small, regular applications of a non-N compound fertiliser are beneficial from May onwards; for example, a half bag of 0:7:30 per acre after every second grazing is very cost-effective.

Nitrogen fixation is a biological process that is regulated by soil pH (lime status). Optimum soil pH for biological N fixation is in the range 6.5 to 7.0, which is higher than is typically recommended for grassland (6.2 to 6.5).

We aim to keep soil pH levels at around 6.5 at Solohead. This is achieved by regular soil testing and application of ground limestone. It is important to be aware that soil pH levels of greater than 6.2 are not recommended for high-molybdenum soils. This does not mean that clover should not be grown on such soils; it means being careful about applying lime and ensuring livestock are adequately supplemented with copper. Your soil test results should indicate if you are in a high-molybdenum area.

Figure 1: Average daily pasture growth rates over 12 years on grass-clover swards receiving 95kg/ha of fertiliser N in spring (green line) and swards receiving annual fertiliser N input of 245kg/ha (red line) at Solohead Research Farm



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Fertilizer Association of Ireland

Q&A

Lime: what you need to know

Eoin O'Carroll from Bennettsbridge Lime and **David Wall** from Teagasc Johnstown Castle answer common questions on the use of lime

National soil test results show that up to 48% of grassland soils are below the target pH of 6.3.

While some soils on the farm, such as habitats and other areas maintained for biodiversity value, may not need to achieve this target pH, the areas used for production of grass and crops require a more neutral pH range (6.3 to 7.0) to reach production targets and high levels of nutrient use efficiency.

These and other benefits of liming Irish soils are well known, as our soils tend to be naturally acidic and require regular lime application to maintain their productive capacity.

Maintaining grassland soils within the correct soil pH range will also help to increase the release of N from soil organic matter soil N (up to 70kg/ha/year N) and improve the availability of soil P and K following application of fertiliser or organic manure.

The following are frequently asked questions about the application of ground limestone.

Soil test results show that 48% of grassland soils need to be limed.

When is the best time to apply lime on silage fields?
On silage ground, it is better to apply lime immediately after cutting, when grass cover is low. This avoids transporting lime to the silage pit where it can keep the pH high and affect silage preservation. Apply slurry or urea one week before applying lime on silage ground.

When is the best time to apply lime to fields targeted for reseeding?
Ideally, apply lime as recommended on the soil test report one year in advance of reseeding to allow it sufficient time to work.

Alternatively, apply lime in advance of reseeding when the old grass swards are being desiccated, or incorporate lime directly into the seedbed where it has good soil contact prior before sowing.

Can slurry and lime be applied at the same time?
Where lime is present on the soil surface it can increase the loss of N to the air after slurry application. If slurry is applied first, leave up to 10 days before spreading lime. If lime has been applied, avoid slurry application for up to three months so that it is well washed into the soil.

What is the maximum rate of lime in a single application?
Apply a maximum of 7.5t/ha (3.0t/ac). Where more lime is recommended, apply the balance after two years.

What is the target soil pH on soil with high molybdenum (Mo) levels?
High levels of Mo in grass can reduce copper uptake in grazing animals. On soils with high-Mo status, there can be increased Mo uptake in grass and an increased risk of copper deficiency occurring. Increasing soil pH (especially >6.2) increases Mo availability. To minimise soil Mo availability and uptake by grass swards, maintain soil pH in the range of 6.0 to 6.2. Alternatively, you can supplement your grazing livestock with copper.

> Ideally, you should apply lime as recommended on the soil test report one year in advance of reseeding

How long should you leave between spreading 10-10-20 or CAN and lime?
There is no need to leave a gap with CAN or N-P-K compounds as lime will not affect N losses from ammonium-nitrate forms.

How long should you leave between spreading protected urea and lime?
There is no need to leave a gap between lime and protected urea as the protection on the urea reduces N losses as ammonia gas.

When is the best time to apply lime to grassland soils?
Lime paddocks when they are grazed out and when rain is forecast.

Once lime is washed off the leaf by rain, you can allow livestock back in to graze paddocks.

How do I determine the quantity of lime required to correct soil pH?
A recent soil report will show the rate of lime required depending on the soil type, soil pH and crop type.

Is there a difference between calcium and magnesium lime?
Both calcium lime and magnesium lime are excellent lime sources for correcting soil acidity. Where soils are low in magnesium, apply magnesium lime. Magnesium lime may be beneficial on soil with suspected high Mo levels due to its slightly slower speed of reactivity (ie it increases the pH at slower rate) compared to calcium lime.

Protected urea – a better environmental choice

PJ O'Connor from Grassland Agro answers common questions on protected urea

The use of protected urea fertiliser can lead to significant reduction in ammonia losses in both grass and tillage cropping when compared to standard urea. It can also lead to an important reduction in nitrous oxide losses in grassland when compared to calcium ammonium nitrate (CAN) fertiliser.

These are key targets in the Government's Climate Action Plan. Ammonia is a pollutant that contributes to poor air quality, leading to negative effects on human health, while nitrous oxide is a powerful greenhouse gas (GHG), 298 times more potent than carbon dioxide.

Along with the environmental benefit of reducing the amount of nitrogen lost to the atmosphere in the form of ammonia and nitrous oxide, protected urea has a clear financial benefit. This is because more nitrogen stays in the soil available for plant uptake and grass growth, therefore maximising nitrogen use efficiency (NUE).

Teagasc research has shown that protected urea has 71% lower nitrous oxide emissions compared to CAN. Protected urea has comparable ammonia loss to CAN, and ammonia loss with protected urea is reduced by 79% compared to standard urea.

What is protected urea?
Protected urea is urea treated with an active agent called a urease inhibitor. The urease inhibitor can be coated on to the outside of the urea fertiliser granule or incorporated into the urea granule during manufacture.

Table 1: Fertiliser products available on the Irish market containing a protected form of urea (N)

Company	Product name	Inhibitor type and name	N %	P %	K %	S %	Na %
Grassland Fertilisers (Kilkenny) IFI	IFI Topper N-Sure	NBPT + NPPT (LIMUS)	46	-	-	-	-
	IFI Super Topper N-Sure	NBPT + NPPT (LIMUS)	38	-	-	7	-
	IFI Topper Boost N-Sure	NBPT + NPPT (LIMUS)	29	-	14	3.8	-
Grassland Agro	Eco Urea	NBPT + NPPT (LIMUS)	46	-	-	-	-
	Eco N 38	NBPT + NPPT (LIMUS)	38	-	-	7.6	-
	Eco 29-0-14 +S	NBPT + NPPT (LIMUS)	29	-	14	2	-
	Alzon Neo-N	2-NPT + MPA	46	-	-	-	-
	Alzon Neo-N + S	2-NPT + MPA	40	-	-	6	-
Goulding Fertiliser	Sustain / KaN	NBPT (Agrotain)	46	-	-	-	-
	Sustain / KaN	NBPT (Agrotain)	38	-	-	7	-
	Sustain / KaN	NBPT (Agrotain)	29	-	14	3.5	-
	Sweet SustaiN	NBPT (Agrotain)	35	-	-	5	5
NitroFert	Nitro Guard	NBPT + NPPT (LIMUS)	46	-	-	-	-
	Nitro Guard	NBPT + NPPT (LIMUS)	38	-	-	7	-
	Nitro Guard	NBPT + NPPT (LIMUS)	30	-	15	2	-
Target Fertilisers	UreaMax	NBPT + NPPT (LIMUS)	46	-	-	-	-
	UreaMax + S	NBPT + NPPT (LIMUS)	38	-	-	7	-
	29-0-14+4% S Max	NBPT + NPPT (LIMUS)	29	-	14	4	-
Yara	Yara Vera AMIPLUS	NBPT (AMIPLUS)	46	-	-	-	-

How does it work?
Urease is an enzyme which controls the conversion of urea to ammonium. It is during this conversion that ammonia gas is lost from untreated urea. A urease inhibitor blocks the active site of the urease enzyme. This moderates the rate at which urea converts to ammonium, therefore ammonia loss is significantly reduced to low levels. Teagasc has conducted research into the different urease inhibitor options, most extensively with NBPT and NBPT+NPPT.

There are a number of options available which are on the market and the following products are recognised as acting effectively as urease inhibitors: NBPT, 2-NPT, NBPT+NPPT.

Can I use protected urea during the summer?
Yes, you can spread protected urea across the growing season when you would otherwise spread either urea or CAN as the main N fertiliser source. This may potentially simplify fertiliser spreading on the farm, with the fertiliser spreader set up for only one straight-N product each year.

Will using protected urea reduce yields?
No, crop and grass yields will not be reduced when using protected urea. Teagasc trials have shown protected urea consistently yields as well as CAN in Irish grasslands, with no difference in annual production. Irish trial results show no significant yield or N recovery difference between CAN and urea protected with NBPT.

However, if conditions remain dry, response to any N fertiliser will be limited. During periods when drought conditions may be limiting grass growth, the demand and uptake of N fertiliser will also be reduced. Therefore, if you are hesitant to spread CAN, you should also be hesitant to spread protected urea. Consider waiting for rain and good growing conditions to return.

Is protected urea cost-effective?
Analysis of costs in March 2020 showed protected urea to be less costly than CAN, while performing just as well in terms of yield and N recovery efficiency. Bear in mind that fertiliser costs fluctuate, but always make cost comparisons on the basis of cost per kilo of N for straight-N products.

www.fertilizer-assoc.ie

Changes to requirements for the nitrates derogation

Jeremiah Murphy from Target Fertilisers and **PJ Browne** from Grassland Agro discuss the changes for farmers in derogation

Every four years, there is a review of the Irish Nitrates Action Programme regulations under EU Nitrates Directive requirements.

The Nitrates Action Programme aims to improve and protect water quality from nutrient and sediment losses from farmland. The present regulations are SI No 605 of 2017 and SI No 65 of 2018. The next review of the Nitrates Action Programme is scheduled during 2021. These regulations apply to all farms and limits stocking rates up to a maximum of 170kg/ha organic nitrogen loading for standard farms.

However, if you want to farm with a higher stocking rate and your organic nitrogen loading for grazing animals falls between 170kg N/ha and up to a maximum of 250kg N/ha, you can apply for derogation and additional terms and conditions must be complied with. An application for derogation must be made each year.

In 2019, following a public consultation, additional rules were put in place for derogation farmers and are regulated under SI No 40 of 2020.

Nitrates derogation is most important for livestock farmers to allow them to farm with increased intensity in an environmentally sustainable fashion and produce food to meet our country's needs. There are currently 7,000 farmers in derogation, representing about 5% of farmer holdings in the country. Applications for a derogation are made to Department of Agriculture, Food and the Marine each spring.

The inclusion of clover in all grass seed mixtures is now mandatory for farmers in a derogation.

Nitrates derogation rules

1 Soil analysis: every four years and one sample per 5ha maximum.

2 Nutrient management plan: this must be prepared, detailing the crop rotation plan, livestock numbers, N and P produced on the farm, N and P used on the farm by field (both organic and inorganic), volume and type of manure storage, and a farmyard sketch.

3 Farm holding: the farm holding must be 80% grass and have grazing livestock. No livestock manure can be imported.

4 Limits: the upper limit on organic N loading (stocking rate limit per ha) from grazing animals is 250kg/ha/annum N. Commonage and rough grazing are excluded. Nitrogen excretion rate for a dairy cow is 89kg organic N.

5 Manure and soiled water storage: each farm holding must have storage for all livestock manure, soiled water and silage effluent. All slurry is to be applied to land using LESS method.

> "The farm holding must be 80% grass and have grazing livestock. No livestock manure can be imported

Lime: a liming programme must be included for the whole farm and in the nutrient management plan based on the most recent soil analysis.

7 Concentrate feed: 15% is the upper limit for feeding crude protein to animals between 1 April and 15 September.

8 Clover: New grass reseeds must include clover at minimum inclusion of 1.5kg/ha naked seed and 2.5kg/ha pelleted seed.

9 Training: complete an approved environmental training course before the end of 2021.

10 Grass production: measure grass and record annual grass production or participate in grassland management training by the end of 2021.

11 Biodiversity measure: derogation farmers are required to adapt at least one of the following: a) allow one mature whitethorn/blackthorn tree in each hedgerow; b) three-year cutting cycle of hedgerows.

12 Farm waterways: water troughs at 20m distance. Correct camber of farm roadways. All new roadways need fence erection at 1.5m distance.

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There has been a 17% increase in fertiliser bag recycling.

Irish farmers embracing fertiliser plastics recycling

John Carroll says there has been a 17% increase in the number of fertiliser bags which are being recycled

Irish farmers are increasingly embracing the recycling of fertiliser plastics waste, with a 17% increase in the number of bags of fertiliser plastics collected at bring centres last year.

The Irish Farm Film Producers Group (IFFPG), which is the national farm plastics recycling scheme, collects fertiliser plastics through its sister company Farm Plastics Recycling, which is a commercial entity. In 2020, a total of 19,000 half-tonne bags of fertiliser plastics were collected at 225 jointly run nationwide bring centres.

While Irish farmers have been leading the way for the last two decades in Europe when it comes to wrap and pit cover recycling (34,000t recycled and a 79% recycling rate achieved in 2020), more recently impressive progress has been made on the fertiliser plastics recycling front.

Over the last five years, there has been a doubling in the volume of fertiliser plastics collected for recycling to the current level of approximately 800t to 1,000t per annum. The increase can be mainly attributed to the low cost and convenience of the service to farmers, as well as a growing waste management awareness among farmers.

Farmers are currently charged at the rate of €10 per half-tonne bag delivered to bring-centres, regardless of the weight of waste in the bag. As the average farmer generates in the region of one to two bags of fertiliser plastics per annum, from a cost point of view bring centres represent an attractive option. In addition, bring centres are convenient in that they spread evenly throughout the country, with the average farmer travelling 9km to his/her local facility.

There has been a marked improvement in the quality of fertiliser plastics delivered by farmers to bring centres in recent years, which is essential to the success of the recycling process.

Fertiliser plastics come in two different polymer types, each of which must be collected separately. In the case of bulk fertiliser bags (comprising both polymers), the liner must be removed by the farmer and can be presented at the bring centre together with small fertiliser bags (both LDPE polymers). The outer parts of bulk fertiliser bags (PP polymer) must be brought in separately in another bag to the bring-centre.

All fertiliser plastics collected are sent for recycling, with the majority sent to Irish recyclers. Examples of products that they are ultimately converted into include plastic packaging, crates and garden furniture. In terms of funding of the service, this is provided through a combination of the previously referred to collection charges at bring centres, as well as Repak subsidies. Most fertiliser producers meet their obligations through Repak membership, where they make a recycling contribution for every tonne of packaging placed on the Irish market.

Provided COVID-19 restrictions do not prevent it, IFFPG – working in partnership with Farm Plastics Recycling – intends to provide a full farm plastics bring centre programme in the period from late April to early August. For further information, visit www.farmplastics.ie or phone 1890 300 444.

Fertilizer Association of Ireland app and new video series

The Fertilizer Association of Ireland (FAI) website www.fertilizer-assoc.ie provides the latest information on fertiliser best practice and advice across a wide range of areas.

This website's resources and information have been built up over the lifetime of the FAI. You will find an archive of technical bulletins and papers going back as far as the 1970s, as well as the most up-to-date content relating to topics that are currently relevant. The website is a free resource, and we encourage you to avail of it to keep up to date with the events and information that the FAI offers.

The FAI's P and K calculator app for both iOS and Android provides general guidelines for crop offtake and/or general agronomic advice for P and K application to grassland and arable crops in Ireland. It is free to download on the Apple Store and Google Play.

You are also invited to tune into the FAI's social media channels (Facebook, etc) for advice and reminders on a host of topical issues relating to soil fertility.

Fertiliser video series on efficient use of fertilisers

The FAI is currently running a video series focusing on:

- The importance of taking good soil samples.
- The first steps in starting the fertiliser planning process.
- What happens your soil samples when they go to the soil lab.
- Guiding farmers/advisers on the efficient use of fertilisers.

These videos will cover choosing the right fertiliser product and applying it at the right rate, at the right time and in the right place on the farm.

As part of the series, Wexford beef, dairy and tillage farmer Michael Doran outlines the key steps and processes he takes each year to set out his fertiliser plan for the season ahead.

This video series will be a "key tool to help both farmers and advisers at key times of the year to use all applied nutrients (chemical and organic fertilisers) as efficiently as possible. Utilising both soil test results and preparing a farm fertiliser plan are the first steps to making every applied unit of N, P and K count during the growing season, while protecting both air and water quality."

Soil sampling is the first step to establishing soil fertility levels on a field-by-field basis. Tim Sheil of the Fertilizer Association of Ireland says: "By using the correct procedure for taking soil samples will ensure that the results will be accurate and representative and provide a solid foundation to build both lime and fertiliser plans for the soils on your farm."

Find the video on: www.fertilizer-assoc.ie or on YouTube.

Every year, the Fertilizer Association of Ireland presents a monetary prize to a student in UCD for excellence in their soil science exams. This year's recipient of the award was Conor Kehoe, animal and crop production student. The award was presented at the annual UCD School of Agriculture and Food Science Awards Ceremony.

www.fertilizer-assoc.ie

Utilising buffer zones to protect water quality

Noel Meehan, ASSAP manager with Teagasc, reminds farmers of their obligations to protect water bodies but also to protect their investment in fertiliser

Once the growing season arrives, farmers begin to apply nutrients to their land. This can be in the form of chemical or organic fertilisers.

Optimising the use of fertilisers in the early growing season is essential. Appropriate application will lead to better utilisation of nutrients and better returns in grass/crop growth.

This, in turn, will ensure less nutrients are lost to the environment – waters and atmosphere.

This will also lead to savings for the farmer, with costly losses minimised and a reduction in the quantity of nutrients needed to be spread due to a greater level of utilisation.

The protection of waters (drains, watercourses, streams, lakes, wells, abstraction points for public water supplies, karst features, etc) from nutrient losses is a key part of the nitrates regulations.

When farmers are applying both chemical and organic fertilisers to fields, they need to be aware that they may need to adhere to buffer zones.

A buffer zone is an area adjacent to a water body that no chemical and organic fertilisers (or pesticides) can be applied to.

These zones vary in width and are required to protect waters from losses of nutrients.

Example of a farmer adhering to buffer zones alongside a fenced off river.
\ Peter Comer, Teagasc

Why is it important to adhere to buffer zones?

Water quality in Ireland has declined somewhat in recent years and is an early warning we all should heed.

Losses of nutrients from land to water bodies is having an impact on this.

These diffuse losses of nutrients are losses can be at field or farm scales where nutrients reach streams, rivers, lakes or groundwater and can be affected by farming activities such as spreading of slurry or fertilisers.

Diffuse losses of nutrients from chemical and organic fertilisers are most likely to occur when soils are at or close to saturation. When soil is saturated or waterlogged, the soil can't soak anymore water.

The water stays on the surface of the field and will flow over the surface, with the fall of the land towards drains or streams, and potentially bring the recently applied fertiliser nutrients with it.

This will have an impact on water quality in the adjoining water body.

Reducing risk

Where a buffer zone is in place this will provide a "break" between where the nutrients are applied on the field and the adjoining water body, reducing the risk of nutrients reaching the water. A permanent fenced-off buffer zone or riparian margin can offer increased protection to the water body.

Buffer zones vary in width depending on the water body and also the time of year.

For example, the buffer zone alongside a drain, watercourse or river is 5m during the open period for spreading slurry.

However, this should be increased to 10m in the two weeks before the closed period and the two weeks after the closed period, ie for an extra two weeks in October and an extra two weeks in January.

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A farmer's journey

Transitioning to more sustainable farming

Donal Sheehan, a dairy farmer from east Cork, chats to **John Carroll** of the Fertilizer Association of Ireland, about towards more sustainable farming

EIP projects such as BRIDE help farmers to help the environment

Donal Sheehan is a full-time dairy farmer milking 72 spring-calving dairy cows in Castlelyons, Co Cork.

He is also one of the people involved in running the Biodiversity Regeneration In a Dairying Environment (BRIDE) project, a European Innovation Partnership (EIP) set up to arrest the decline in farmland biodiversity and restore the species that have been lost through modern farming practices.

The BRIDE project draws up tailored environmental plans in consultation with the farmer and encourages every farmer to retain a minimum of 10% of their farm for nature. This Biodiversity Managed Area (BMA) is made up of the natural habitats found on farmland such as hedgerows, ponds, wetland, natural grasslands, bog, field margins and buffer strips.

Key to the success of the project will be the results-based payments (RBPs) system whereby each farmer will receive an annual payment based on the quantity and quality of their BMA. This in essence will mean the project will be paying farmers to improve biodiversity and water quality and lower their carbon footprint.

Donal is also one of 12 farmer participants in a sister EIP – the Danu project. This project is based in the midlands and involves farmers, both livestock and tillage, trialling lower fertiliser and pesticide usage through targeted plant nutrient use. The concept focuses on the soil as a living organism and attempts to improve the soil and unlock and make available nutrients and trace elements to the plant.

On his own farm, Donal is transitioning away from high nitrogen use and has incorporated several changes in his farm management practices, as outlined below, to help improve nutrient use efficiency:

- All of the slurry is applied with a trailing shoe, with most slurry spread in the spring and the last of the winter housing slurry applied after the second cut of silage.
- Slurry is applied little and often at a maximum application rate of 1,500gal/acre although this can prove an issue when ground conditions are not optimum.
- The slurry and dairy yard washings were tested for their N, P and K content and this has been factored into the farm software package, so that an allowance is made once the slurry application has been inputted into the computer.
- All slurry was treated in October with an additive. It is hoped that this will improve agitation as well as reduce odour and improve the nutrient uptake value of the slurry.
- Early nitrogen in January is cut out completely and instead the focus is pushing out the first application until soil temperatures (>6°C) are moving upwards and suitable weather conditions are on the horizon.
- Heavy covers receive no application until after the first grazing and no fertiliser application is given to any paddocks that have received slurry.
- Stocking rate has been reduced to take into account present winter slurry storage capacity, adequate home-produced forage and a good work-life balance.
- Fertiliser applications are timed in as much as possible to coincide with pending rainfall. Donal feels that fertiliser granules sitting on top of the ground are prone to atmospheric losses and applying fertiliser in drought conditions is avoided. Poor grass growth is more likely to be caused by poor weather conditions rather than insufficient nitrogen supply.
- All fertiliser and slurry applications are inputted into the computer as Donal feels in mid-season it is impossible to keep track of fertiliser applications on different paddocks and different blocks. This ensures a better balance between fertiliser or slurry applications. It also ensures that slurry is applied to all paddocks rather than giving several applications to the dry fields or the fields around the yard.
- No fertiliser or slurry should escape onto field margins, riverside margins or other natural habitats. A border deflector is used on the fertiliser spreader to avoid losses in field margins and hedgerows and the trailing shoe system means there is no contamination of field margins and riverside margins.

Donal Sheehan.

Multi-species swards

Donal set his first multi-species sward in 2017 and this will mean a significant change in grassland management compared to the traditional ryegrass sward. The benefits of incorporating this type of sward are many but, equally, there are many challenges.

Pesticide use is counterproductive as it will take out many of the species that were planted so a knowledge of alternative weed control is needed. There are different species of grass, herbs and legumes and nitrogen use will need to be reduced to allow for the full value of clovers in the sward.

Grazing and cutting management is also important as both can affect some of the planted species. Rotation length will need to be changed to prolong the lifespan of the sward.

Biodiversity loss and use of nutrients

Donal explained how adding too much nitrogen over the years has not favoured many of our more ecologically important grasslands. Wildflowers that traditionally grew in Irish pastures are now rare because they cannot compete with high fertiliser inputs and the intensive regime of modern livestock farming.

Intensive farmers wanting to improve biodiversity could consider a "biodiversity paddock" where a small portion of the farm or field is kept as a natural grassland and managed with livestock.