Teagasc
Agriculture and Food Development Authority

Agriculture & Food Development Authority
Johnstown Castle

FARMING FOR A BETTER FUTURE

OPEN DAY

'INNOVATING FOR HEALTHY SOILS & CLEAN WATER'

Wednesday,
10th June

Teagasc,
Johnstown Castle, Co. Wexford

FARMING FOR A BETTER FUTURE 2026

'Innovating for healthy soils and clean water'

Route
Display
Food
Toilets

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5. Management of grassland swards
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11. Farming lifestyle – Wellbeing and Health & Safety
12. Spring & Winter Dairy production systems
13. Water Quality & biodiversity
14. Forestry & hedgerow management
15. Organic Manure management

FARMING FOR A BETTER FUTURE

ACKNOWLEDGEMENTS

Teagasc acknowledges the support of Research, Advisory, Technical, Farm & Maintenance and Administration Staff for preparing and delivering this open day event

WEDNESDAY, 10TH JUNE 2026

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Open Day Field site coordinated by Rioch Fox

Teagasc, Crops, Environment and Land-use Programme, Johnstown Castle, Wexford, Co. Wexford.

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To minimise disease risks and accidents, visitors entering and leaving Johnstown Castle Research Centre are asked to:

Use Footpaths

Do Not Handle Cattle

Do Not Enter Pens or Paddocks containing Cattle

Thank You

Farming for a Better Future 2026

Foreword

I am delighted to welcome you to the Johnstown Castle Open Day "Farming for a Better Future 2026 – Innovating for healthy soils and clean water".

Farming systems for the future must be both economically, environmentally and socially sustainable. Profitability has long been a challenge for the sector, but in recent years, it is the environmental issues that have come to the fore. These encompass emissions reduction, water quality, biodiversity loss as well as adapting to a changing climate. Policy in this area, both national and EU is complex, and policies such as the Nitrates Directive, the Climate Action Plan, the Carbon Removals and Carbon Farming Regulation (CRCF), the Nature Restoration Law, the CAP Strategic Plan, and the new Soil Monitoring and Resilience Law, all have implications for farmers and the agriculture sector. Irish agriculture has shown itself capable of great change and development over many decades. The key priority for Teagasc at this point in time is to provide leadership and support to the agri-food sector as it changes and adapts to meet these challenges.

This Open Day will discuss the key benchmarks and indicators (KPIs) for sustainable farming systems, and how Irish farms can reach these. It will identify the technologies and farming practices that are important to help farms to become more resilient in the face of a changing climate. Technology will play a very big role in meeting the challenges, and there is a large research programme at Johnstown Castle and other Teagasc centres to develop and adapt the technologies needed for the future. These include innovations that are currently ready to be put into use on farms (and indeed are already in use on many farms) such as white clover and red clover silage, slurry additives, sustainable fertilisers, home grown protein feeds for winter milk, spring dairy production on multi-species swards, profitable dairy-beef and organic beef production systems, practices to enhance farmland biodiversity both above and below ground. These technologies will all be on display at the Open Day, and you will also learn about other technologies being researched for the future such as feed additives to reduce methane production, carbon sequestration, soil biostimulant technologies, drought resistant

swards, and using slurry separation and digestate to replace chemical nitrogen. In addition, performance details of the farming systems operating at Johnstown Castle which include winter and spring calving dairy systems, dairy calf to beef, organic beef finishing systems and nutrition of tillage crops will be outlined. There will also be a lot of information for tillage farmers around soil health, crop nutrition, and cover crop establishment and management.

The supports available to farmers to adopt and implement these technologies on their farms will also feature prominently at the Open Day. Teagasc runs a number of important campaigns and programmes such as the new Better Farming for Water 8-Actions for Change campaign along with the ASSAP and ACP, the Signpost Progamme (including AgNav), and the Grass10 campaign and Dairy beef 500 which will be part of the Open Day, and advisers will be present to talk to farmers. These are multi-actor campaigns and programmes, and we acknowledge the strong contribution of our many partners. Our forestry and organics teams will also be present to outline the opportunities in these sectors. Knowledge transfer is obviously key to seeing widespread change at farm level, and this means a very important role for the Teagasc Advisory service and also the Teagasc Education service in leading this change. Overall it promises to be a great day, packed with knowledge and I very much hope you enjoy the day and find it informative and useful.

Professor Frank O'Mara

Director Teagasc

Farming for a Better Future 2026

Welcome to Johnstown Castle

David Wall & Karen Daly

Teagasc, National Agriculture Sustainability and Research Innovation Centre, Johnstown Castle, Co Wexford

On behalf of the staff at the Teagasc, National Agriculture Sustainability and Research Innovation Centre, Johnstown Castle and other staff involved with today's event, it is a pleasure to welcome you to FARMING FOR A BETTER FUTURE 2026. The theme today is 'Innovating for Healthy Soils and Clean Water" as farmers and those working in the farming sector will be acutely aware that maintaining healthy and productive soils underpins their farming business, while access to clean water is essential for farming to thrive and for the farm family and wider society to utilise and remain healthy. The information available at this Open Day, including the practices and technologies demonstrated, will help farmers deal with the many challenges facing the sector such as changing weather patterns, input price volatility, policy changes etc., and to build more resilient farming systems for the future. Many of the technologies and farm practice strategies we have on show today will help farmers maintain productivity while increasing the profitability and environmental sustainability of their family farm businesses. These include; options to diversify grassland swards for grazing and silage conservation management, sustainable soil and crop nutrition technologies and organic manure management practices, winter and spring dairy cow management and nutrition, dairy calf-to-beef and organic beef finishing production systems, tillage soil management and farm planning. Reducing gaseous emissions, protecting water quality, enhancing biodiversity and soil health in order to reduce the environmental footprint of grassland and tillage production systems will be essential to maintain the competitiveness and sustainability of Irish farms and the agricultural and food sector. All technologies and much more will feature strongly at FARMING FOR A BETTER FUTURE 2026.

Many of these technologies can also help address the high input prices that Irish farmers are currently experiencing and strategies can be put in place to mitigate their impact on farm profitability. Today's event is comprised of three main 'speaking' stands where the key

challenges and indicators for reaching sustainability targets that farmers are facing into will be addressed. We will take you through some of the strategies and technologies available to meet these challenges, including, enhancing soil health, water quality, biodiversity and reducing gaseous emissions while maintaining economic sustainability. We will discuss how knowledge will be transferred to empower farmers and the supports available to support the transition at farm level. And most importantly, how and when to best implement these strategies and technologies within your farming system. The main stands are followed by a series of 'villages' where the latest research findings is presented and knowledge and practical advice can be gained on a range of topics; grassland and tillage soil management, water quality, soil fertility and health, biodiversity, gaseous emissions, carbon farming and sequestration and livestock production systems.

The key management practices and technologies to improve farming sustainability will be shown throughout the day with demonstrations that will be both informative and interactive. You will also have the opportunity to meet our advisory service, education officers, and KT programmes e.g. Ag Sustainability Support Advisory programme (ASSAP), Signpost programme and Grass 10 programme in the Knowledge Transfer village and discuss the supports and services available to you. Our farm Health & Safety team will also be on site to demonstrate and discuss how we can make our farms safer working environments for farmers and their families.

FARMING FOR A BETTER FUTURE 2026 has been developed to update farmers and the wider agricultural industry on the latest emerging research and to become more informed on potential solutions that can be adopted on farms to overcome emerging challenges. We encourage everyone to ask questions of the experts on the day to gain such knowledge. In preparation for this event, particular attention has been paid to health and safety, and biosecurity arrangements. Please use the footbaths provided, pay attention to the signs erected throughout the circuit and follow the direction of our staff. Visitors are asked not to enter paddocks with cattle, which are 'double-fenced', or pens with cattle in them for both bio-security and safety reasons. Your help and co-operation with these safety measures is greatly appreciated. A major Open Day at our National Agriculture Sustainability Research and Innovation Centre in Johnstown Castle is an opportunity for you, the visitor, to see first-hand the latest research and advice on a wide range of topics that will make your farm more resilient and sustainable, both profitably and environmentally, into the future. Again, on behalf of Teagasc and Johnstown Castle staff we hope you have an enjoyable and worthwhile visit and can take some of what you see here today back to your own farm.

Teagasc, National Agriculture Sustainability Research and Innovation Centre (NASRIC), Johnstown Castle, Wexford

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Challenges and Opportunities for building Resilient Farming systems

Karen Daly and David Wall
Teagasc, Crops Environment, and Land-use Research Centre, Johnstown Castle, Co. Wexford

Farmers have faced and overcome the challenge of economic, social and environmental sustainability for some time now, however, challenges concerning agriculture's role in maintaining and improving the surrounding environment have been increasing in recent years. The EU Agri-environmental policy has set targets to halt biodiversity decline, improve water quality, reduce fertiliser and pesticide use and protect soil health. In Ireland, the agricultural sector is facing multiple policies and frameworks and very challenging environmental targets. The sectoral targets to reduce greenhouse gas and ammonia emissions, improve water quality and reverse the decline in farmland biodiversity are fast approaching. The trends in emissions, water quality and biodiversity continue to decrease or remain static and we urgently need to work together to implement solutions and technologies that are known to reverse these trends. Farmers need technologies that allow them to combine economic and environmental sustainability.

Soil Health

Soil is one of the most valuable resources on the farm, and how we manage soils can have an impact on crop production, nutrient availability, water quality, carbon storage and the biology that lives in the soils that helps to break down organic matter. Soil Health is one of the main themes of the Farming for a Better Future open day, and this event is an opportunity to highlight how healthy soils can build resilience into farming systems. Healthy soils, that are not compacted, can withstand extreme weather events and avoid flooding and drought. Good nutrient management is essential for crop growth but also has benefits for soil health and carbon storage. There are many co-benefits to keeping soils healthy, and these will be on display at this open day. In addition to the demonstrations on soil health at this event, the Farming for Soil Health booklet is available and a valuable source of information on the technologies and actions that everyone can take to keep soils healthy.

Water quality

The effect of agriculture on water quality has been subject to large amounts of research over the past 20 years. While Irish water quality is above average within the EU, only 54% of Irish surface waters are at satisfactory or good status, with the presence of too much P and N in our waters as the primary challenges. Agriculture has a significant role to play in helping achieve good water quality targets and the Teagasc Better Farming for Water campaign has a clear objective to reduce nutrient and sediment loss to water through its 8-Actions for change focussing on nutrient management, farmyard management and land management. Good nutrient management planning is a major corner stone to reducing diffuse nutrient losses. The Agricultural Catchments Programme have greatly improved the science behind water quality and have developed a new critical source area tool for highlighting areas for

farmers to address on their farms. The Agricultural Support and Advisory service provides free advice to farmers on appropriate technologies in areas with poor water quality. New technologies have been developed to reduce nutrient and sediment loss to water from farm roadways.

Livestock production systems

Technologies at the systems level are required to reduce emissions per hectare to meet the 25% target by 2030 and climate neutrality by 2050. Continued improvements in grazing management, breeding of efficient animals, reducing the age of slaughter and increasing home-grown feed supplementation will lead to further reductions in emissions. In addition to these proven technologies for improving livestock production systems, newly emerging technologies are being tested for Irish systems such as feed additives for reducing biogenic methane and breeding of lower methane emitting animals in future, hold the potential to reduce emission further over time.

Greenhouse gas emissions

The 25% greenhouse gas reduction target will be extremely challenging and the recent emissions increases will have to be reversed. Nitrous oxide (N_2O) from nitrogen fertiliser, manures and urine accounts for c. 30% of agricultural emissions. The remaining 70% comes from slurry management and directly from the animals. Agricultural soils are a source of emission in the Land use and forestry part of the inventory. Carbon sequestered in our mineral soils is four times lower than the carbon lost from agricultural peat soils.

Reduce nitrogen fertiliser use

One big challenge is to dramatically reduce reliance on imported, fossil fuel derived fertilisers. There are a range of proven technologies today to reduce this reliance. Optimising soil fertility releases c.70kg N/ha from the soil and reduces fertiliser requirements. Soil fertility is important for clover/multispecies sward establishment and the opportunity to dramatically reduce nitrogen fertiliser use. Use of using low emission slurry spreading increases the nitrogen supply in slurry, reducing fertiliser requirements. Where chemical N is used then replacing CAN and urea with protected urea can reduce emissions by over 70%. New research is showing lower emissions when certain low nitrate compound fertiliser are used and that optimal soil fertility can directly reduce emissions by c. 40%.

Carbon farming and sequestration

A carbon farming framework for Ireland is under development by government that needs accurate information to monitor, verify and report on carbon capture and removals and research is underway to bring this data to government. Strategies that we can adopt now to increase carbon sequestration include increasing trees on farms through hedgerow management, on farm forestry and agro-forestry. Currently our national inventories are using default values to account for carbon emissions and sequestration in agricultural soils

and research is underway to refine these emission factors for different soil types, land-use, land management practices. Research on the effects of water table management of drained grassland peat soils and improving the accuracy of mapping our drained grassland peats is getting underway. This will improve the accuracy of the inventory and identify technologies to reduce emissions from soils and the management practices to enhance carbon sequestration

Biodiversity

The EU biodiversity strategy aims to have at least 10% of agriculture area under high-diversity landscape features by 2027. The area of semi-natural habitat across Ireland and there are declines in important farmland bird species and pollinators. A recent survey of intensively managed farms found that the median wildlife habitat area was 5% (tillage), 6% (intensive beef) and 6.6% (intensive dairying). There are many ways that farmers can actively improve habitats and wildlife on their farms achieve the 10% target. Actions such as managing hedgerows less intensively, creating nesting habitat for solitary bees, increasing field margins, and replacing perennial rye grass swards with multispecies swards or incorporating clover can benefit biodiversity. Current results-based payments for biodiversity has the potential to benefit biodiversity and current research is investigating approaches to quantifying biodiversity-friendly farmland habitats and creating evidence-based management plans.

Summary

There are a large number of strategies and solutions available to improve environmental sustainability on farms. These are on display through out the open day and have advisers to support farmers on how to adopt these on their farms. You will also get a glimpse of the future research investigating emerging technologies to help farmers further improve sustainability. Many of the actions and strategies to improve water quality, soil health, farmland biodiversity and reduce gaseous emissions that you will see today have multiple co-benefits and also improve farm profitability. Please identify the solutions and actions that will work on your farm and you could implement over the next year.

Other resources & online information

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Strategies and Actions for Healthy soils and clean water

Bridget Lynch & Patrick J. Forrestal
Teagasc, Crops Environment, and Land-use Research Centre, Johnstown Castle, Co. Wexford

Why manage for healthy soil?

Soil is one of the most valuable resources on farms, it underpins our production system. Soil has formed over many centuries and millennia. However, soil can be damaged, degraded or lost in a short timeframe. It is a critical irreplaceable resource for current and for the future generations. Preserving soil and handing it on to the next generation in improved condition benefits farm families and society at large, today and for the future. Managing to maintain and improve soil health helps to ensure that your soil has continued capacity to provide critical functions including of food production, being the basis for farm livelihoods, for the filtering, absorption and storage of the water from rainfall events and storms, for storing and building soil carbon. Soil provides all these functions while also providing a home for diverse underground biodiversity that performs many services including regulating nutrient cycling from soil to plants.

The soils of Ireland and your farm

The soils of Ireland are very diverse with 213 different soil types documented. Across farms and even fields the soil type often varies. This directly impacts how the soil is managed, when it can be grazed and cultivated and even which crops can be grown successfully. The physical, chemical and biological characteristics of soil can vary to a large extent across soil types, however all soils can benefit from farm management practices that include managing for soil health.

Soil texture is a key **physical** aspect of soil that describes the sand, silt and clay content of your soil. Soil texture has a strong bearing on the friability, water holding capacity and chemical aspects of a soil. While texture is a physical soil health feature that cannot be easily changed the physical structure of soil can be changed for any given soil texture. For example, structure can be improved by increasing aeration or damaged through compaction.

Cation exchange capacity (CEC) is a key **chemical** aspect of soil that is linked to the clay mineral content and to organic matter. The Department of Agriculture, Food and the Marine soil sampling programme has included CEC measurement. Check your report. The soils of Ireland typically have CEC in the range 1.1 to 36.5 meq/100g. Soils with lower CEC retain less nutrients and need to be managed accordingly to optimise return from nutrient applications and minimise losses for example of Potassium fertiliser.

The **biological health** of soil is one of the most complex aspects of soil health. The soil biology plays fundamentally important roles that affect soil physical health by adding structure, airspaces and stability to soil particles through burrowing and secretions for example. The

cycling of plant nutrients from organic forms to plant available forms is mediated and made available by the soil biology, especially for Nitrogen, Phosphorus and Sulphur.

6 Principles of good soil management

1. Know your soil
2. Assess your soil health
3. Avoid physical damage
4. Support soil biodiversity
5. Build or maintain soil organic matter
6. Maintain balanced soil fertility

Learn how by downloading your free 30-page illustrated copy of Farming for Soil Health at: https://teagasc.ie/publications/farming-for-soil-health/

Example practical actions for healthy soils:

- Minimise physical damage to soil by avoiding or minimising compaction for example by using umbilical systems to spread slurry, appropriate tyre and pressure selection, control machine traffic particularly in poor weather and use of grazing management based on farm soil knowledge and weather conditions.
- Return carbon to soil for example by applying organic manures and other recycled fertilisers that contain carbon, incorporation of cover crops and straw on arable farms.
- Maintain soil cover and living roots to reduce erosion, to reduce sediment (often the finest most fertile soil particles) loss potential and to maintain biological life for example by sowing cover crops and minimising cultivation in grassland reseeding, particularly on carbon rich soils.
- Maintain balanced soil fertility for example by liming to address soil acidity and ensuring adequate soil P and K for your system productivity needs and intensity.

What is Water Quality or what do we mean by Clean Water?

The EPA monitor, assess and report on different types of water: (1) ground water (2) rivers (3) lakes (4) estuaries and lagoons and (5) coastal water.

Nitrate and phosphorus are essential nutrients that support plant growth. However, excessive amounts of these nutrients in water can result in rapid growth of aquatic plants and algae, a process known as eutrophication. This overgrowth can outcompete other plant species, reduce dissolved oxygen levels, and block sunlight from reaching deeper waters, disrupting the balance of the ecosystem.

Both phosphorus and nitrogen contribute to eutrophication. Generally, phosphorus is the primary concern in freshwater systems, while nitrogen is more problematic in estuaries and coastal waters.

However, it is not just nutrients that determine water quality, there are many other factors such as dissolved oxygen, temperature, chemicals, ecological species, physical characteristics of the waterbody (hydromorphology) and sediment. Focussing on water quality at a national level may disguise local trends, which can lead to misplaced actions with little improvement. The EPA water quality monitoring network and reporting is so extensive that we have a good knowledge of which aspects require attention in a local setting. The first step to improving water quality nationally is to act locally, and to do this, we need to implement the **"right measure in the right place"**.

Better Farming for Water – 8 Actions for change:

The aim of the 'Better Farming for Water' campaign is to support and accelerate the adoption of actions locally on all farms to improve all water bodies (where agriculture is a significant pressure) to Good or High Ecological Status. The campaign will focus on 8-Actions for Change for farmers to adopt to improve water quality through their farming activities. These 8-Actions for Change provide a structure through which farmers can engage with addressing water quality in a more relatable way, help understand why actions are required, and to have confidence that the action being taken is worthwhile and will lead to a positive improvement.

The 8-Actions for Change can be divided into three areas of practice improvement: Nutrient Management, Farmyard Management and Land Management.

Nutrient Management:

1. Reducing purchased nitrogen surplus through greater precision in the application of both chemical and organic nitrogen.

2. Optimising soil fertility by initially focusing on increasing soil pH to improve nitrogen use efficiency and increase soil available phosphorous.

3. Applying fertilizer at the appropriate rate, time, and conditions.

Farmyard Management:

4. Having sufficient slurry storage which will allow greater nutrient use efficiency from slurry and prevent losses.

5. Minimising point source nutrient loss from farmyards and roadways by diverting clean water away from the farmyard and reducing soiled yard areas.

Land Management:

6. Fence off all water courses to prevent bovine access.

7. Use riparian margins and buffer strips to prevent over land flow of nutrients into

watercourses.

8. Maintain over-winter green cover on tillage land as research has shown that cover crops significantly reduce nitrogen leaching losses to water over the winter.

Conclusion

Maintaining healthy soils and protecting water quality are essential for the long-term sustainability of Irish agriculture. Soil is a vital resource that supports our food production, biodiversity, nutrient cycling, carbon storage, and water regulation. By understanding the diverse nature of Irish soils and adopting practices that improve soil physical, chemical, and biological health, farmers can enhance productivity while safeguarding the environment for future generations. At the same time, protecting water quality requires targeted local actions. The Better Farming for Water campaign highlights practical measures that farmers can implement to reduce nutrient losses, improve nutrient efficiency, and minimise environmental impacts. Together, healthy soil management and water protection measures create a more resilient farming system that benefits farmers, communities, and the wider environment both now and into the future.

Other resources & online information

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Farming for Soil Health - Best practices for managing Irish agricultural soils https://teagasc.ie/wp-content/uploads/uploads/media/website/publications/2025/Farming-for-Soil-Health-Web.pdf

Better Farming for Water - 8 actions for change. https://teagasc.ie/environment/water-quality/better-farming-for-water/

Supporting Farmers to Achieve Sustainable Farming Systems

Veronica Nyhan[1] and Noel Meehan[2]

[1] Teagasc, Crops Knowledge Transfer; [2] Teagasc, Water Quality Knowledge Transfer

Farming in Ireland is changing. As a farmer, you are being asked to protect water quality, reduce greenhouse gas and ammonia emissions, improve soil health and enhance biodiversity, while continuing to run a productive and profitable business. At the same time, weather patterns are becoming less predictable. Wetter winters, heavier downpours, longer dry spells and more difficult spring and autumn conditions are already affecting grazing, nutrient management and overall farm performance across many systems.

Irish agriculture is also operating in a more uncertain international environment. Energy market volatility, fertiliser price shocks, supply chain disruption and changing trade dynamics have highlighted the importance of resilience, efficiency and sustainable resource use at farm level. Long-term sustainability must support profitable farm businesses alongside environmental improvement and vibrant rural communities.

For many farmers, the willingness to improve sustainability already exists. The challenge is often identifying which actions will make the biggest difference on the farm and knowing where to start. This is where Teagasc advisory, Knowledge Transfer (KT) and decision-support services can help by providing practical guidance that supports both environmental and economic performance.

Using Advisory and KT Supports

There is now a far broader range of advisory, technical and decision-support resources available than ever before. Programmes such as Signpost, ASSAP, Better Farming for Water 8-Actions for Change campaign, KT discussion groups and demonstration farms are designed to help farmers improve sustainability while maintaining productive and profitable systems.

Support is available through one-to-one advisory visits, discussion groups, demonstration farms, webinars, podcasts, digital tools and local events. This allows you to access guidance in ways that best suit your own farming system, workload and priorities.

The structure and the role of Teagasc advisory services is also continuing to evolve. While schemes and regulation remain important, there is increasing focus on helping farmers improve technical performance, strengthen resilience, adopt suitable technologies and make informed long-term decisions. Many sustainability measures are also efficiency measures that can improve nutrient use efficiency and strengthen profitability.

No two farms are the same. Soil type, enterprise, climate, topography, stocking rate and

local environmental pressures all influence which actions are most appropriate. This is why tailored advice and farmer-to-farmer learning are becoming increasingly important.

Understanding Risks and Opportunities on the Farm

One of the first steps in improving sustainability is understanding where the main risks and opportunities exist on the farm. Soil health is now recognised as a foundation of sustainable farming systems, influencing productivity, nutrient use efficiency, water quality, biodiversity and climate resilience.

A wide range of tools and resources are available to help identify priorities for action. For water quality, farmers can access EPA water quality data, Priority Areas for Action (PAAs), ASSAP farm assessments and recently launched Better Farming for Water Catchment Action Plans to better understand the pressures affecting local water bodies.

Pollution Impact Potential (PIP) maps and interactive soil maps can help identify where land is more vulnerable to nutrient or sediment loss. Combined with local catchment assessments, these tools allow for a more targeted approach to nutrient management and land management decisions.

In relation to greenhouse gas and ammonia emissions, tools such as AgNav and the Bord Bia Farmer Feedback Report can help assess environmental performance and identify practical opportunities for improvement. The Teagasc MACC has also identified a range of technologies and practices capable of reducing emissions while maintaining productive farming systems.

Digital platforms such as NMP Online, PastureBase Ireland and the Teagasc Fertility Dashboard are helping farmers better manage nutrient use efficiency, grass production and soil fertility. Economic benchmarking tools from the Teagasc National Farm Survey can also help show the relationship between technical performance, environmental efficiency and profitability.

Turning Knowledge into Action

Sustainability improvements are most successful when they are practical, targeted and economically viable. For many farms, relatively small changes can collectively make a significant difference over time.

Examples include:

- improving nutrient management planning and nitrogen use efficiency,
- adopting protected urea and low emission slurry spreading,
- improving soil fertility, pH and grass utilisation,
- protecting watercourses and improving farmyard infrastructure,

- reducing nutrient losses from roadways and yards,
- incorporating clover and mixed swards where suitable,
- managing hedgerows appropriately,
- and increasing space for nature on farms.

Many of these measures improve both environmental and economic performance by reducing nutrient waste, improving efficiency and making better use of existing farm resources.

Working with an adviser or discussion group can help identify which actions are likely to deliver the greatest benefit in your own situation. In many cases, beginning with practical, high-impact measures that can be implemented quickly, and cost effectively is the best approach.

Building a More Resilient Farm Business

Helping farms become more resilient to climate and economic pressures is now a major focus of advisory and KT programmes. The emphasis is not simply on reducing emissions, but on improving the overall resilience and adaptability of farming systems.

Measures that improve nutrient use efficiency, grass growth, soil health, water management and animal performance, and additional slurry storage can also help farms better cope with difficult weather conditions, rising input costs and market volatility.

Technology is also playing a more important role in supporting practical farm decisions. Digital platforms, remote sensing, GIS tools and precision farming technologies are helping farmers monitor grass growth, manage nutrients more accurately and target actions where they are most effective. Technology delivers most value when it improves efficiency, saves time or supports better decision-making at farm level.

Teagasc research farms, demonstration farms and on-farm trials also play an important role in testing and validating new technologies and management practices under Irish conditions before wider farm adoption.

Water Quality and Biodiversity

Water quality remains one of the most important environmental challenges facing Irish agriculture. The Better Farming for Water– 8 Actions for Change campaign supports farmers in adopting practical measures that reduce nutrient and sediment losses through improved nutrient management, farmyard management and land management.

The campaign builds on initiatives including ASSAP, Farming for Water EIP, Waters of LIFE, Blue Dot Catchments and the Agricultural Catchments Programme (ACP). These programmes

provide practical and confidential support to help farmers identify local pressures and implement targeted improvements while the ACP and other Teagasc research provides water quality science to support farmers.

Simple actions can often make a significant difference, including managing slurry and soiled water correctly, maintaining drains and gutters, fencing watercourses, improving yard runoff management and avoiding spreading during unsuitable conditions.

There is also growing recognition of the importance of biodiversity and ecosystem health within farming systems. Measures such as improved hedgerow management, pollinator-friendly areas, agroforestry and increasing space for nature can improve biodiversity while complementing productive agriculture and strengthening farm resilience.

Learning from Other Farmers

Farmer-to-farmer learning remains one of the most effective ways to support practice change. Demonstration farms, discussion groups, open days and local events allow farmers to see how new technologies and management practices are working under real commercial farming conditions.

These programmes help build confidence, encourage discussion and allow farmers to assess the practical, technical and financial implications of adopting new measures on their own farms.

Looking Ahead

The transition to more sustainable farming systems will require practical action, continued innovation and strong collaboration between farmers, advisers, researchers and industry.

The scale of change required across Irish agriculture is significant, but Irish farmers have consistently demonstrated their ability to adapt, innovate and improve. By making use of available advisory services, decision-support tools, research and farmer networks, you can improve environmental performance while maintaining a productive, profitable and resilient farm business into the future.

Other resources & online information

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Lime the basis to sustainable farming - Improving water quality and reducing total farm emissions

Mark Plunkett[1], Siobhan Kavanagh[2], John Maher[3] & Noel Meehan[4]

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A small investment of €14/ac year in lime will deliver large production and environmental benefits while insulating your farming business against global energy shocks. Soil test results show that a large proportion of grassland soils are sub-optimal for soil pH and would benefit from an application of ground limestone. Fertiliser prices have rocketed over the last number of months due to conflict in the Middle East. In the last fertiliser crisis one of the key learning was that applying lime helped increase N use efficiency of both soils and applied N sources, while reducing our dependence on imported fertilisers.

Soils tested annually show a large lime requirement especially on drystock farms where in 2025 59% of soil have a lime requirement compared to 39% on dairy farms. Lime application rates range from 5 to 7.5 t/ha with 5t/ha (2t/ac) being the typical application rate. This costs €175/ha or €70/ac and when costed over 5 years represents a lime maintenance cost of €14/ac/yr.

The following are some of the key benefits from applying lime to build or maintain soils in the optimum soil pH range for grassland mineral soils.

1. Soil N supply

- Correcting mineral soil pH levels to pH 6.3 to 6.5 can release up to 70kg N / ha (56 units / ac / yr)
- Correcting soil pH 5.5 to 6.3 increases NUE from 35 to 51% (see figure 1)
- Thus, reducing our reliance on chemical N fertilisers & GHG emissions
- Represents a cost saving of ~€140/ha at current fertiliser N prices

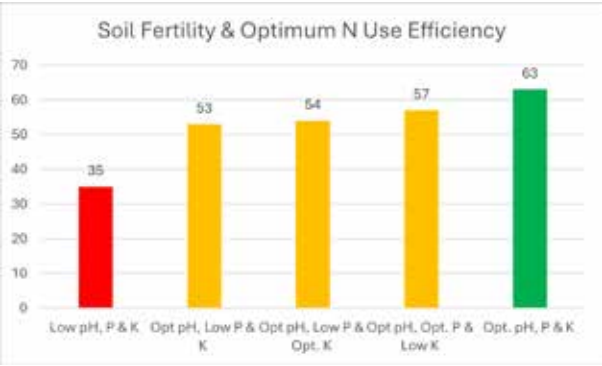

Figure 1. Percentage NUE and grass growth response to N fertiliser across grassland fields according to the status of soil pH, phosphorus (P) and potassium (K) fertility. (adapted from Wall. D.P. et al., 2017).

2. Soil P supply

- Correcting mineral soil pH levels from soil pH 5.5 to 6.3 improves soil P, thereby increasing soil P availability
- Research shows that soil P levels can increase by a full soil P index
- Approximately 50kg P / ha is required to increase soil P by 1 mg/L. Therefore, 150kg P / ha to move a soil P index.
- This represents a cost saving of ~€450 / ha at current fertiliser P prices or 1.2 tonnes of a fertiliser such as 10-10-20

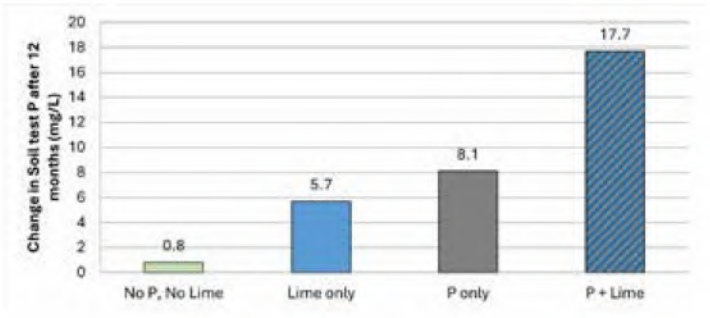

Figure 2. Average change in soil test P (Morgan's P test) across 16 mineral soils treated with P (100 kg/ha of P), Lime (5 t/ha of lime), and P + Lime and re-tested after 12 months *(Sheil, T. et al, 2013).*

3. Increase grass production

- Correcting mineral soil pH levels to pH 6.3 to 6.5 can increase grass production by up to 2.5t DM / ha / year (see figure 3)
- On a dairy farm this worth €428ha / year and on a drystock farm its worth €262 / ha / year
- On a 100-cow dairy herd this is worth €17,000 in extra grass production
- On a 40 cow suckler herd this is worth €10,500 in extra grass production
- Return on investment for everyone €1 invested in lime is €7.5 to €13 for drystock and dairy farms

4. Improving water quality

- Having soils at optimum pH ensures that nutrients applied (N & P) to crops are utilised by the growing plant efficiently and this reduces the risk of nutrient loss to waters
- Soils with sufficient lime are also healthier and have better soil structure which improves permeability thus reducing the risk of overland flow of water and diffuse loss of nutrients and sediment to water

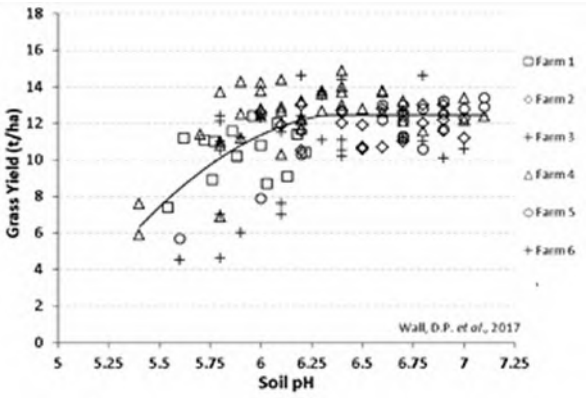

Figure 3. The relationship between soil pH and grass yield across a range of farms in Ireland

5. Reducing the carbon footprint of both meat and milk production

- Increasing farm N use efficiency drives farm productivity while reducing total farm emissions by 3 to 8% through reduced N usage. Reducing fertilisers costs by up to €140/ha/year
- Soil pH reduces N_2O emissions up to 39% at soil pH 6.9 (see figure 4)
- Maintaining optimum soil pH increases soil C sequestration by 0.5t C/ha/yr

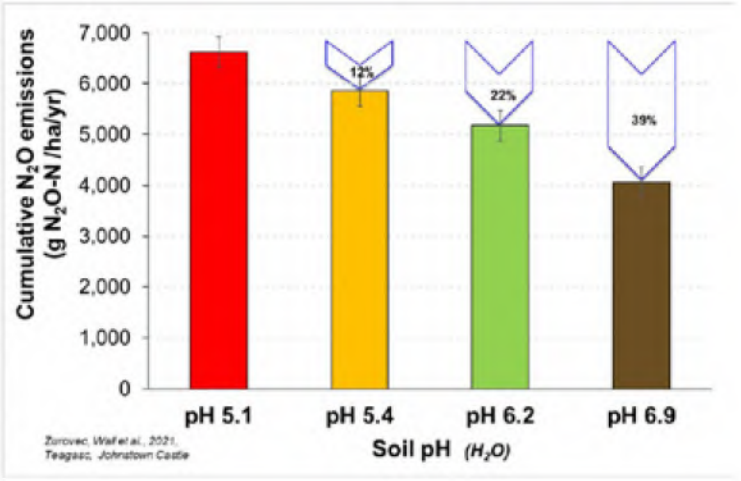

Figure 4. The effect of soil pH on nitrous oxide emissions (adapted from Žurovec et al., 2021).

Other resources & online information

Further information:- https://teagasc.ie/wpcontent/uploads/uploads/media/website/environment/climate-change/signpost-programme/LIME.pdf

https://teagasc.ie/wpcontent/uploads/uploads/media/website/environment/climate-change/signpost-programme/LIME.pdf

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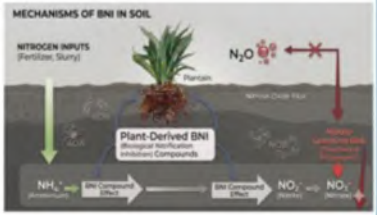
Soil Health and Grassland Management

FARMING FOR A BETTER FUTURE

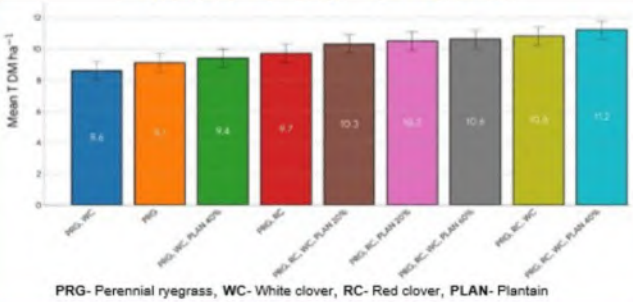
Plantain inclusion in grass-clover leys

Plantain inclusion effect - yield, fertiliser and N retention

- Perennial ryegrass based grasslands dominate Irish livestock systems. Clover inclusion reduces fertiliser N inputs; however, it does not reduce reactive N losses
- Plantain inclusion may mitigate N losses by suppressing soil nitrification via biological nitrification inhibition (BNI)
- Plantain-driven BNI effects support greater N retention in ammonium form



Effect of sward type on biomass yield (tonnes DM ha^{-1}) Grazing season (May – October 2025)



PRG- Perennial ryegrass, **WC**- White clover, **RC**- Red clover, **PLAN**- Plantain

Take Home Message

- ✓Plantain inclusion can reduce N losses and enhance NUE
- ✓Grass clover leys including plantain can support sustainable environmentally-resilient intensive pasture production
- ✓Ongoing work investigating plantain as a mitigation tool to reduce N losses in grass and cover crop seed mixes

Benefits of plantain in grass-clover leys

Jake Mac Lochlainn[1,2], Claire Chapeau[1], Gary Gillespie[2], and Bridget Lynch[1]

[1]Environment, Soils and Land Use Department, Teagasc, Johnstown Castle, Co. Wexford, Ireland

[2] University College Dublin, School of Agriculture and Food Science, Dublin, Ireland

Summary:

- In grazed and cut grasslands, soil N is vulnerable to transformation and loss through nitrification and denitrification, which convert stable ammonium (NH_4^+) into mobile nitrate (NO_3^-) and gaseous forms such as nitrous oxide (N_2O). These processes reduce N availability for the growing crop and contribute to environmental pollution.
- Incorporation of plantain (*Plantago lanceolata*) into grass-clover swards has been identified as a potential strategy to improve N retention and reduce soil N losses through biological nitrification inhibition (BNI), whereby plant derived bioactive compounds suppress soil nitrifier activity and slow the conversion of ammonium (NH_4^+) to nitrate (NO_3^-).
- This natural inhibiting activity has been shown to reduce nitrous oxide emissions and reduce nitrate leaching
- Research is under way to evaluate the effect of varying rates of plantain inclusion in short term grass-clover leys (which include various combinations of perennial ryegrass, white clover, red clover and plantain) on grass yield, forage quality, N_2O emissions, and legacy effects on subsequent cereal crops.
- Provisional findings from this study suggest there are benefits to including more than two species in the mixture; plantain (40%) together with red and white clover and perennial ryegrass yielded the highest in the establishment year.

Other resources & online information

Teagasc Website: https://teagasc.ie/news--events/daily/higher-yields-and-reduced-fertiliser-from-diverse-swards/

FertiGO, funded by Green ERA-Hub https://www.greenerahub.eu/fertigo

Email: jake.mclaughlin@teagasc.ie

Principles of Soil Health

Soil Health is our Wealth!

Healthy soils support:

- Farms - productive crops and livestock, and weather resilience
- People - food security and clean water
- Planet - biodiversity and climate mitigation

Soil management today shapes harvests for years to come.

Follow these 6 principles for healthier soils.

Scan to access 'Farming for Soil Health'

Principle 1

Know your Soils

Principle 2

Assess your soil health

Principle 3

Avoid physical damage

Principle 4

Support soil biodiversity

Principle 5

Build or maintain soil organic matter

Principle 6

Maintain balanced soil fertility

Farming for Soil Health: Principles of Good Soil Management

Fiona Brennan[1], Dermot Forristal, Veronica Nyhan[2], Luis Lopez-Sangil[1], Gabriela Cardenas-Alvarez[1], Saorla Kavanagh[1], Cathal Somers[3], Owen Fenton[1], Giulia Bondi[1], Karen Daly[1], Lilian O'Sullivan[1], John Finn[1], Aaron Fox[1], David Wall[1]

[1]Teagasc, Johnstown Castle; [2]Teagasc Crop Knowledge Transfer; [3]ASSAP Advisory

Summary:

- Soils are at the heart of our food systems and are essential for human, environmental and planetary health.
- A dynamic mixture of minerals, organic matter, air and water, healthy soils are the most biodiverse ecosystems on the planet, providing habitat for a myriad of beneficial organisms. Their correct functioning is the foundation that sustains farm productivity, food security, and the resilience of human communities.
- Healthy soils are one of the most valuable resources on the farm, and amongst the greatest legacies farmers – as the main custodians of our soils – can give to society. This is because soils take a long time to form, can be lost or damaged quickly, and if badly degraded, they are not easy to fix. It's critical that soils are managed sustainably.
- Soils are also very diverse! Different soils need to be managed in different ways, according to their specific capacities and vulnerabilities. There are, however, some general principles for the good management of soils that can be applied universally, and which can help with keeping soils healthy. We have grouped them into six evidence-based principles that farmers, advisors, educators and any soil custodian can use to manage soils more effectively and sustainably. Like any general advice, these principles work best when soil custodians adapt them to suit local conditions and farming systems:
    1. KNOW YOUR SOILS
    2. ASSESS YOUR SOIL HEALTH
    3. AVOID PHYSICAL DAMAGE
    4. SUPPORT SOIL BIODIVERSITY
    5. BUILD OR MAINTAIN SOIL ORGANIC MATTER (SOM)
    6. MAINTAIN A BALANCED SOIL FERTILITY
- In the following pages, you will find guidance and useful resources linked to each of these principles. You will also find some interesting visual displays demonstrating these principles during the Teagasc Johnstown Castle Open Day 2026.

Other resources & online information

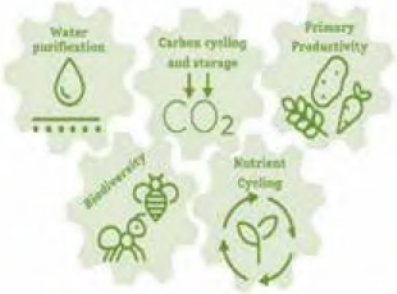
Farming for Soil Health Handbook https://teagasc.ie/wp-content/uploads/uploads/media/website/publications/2025/Farming-for-Soil-Health-Web.pdf

1. Know your Soils

WHY SOIL MATTERS?

Understanding your soil helps improve management, efficiency, and sustainability.

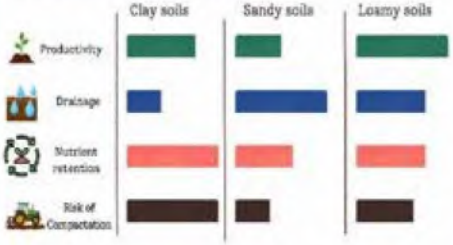
Soil Functions



Healthy soils are the foundation of productive, resilient and sustainable farms.

UNDERSTAND YOUR SOIL

Play with your soil's strenghts



TAKE HOME MESSAGES

Use local knowledge

Record field characteristics such as previous drainage ditches and past management practices.

Access free national maps

Maps can help you to identify soil types, sub soils and bedrocks in your area.

Test your soil!

Testing your soil helps you make informed decisions about nutrients, pH and soil health.

Farming for Soil Health: Know your Soils

Gabriela Cardenas-Alvarez[1], Luis Lopez-Sangil[1], Lilian O'Sullivan[1], Veronica Nyhan[2], Owen Fenton[1], Fiona Brennan[1], Giulia Bondi[1], David Wall[1], Reamonn Fealy[3], Karen Daly[1]

[1]Teagasc, Johnstown Castle; [2] Teagasc Crop Knowledge Transfer; [3]Teagasc, Ashtown

Summary:

- Soils in Ireland are young – less than 15,000 years old –, but very diverse, with 213 different soil types. It is quite common to find multiple soil types at the same farm, or even at the same field!
- All soils have unique properties that result in different capabilities and vulnerabilities, which may need to be managed differently. Understanding what type of soil you have can help you take better decisions for managing it more effectively and sustainably.
- While some important soil features – like pH, soil organic matter (SOM) and nutrient contents, compaction, porosity or drainage – can be changed or amended with correct farming practices, others – like soil texture, slope or position in the landscape – cannot, so landowners need to adapt their management practices accordingly. For example, soils with higher clay content can retain more nutrients, water and organic carbon (as SOM), better supporting long-term fertility, but they can be slow to drain the excess of water and more susceptible to traffic compaction. Sandy soils, on the other hand, drain quickly and are more resilient to compaction (common issues in Irish soils), but they don't hold on to nutrients, water and carbon as effectively. The key is to manage the soil you have, *playing* to its strengths!

What to do

- Even when knowledgeable about the fields on your farms, getting to know which soil types there are, what they mean, and where they are, is critical.
- Obtain local knowledge on past management or soil properties (such us fields prone to flooding or previous soil test results) where available; such information can be invaluable for guiding future management.
- Access free national maps that can give you a general idea of the main soil types, subsoils, slopes, bedrock, or nutrient pollution risks in your area. But keep in mind that most of these maps are too coarse in resolution to show what's really happening at farm or field level. Always check the land yourself before using these maps to guide decisions on soil management.
- If you haven't had your soil fertility tested recently consider conducting some baseline chemical analysis to help you tailor management practices effectively.

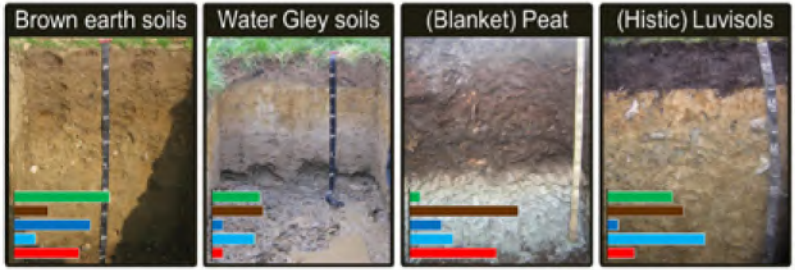
Other resources & online information

Farming for Soil Health Handbook https://teagasc.ie/wp-content/uploads/uploads/media/website/publications/2025/Farming-for-Soil-Health-Web.pdf

Interactive Soil Map of Ireland (Irish Soil Information System) https://teagasc.ie/environment/soil/irish-soil-types-and-maps/irish-soil-information-system/

2. Assess your Soil Health (*in situ*)

Different soils have different properties, which dictate their different **functions**… and vulnerabilities.
A quick look at the topsoil and profile can give you valuable information about soil and its **health status**.



Legend: potential soil functions & vulnerabilities

- Plant productivity
- Carbon sequestration & storage
- Water percolation
- Nutrient retention (no leaching)
- Resistance to compaction

Take home messages

- Soil health can be assessed *in situ* (in the field) observing key soil features.
- A combination of topsoil and soil profile indicators works best.
- The critical functions we rely on from our agro-ecosystems depend on maintaining good soil health.

Farming for Soil Health: Assess your Soil Health

Luis Lopez-Sangil[1], Veronica Nyhan[2], Gabriela Cardenas Alvarez[1], Cathal Somers[3]; Giulia Bondi[1], Lilian O'Sullivan[1], David Wall[1], Karen Daly[1], Fiona Brennan[1]

[1]Teagasc, Johnstown Castle; [2]Teagasc Crops Knowledge Transfer; [3]ASSAP Advisory

Summary:

- Soils are multifunctional living systems. As such, the critical functions they provide to societies rely on their healthy status. Soils are also limited resources, irreplaceable at human time scale. In the EU, 60-70% of soils are currently degraded, and continue to deteriorate, costing over €50 billion per year. Protecting healthy soils from degradation is critical for human wellbeing, food production and economic development.
- Soil health assessments can easily be done in the field (*in situ*). A quick look at the topsoil combined with digging a small pit (exposing the top 40-50cm of soil profile) can give us valuable information about the type of soil and its health status. It's important to note that soils are very diverse, with their different physical, chemical and biological properties dictating their functions and vulnerabilities. Soils also vary by depth, with soil organic matter (SOM) and biological processes normally accumulating at the top. All these natural differences need to be accounted for when assessing soil health.

What to do

- Compare areas of good and poor performance on the farm. Look for evidence of poor crop establishment or growth, reduced water infiltration, physical damage and/or erosion... These are areas you may want to investigate further.
- Use visual assessment techniques. Features of biological activity are the main indicators of good soil health status: check for deep and extensive root growth, presence of rounded aggregates, crumbly structure, earthworms and other soil organisms, high porosity and bio-channels, and the dark colours from SOM.
- Many Irish soils are affected by water stagnation (when excess of water in the soil accumulates over prolonged periods), and are prone to compaction or nutrient leaching. These issues pose serious challenges to farmers and soil life. Features like iron redox mottles (brownish/greyish-coloured patterns indicative of lack of oxygen), compacted layers in the soil, poor rooting and/or reduced porosity can help identify the issues and tailor corrective measures before they start affecting farm productivity or water quality.
- Assess chemical health by conducting regular soil analysis tests, particularly for pH and available macronutrients, while also monitoring SOM (organic C) levels.

Other resources & online information

Farming for Soil Health Handbook: https://teagasc.ie/publications/farming-for-soil-health/

Videos and guides on how to assess soil health https://teagasc.ie/environment/soil/soil-health/ground-truth/groundtruth-resources/

EU Commission's proposal for a Directive on Soil Monitoring and Resilience: https://ec.europa.eu/commission/presscorner/detail/en/qanda_23_3637

Contact: Luis.Lopez-Sangil@teagasc.ie

DIY Soil Health Tests for the Farm or School

Soil health test

Simple and practical activities to explore soil health

Resources

Scan to access resources

1 Underwear decomposition test

Bury cotton underwear in the soil for two months

More decomposition = more active soil

2 Flower insect timed count

Many insects live in our soil!

Count insects visiting flowers in 10 minutes

Assesses biodiversity and pollinator activity

3 Visual Evaluation of Soil Structure

Dig and examine a soil block

Look at roots, pores, colour and structure

4 Earthworm count

Count earthworms in a soil sample

Earthworms indicate a healthy soil biology & structure

Take Home Messages

Simple tests support better soil decisions

Great for practical outdoor learning

Farming for Soil Health: On Farm DIY Soil Health tests

Fiona Brennan[1]; Veronica Nyhan[2], Saorla Kavanagh[3], Luis Lopez-Sangil[1], Karen Daly[1], Karla Burke[1], Gabriela Cardenas-Alvarez[1], Elena Hayes[3]

[1]Teagasc, Johnstown Castle; [2]Teagasc Crops Knowledge Transfer; [3]Teagasc, Moorepark

Summary:

- How we manage our soils impacts their ability to perform essential roles.
- Simple, on-farm tests can offer valuable insights into soil health and help farmers to make informed management decisions. They are also useful hands-on outdoor learning tools in educational settings.
- These tests require limited equipment, often just a spade, and most have no economic cost other than time. These tests include:
    1. Earthworm count: Earthworms are indicators of biological soil health and as ecosystem engineers they play an important role in maintaining soil structure. Counting the number of earthworms of different functional groups (anecic, epigeic and endogeic) within a block of soil (20x20x25cm) is a quick and easy method of assessing soil biological health.
    2. Visual evaluation of soil structure: This involves assessing the soil's physical structure, which influence all aspects of soil health. Visual soil assessments can provide an objective score based on manually breaking down a block of soil by hand to assess specific soil features such as colour, aggregate size, shape and strength, pore structure, and the presence of roots at different levels. These features indicate if soil has a good or poor soil structure.
    3. Underwear degradation test: This test requires burying cotton underwear in the soil and observing its degradation after two months. This is an easy method of assessing biological activity and gives an indication of how well your soil is functioning.
    4. Flower insect timed count: Many flying insects live in soil and are an important part of the soil ecosystem. By counting the number of insects visiting a small area over a ten-minute period, valuable information can be obtained about the biodiversity of the area. This method can also contribute to national monitoring efforts.

Other resources & online information

https://teagasc.ie/environment/soil/soil-health/ground-truth/groundtruth-resources/

Email: Fiona.Brennan@teagasc.ie

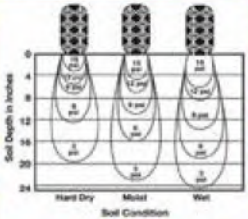
3. Avoid Physical Damage

Soil Compaction

- ✓ Common problem in many Irish soils
- ✓ Wet soils transfer damage deeper into soils
- ✓ Subsoil compaction (*plough pan*) difficult to fix

PREVENTION
ALLEVIATION
INTERVENTION

Avoid trafficking when soils are too moist (SMD <10mm as reference)



Identify depth & extent of damage

Mechanical intervention (SUBSOILING) is last resort: if subsoil still moist, remedy may be worse than cure!

Take Home messages

- Prevention much better than intervention!
- Machinery traffic & cultivation → main threats
- Aim trafficking only when soils are sufficiently dry (*Met Éireann* SMD values are a useful guide)

Farming for Soil Health: Avoid Physical damage

Luis Lopez-Sangil[1], Lilian O'Sullivan[1], Owen Fenton[1], Fiona Brennan[1], Giulia Bondi[1], David Wall[1], Karen Daly[1]

[1]Teagasc, Johnstown Castle;

Summary:

- When soils are physically damaged, their structure gets disrupted, affecting soil life and their capacity to cope with future stresses.
- The most common cause of physical damage in Irish soils is compaction, which reduces soil porosity both in between and within the soil aggregates – 'the building blocks' of soil structure. This leaves soils without space for roots to grow, air to breath, and habitat for soil organisms, reducing the capacity of soils to support crops, infiltrate water, and cope with extreme weather events (like runoff erosion, droughts or floods).
- Soil compaction usually happens due to increasingly heavy machinery and livestock trafficking, especially when soils are wet. Poorly drained soils are thus more at risk of severe damage.
- Worst part is, if soil structure becomes badly degraded (especially below surface), it's not easy to fix. When it comes to soil physical damage, prevention is better than cure!

What to do

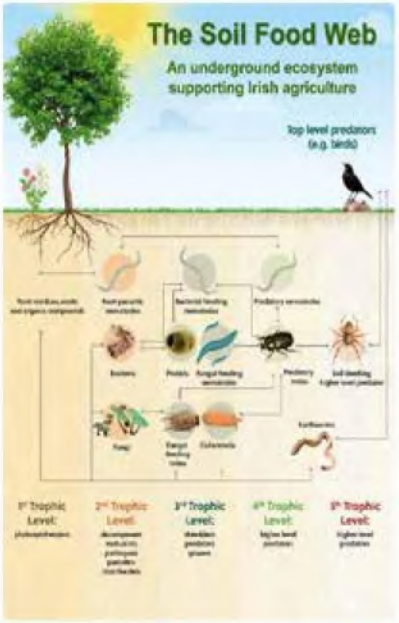
- Reduce heavy machinery traffic on soils as much as possible.
- Lighten the load! Reduce ground pressure on soils by using lighter machinery (where possible) & spreading weight over more/larger/wider/low pressure tyres.
- Avoid or limit machinery and cattle traffic on wet soils. Moisture can transfer load stresses further down the soil profile, making it more difficult to fix.
- When reseeding grassland or cultivating arable crops, consider reducing tillage depth, frequency and intensity. Vary cultivation depth occasionally, to avoid forming compacted layers (such as 'plough pans') just beneath the cultivation depth. Include crops with different rooting depths in your rotation to naturally break up minor compaction and incorporate organic amendments into the soil to foster earthworm and fungal activity, which builds up healthy soil aggregation.
- Pay extra attention to headlands, as they are more prone to compaction from frequent machinery traffic. Consider fixed tramlines and other controlled traffic farming (CTF) measures to reduce machinery damage in the wider area.
- Benefit from soil biology! Increase soil organic matter levels and keep a living root system for as long as possible to enhance physical anchoring of soil.
- Take particular care of soils after mechanical disturbances (like ploughing), as such soils are more prone to subsequent compaction or loss through erosion.

Other resources & online information

The Soil Structure A B C. A Practical Guide to managing soil structure https://teagasc.ie/wp-content/uploads/2025/05/The-soil-structure-ABC.-A-practical-guide-to-managing-soil-structure-3.pdf

How to protect soils from impact of machinery https://teagasc.ie/wp-content/uploads/media/website/publications/2024/How-to-protect-soils-from-the-impact-of-machinery.pdf

4. Support Soil Biology



Meet some key organisms in Irish soils

Take home messages

Practices to support soil biology

- Maintain a good soil structure
- Get to know what species live in the soil
- Maintain or build soil organic matter
- Keep a living root system in the ground
- Minimise soil disturbance
- Diversify cropping
- Reduce chemical inputs
- Prioritise the use of organic fertilisers
- Avoid overloading soils with nutrients
- Maintain farmland habitats

Farming for Soil Health: Support Soil Biology

Fiona Brennan[1]; Saorla Kavanagh[1]; Aoife Duff[1]; Veronica Nyhan[2]; Karla Burke[1]; Eithne Browne[1]; Georgia Voulgari[1]; Laura Dayot[1]; Jack Bradley[1]; Phinda Magagula[1]; Aaron Fox[1]

[1]Teagasc, Johnstown Castle; [2]Teagasc Crops Knowledge Transfer

Summary:

- Our soils are alive - they are home to nearly 60% of the life on Earth and are essential members of our farming workforce.
- Soil biodiversity drives nutrient cycling, improves soil structure, filters water, stores carbon, and provides essential nutrients, vitamins and hormones that support crop health — supporting our food systems and planetary health.
- Soils support many beneficial organisms such as insects (bees, hoverflies, ground beetles), arachnids (spiders), microorganisms (bacteria and fungi), and nematodes. These organisms can act as natural pest enemies – protecting plants from pests and diseases and reducing the reliance on chemical controls. Additionally, soils rich in biodiversity are more resilient to environmental changes and stresses like droughts, floods, and other disturbances.
- Many of our most important pollinators live in soil.
- The following practices encourage a diverse soil biology:
    - Maintain a good soil structure
    - Get to know what species live in the soil
    - Maintain or build soil organic matter
    - Keep a living root system in the ground as much as possible
    - Minimise soil disturbance
    - Diversify cropping
    - Reduce chemical inputs
    - Prioritise the use of organic fertilisers
    - Avoid overloading soils with nutrients
    - Maintain farmland habitats

Other resources & online information

Soil Biodiversity of Ireland poster https://teagasc.ie/wp-content/uploads/uploads/media/website/environment/soil/Soil-Biodiversity-of-Ireland.pdf

Farming for soil health handbook https://teagasc.ie/publications/farming-for-soil-health/

How to guide and videos for assessing soil biology https://teagasc.ie/environment/soil/soil-health/ground-truth/groundtruth-resources/

Bluesky: @soilmicrobio.bsky.social

5. Build or Maintain Soil Organic Matter

Where SOM comes from...

- ✓ Living roots in soils
- ✓ Crop residues, plant litter
- ✓ Organic amendments

...and why is SOM important?

What to do on farms?

1 Cover crops & natural regeneration
2 Grass-clover & Multi-Species Swards (MSS)
3 Intercropping with deep-rooting perennials (hedgerows, agroforestry...)
4 Replenish carbon & nutrients, especially on depleted soils (silage, out blocks)
5 Incorporate crop residues (straw)
6 Minimise soil physical disturbance

Take Home messages

- SOM is the basis of healthy soil functioning
- Irish soils usually have good levels of SOM
- Protecting or improving SOM is essential for soil health, food security & climate resilience

Farming for Soil Health: Build or Maintain Soil Organic Matter (SOM)

Brendan McGoldrick[1], Luis Lopez-Sangil[1], Fiona Brennan[1], Lilian O'Sullivan[1], Giulia Bondi[1], David Wall[1], Donal O'Brien[1]

[1] Teagasc, Johnstown Castle

Summary:

- Soil organic matter (SOM) plays an essential role in how agricultural soils function. It helps binding soil particles into stable aggregates, improving soil structure and giving soils a sponge-like capacity to retain water and nutrients, enhancing at the same time water infiltration into the soil and preventing run-off and erosion. SOM provides habitat for organisms and fuels the complex food web system that supports the chemical and biological functioning of soils, key for plants to grow healthy. And it also locks atmospheric carbon into the soil, thus contributing to mitigate climate change.
- Healthy levels of SOM are necessary for soil resilience. They bring improved soil structure and trafficability, greater resistance to compaction and weather extremes, enhanced water and nutrient supply, buffering of soil pH extremes, suppression of soil-borne pests and diseases, and promotion of plant growth.
- Agricultural soils in Ireland generally have good levels of SOM already. This is a major asset of Irish farming systems. But SOM can be lost quickly if soils are repeatedly disturbed. Moreover, rebuilding SOM takes time, especially in soils that are already carbon-rich, making the protection of existing stocks critical.
- Having living roots in the soil, for as long and as deep as possible, is the primary pathway for protecting and increasing SOM levels. Permanent grasslands with grass-clover or multispecies swards, cover crops, intercropping with deep-rooting perennials, and natural regeneration between crops all help to sustain organic matter inputs to soil, via root exudation and natural decay..
- Returning organic matter into the soil is important for replenishing the carbon and nutrients removed after harvesting crops and residues. Farmyard manures (FYM), chopped straw, compost and other amendments help to restore carbon offtakes, particularly on silage ground and in tillage systems where removal of crops and straw can otherwise lead to a gradual decline in SOM.
- Management choices strongly influence long-term SOM retention. Minimising soil disturbance, avoiding compaction and supporting soil biology all help maintaining SOM. Protecting carbon-rich soils is important for regulating the climate.
- Ongoing research under the VistaMilk programme is improving understanding of how soil management and land use influence SOM and carbon stocks in Irish agricultural soils. This work includes developing national baseline datasets, long-term monitoring and modelling that integrate soil, climate and management data to quantify changes in soil carbon and support sustainable soil management.

Other resources & online information

Farming for Soil Health Handbook: https://teagasc.ie/publications/farming-for-soil-health/

Email: brendan.mcgoldrick@teagasc.ie; donal.mobrien@teagasc.ie

6. Maintain Balanced Soil Fertility

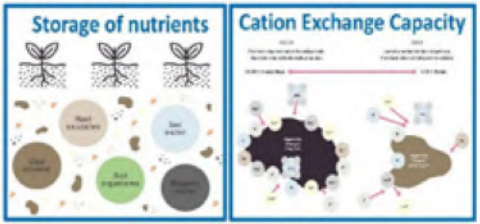
Why does soil fertility matter?

- ✓ Crop productivity, crop quality and profitability are the most common drivers of soil fertility. management. *Fertiliser accounts for 20-25% of input costs.*

- ✓ **Fertile soils are more resilient** to stresses such as compaction extreme temperature, drought, waterlogging & pests.
- ✓ **Balancing nutrient inputs with offtakes** at the field scale is critical for maintaining soil chemical health. Look beyond just N-P-K !!
- ✓ **Applying nutrients precisely** based on plant needs, and reduce the risk of nutrient losses through runoff, leaching & gaseous emissions.

Soils capacity to store nutrients?

- ✓ Nutrients exist in different forms in the soil. Plants take up nutrients in their inorganic form.
- ✓ **Cation exchange capacity (CEC)** reflects the soils ability to retain and re-supply nutrients.



Key Soil Fertility Questions

1. What nutrients will my soils supply?
2. Is my soil pH level optimum?
3. Nutrient needs for my crops?
4. Are nutrient sources available?
5. What nutrients do I purchase?

Take home messages

Practices to support Balanced Soil Fertility

- Conduct soil tests and apply lime if required to correct pH
- Get to know the (CEC) nutrient storage capacity of your soils
- Build resilience to stress by maintaining or building soil organic matter and fertility
- Prioritise the use of organic manures and explore biobased fertilisers. Reduce reliance on chemical fertilisers!
- Maintain a healthy soil nutrient balance. Avoid overloading soils with N-P-K nutrients or with heavy metals & pesticides
- Apply nutrients precisely and according to the 4 R's

Farming for Soil Health: Maintain a balanced Soil Fertility

David Wall[1], Veronica Nyhan[2], Patrick Forrestal[1]; Gabriela Cardenas-Alvarez[1]; Fiona Brennan[1], Karen Daly[1]

[1]Teagasc, Johnstown Castle; [2] Teagasc Crop Knowledge Transfer;

Summary:

- Maintaining balanced soil fertility and pH supports healthy crop growth, improves soil health, supports carbon storage and essential soil functions like nitrogen fixation, and reduces input costs.
- Know the soils you have - this helps you align production goals with the soil's capabilities.
- Regularly test moderately or intensively managed soils for pH and key nutrients like phosphorus (P) and potassium (K).
- Soil pH plays a central role in nutrient availability, biological activity and fertiliser efficiency, making it a key foundation of soil fertility. Correcting soil acidity through lime application, based on soil test recommendations, is often the first and most cost-effective step in improving soil productivity and nutrient use efficiency.
- Prioritise use of organic manures, such as slurry or farmyard manure, to reduce the need for chemical fertilisers. Organic manures should be targeted at fields with a requirement for phosphorus (P) and potassium (K) or soils that are low in soil organic matter for example, silage fields and arable.
- Promote nitrogen fixation through use of legumes where appropriate.
- Use a nutrient management plan to target nutrients where they're most needed on the farm. Follow the 4Rs of nutrient management - use the Right product, at the Right rate, in the Right place, and at the Right time to get the best return and avoid nutrient losses.
- Aim for balanced soil nutrition by applying only the nutrients your crops need, considering those supplied naturally through nitrogen fixation and mineralisation processes. Replace nutrients and carbon removed during harvest and maintain organic matter inputs to support long-term soil health. Avoid overloading the soil with any nutrient.
- Know your soil's capacity to retain and supply nutrients, which is strongly influenced by Cation Exchange Capacity (CEC) and organic matter content. Sandy soils, for example, have a low CEC and therefore low nutrient-holding capacity. Clay rich and peaty soils have a high CEC, but nutrients are often tied up in organic matter and released slowly through mineralisation, so plant-available forms are limited. Some soils can "fix" nutrients, meaning they hold them too tightly for plants to use. This often occurs in acidic soils, rich in iron or aluminium, or alkaline soils high in calcium. In these soils, applying nutrients little and often as crops need them, is often the most effective fertilisation strategy.

Other resources & online information

Farming for Soil Health Handbook https://teagasc.ie/wp-content/uploads/uploads/media/website/publications/2025/Farming-for-Soil-Health-Web.pdf

Major and micro nutrient advice for productive agricultural crops

https://teagasc.ie/wp-content/uploads/2025/05/Major-Micro-Nutrient-Advice-for-Productive-Agricultural-Crops-2020.pdf

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Optimizing site selection for soil sampling and monitoring

Context

High-quality soil data is crucial to support policies and actions in sustainable food production. However:

- Legacy data is often fragmented or too coarse in resolution
- Soil sampling campaigns are extremely expensive and labour-intensive

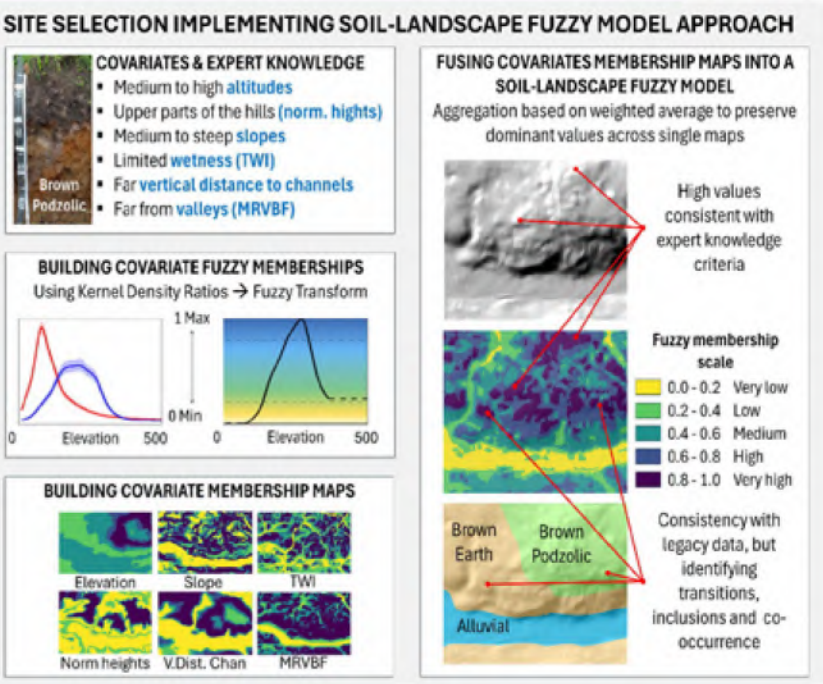
Objective

To develop protocols that optimize site selection in soil sampling, to minimize time, costs, and efforts in soil monitoring

Utility of Fuzzy Models

- Developing rules consistent with expert knowledge
- Based on covariates relevant to soil-forming processes
- To support advisors and farmers in identifying suitable locations for different soil types at more localised scales

SITE SELECTION IMPLEMENTING SOIL-LANDSCAPE FUZZY MODEL APPROACH



Optimization of site selection for soil sampling and monitoring based on soil-landscape fuzzy models

Alex Castellón Meyrat [1, 3, 4], Reamonn M. Fealy[2], Paul Holloway [3, 4], Giulia Bondi [1], Lilian O'Sullivan[1]

1. **TEAGASC, Crops Environment and Land Use Programme, Johnstown Castle, Wexford Y35 TC97, Ireland.**
2. **TEAGASC, Rural Economy and Development Programme, Ashtown, Dublin**
3. **Department of Geography, University College Cork, Cork, Ireland**
4. **Sustainability Institute, University College Cork, Cork, Ireland**

Summary:

- High-quality soil data is crucial to support policies and actions in sustainable food production.
- However, legacy data is often fragmented or too coarse in resolution for certain needs.
- Soil sampling campaigns are extremely expensive and labour-intensive.
- Therefore, there is the need to develop protocols that can support stakeholders to optimise site selection in soil sampling, to minimize time, costs, and efforts in soil monitoring
- As an alternative, implementing fuzzy logic approaches in site selection allows:
    - Rules to be developed that are consistent with expert knowledge
    - Based on factors that are relevant to soil-forming processes that are available in geographic information formats
    - Maps that can support advisors and farmers in identifying different soil types at more localised scales
- These products also make it possible to identify inclusions, transition zones, and potential areas of soil-type co-occurrence.
- This is valuable information to plan future sampling campaigns or fill gaps in existent data

Other resources & online information

Email: Alex.Meyrat@teagasc.ie; Paul.Holloway@ucc.ie; Reamonn.Fealy@teagasc.ie; Giulia.Bondi@teagasc.ie; Lilian.OSullivan@teagasc.ie


Soil Compaction
Your soil can't work if it can't breathe.
Cause: Heavy Machinery
NORMAL SOIL
COMPACTED SOIL
Air
Water
Air
Water
✓ Good air flow
✓ Water infiltration
✓ Roots grow easily
✓ Healthy soil
× Poor air flow
× Water runs off
× Roots struggle
× Unhealthy soil
IMPACTS ON SOIL & GRASS
Poor Drainage
Water pools on the surface leading to runoff and erosion.
Restricted Root Growth
Roots can't penetrate, limiting access to nutrients and water.
Weak, Unhealthy Grass
Thinner turf, more weeds, less resilient to stress and wear.
Healthy soils grow healthy grass — reduce compaction, protect root growth, and safeguard productivity for generations.
Umbilical System
The lightest way to get slurry on the ground.
UMBILICAL SYSTEM
No wheel compaction
Umbilical + Tractor
4–6 t
CONVENTIONAL TANKER SYSTEM
Wheel compaction
Full slurry tanker
20–30 t
Useful in spring time and on heavier soils
Compaction still a risk on very wet soils
Important not to over-apply slurry
Pairs with low-emission spreaders
No tanker in the field
No wasted road passes
Umbilical systems. Reduce compaction. Protect your soil

Protecting Your Soil: Umbilical Systems and Soil Compaction

Shaun Connolly[1], Luis Lopez-Sangil[1], Owen Fenton[1], Giulia Bondi[1], David Wall[1]

[1]Teagasc, Johnstown Castle

Summary:

- Soil compaction is the single biggest barrier to getting value from your slurry. Compacted soil can't store and percolate water, nutrients can't move to roots, and grass response to applied N drops sharply.
- Teagasc research (Lepore et al., 2024) at Johnstown Castle measured the physical damage caused by machinery traffic on grassland soil across a range of soil moisture deficits. The study confirmed that compaction severity is directly linked to how wet the soil is at the time of trafficking.
- Soils trafficked at low moisture deficit (wet conditions) suffered the worst structural damage, reduced porosity, increased bulk density, and restricted root growth.
- Tanker axle weight is the main driver of compaction on Irish farms. A full slurry tanker imposes 20–30 tonnes of axle load on your soil. An umbilical applicator system runs at 4–6 tonnes, a fraction of the impact.
- Umbilical isn't just for tillage. It pays back on heavier ground and in wet spring spreading windows where tankers leave deep wheel ruts and compact the rooting zone.
- Umbilical pairs naturally with low-emission applicators, dribble bar, trailing shoe, injection. The combination delivers slurry under the grass canopy with minimal soil stress and maximum N retention.
- If a tanker is the right tool for your farm, focus on tyre choice and pressure and ensure the soil has enough integrity to bare the weight.

Other resources & online information

Teagasc soil compaction: https://teagasc.ie/environment/soil/research/soil-health/square/compaction/

Teagasc machinery and LESS resources: https://teagasc.ie/news--events/daily/transitioning-to-less/

Solid-Liquid Separation

One slurry in. Two products out.

INPUT
Raw slurry

↓

SEPARATOR

↓

LIQUID — ~1-2% DM Available N + K	SOLID — ~25% DM P + Organic Matter

LIQUID FRACTION

- Precision applied near grazing
- Lower P → suits high P-Index
- Wider grazing window
- Easy to spread with LESS

SOLID FRACTION

- Soil structure & carbon
- Bedding or export
- Concentrated P source

Right product to the right field — separation gives you the choice.

Feed Your Soil

Organic matter builds the soil that feeds your grass.

Organic fertilisers build soil organic matter.

Chemical fertilisers alone can lead to soil organic matter mining.

What organic matter does for your soil

Aggregate stability	OM binds mineral particles into crumbs — resists compaction and erosion.
Water holding	Holds up to 20× its own weight in water — drought resilience.
Soil biology	Feeds billions of microbes that cycle N, P, K into plant-available forms.
N mineralisation	OM releases N slowly through the season — free background fertility.

Separated Solids

~200 kg OM/m³

- P-rich
- Exportable
- Can be used as bedding
- Concentrated carbon source for tired soils

Straw-bedded FYM

~200 kg OM/m³

- Balanced N-P-K
- Slow-release N
- Long-term soil conditioner for run-down ground

Typical slurry: ~45 kg OM/m³. Separated solid or FYM: ~200. *Solid Fraction = Carbon.*

Solid-Liquid Separation & the Soil-Health Value of Solids

Shaun Connolly[1], Gabriela Cardenas Alvarez[1]; Luis Lopez Sangil[1], Anika Akther[1,2], Owen Fenton[1], Giulia Bondi[1], Fiona Brennan, David Wall[1]

[1]Teagasc, Johnstown Castle; [2]University College Cork

Summary:

- One slurry in — two products out. A mechanical separator splits raw slurry into a liquid fraction and a solid fraction.
- The liquid fraction carries the available N and K. Lower P and lower DM make it ideal for precision N application closer to grazing, with a wider grazing window after spreading.
- The solid fraction carries most of the P and almost all of the organic matter, it can be exported off-farm to reduce nutrient surplus, used as bedding (if the dry matter is very high), or applied where soil structure is poor.
- Separation also enables the next step in the slurry-to-fertiliser pathway: RENURE-qualifying products start as a liquid fraction.
- Why the solid fraction matters for soil health? Typical slurry contains ~45 kg organic matter per m^3. Separated solid or straw-bedded FYM contains ~200 kg/m^3, over four times as much.
- Organic matter does four key jobs in soil: aggregate stability (binds particles into crumbs, resists compaction and erosion), water holding (up to 20× its weight), feeds soil biology (microbes that cycle nutrients), and slow-release N through the season.
- *"Organic fertilisers build soil organic matter — chemical fertilisers alone can lead to soil organic matter mining."*
- New Teagasc research (Lepore et al., 2025) used X-ray CT scanning and physical measurements to test how slurry, FYM and gypsum restore grassland soil degraded by machinery traffic. Key findings:
- FYM was the most effective amendment, it improved bulk density and pore volume within 6 months of application, restoring soil structure faster than slurry or gypsum.
- Slurry was effective in moist soil conditions, while gypsum enhanced recovery in dry soils over the longer term.
- All amendments failed under waterlogged conditions, reinforcing the message that timing of application and trafficking matters as much as the product itself. You can't fix compaction damage by spreading onto saturated ground.
- The practical implication: where soil structure has been damaged, applying FYM or separated solids is the fastest route to recovery, but only when ground conditions allow for it. Remember use right product, at the right time, in the right conditions.

Other resources & online information

Teagasc soil health resources: https://teagasc.ie/environment/soil/soil-health/

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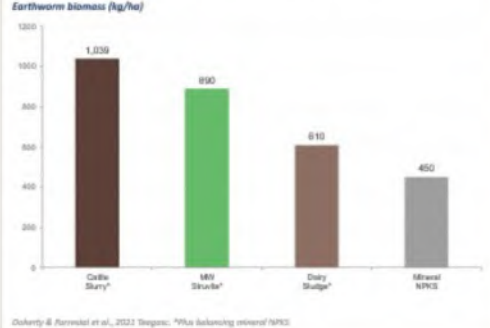
Bio-Based Fertilisers

Nutrients recovered from waste streams — back into your soil.

What the research shows

- BBFs can match mineral fertiliser for plant -available P over the long term.
- Yields maintained when BBFs included in a fertiliser programme.
- Some BBFs boost soil bacterial diversity vs mineral fertiliser alone.
- Soil fertility and structure can be enhanced using bio -based products.



4-year avg. annual grass yield (t DM/ha)

Treatment	Yield
Zero fertiliser	5.7
Chemical fertiliser (CF)	14.6
Cattle slurry + CF	14.6
Struvite (potato) + CF	15.2
Struvite (sewage) + CF	14.8
Ash (sewage) + CF	14.8
Ash (poultry) + CF	14.2
Lime dairy sludge + CF	14.3
Activated dairy sludge + CF	14.5

P recovery over 3 years

Struvite and cattle slurry matched or exceeded super phosphate for cumulative P recovery by year 3. For several BBF P availability was as good or better than mineral P over the long-term.

Take home messages

- Several BBFs had as good or better plant P availability over the long term vs mineral fertiliser P.
- BBFs maintain yield when included in a fertiliser programme.
- Potential role in soil health for some BBFs → positive impact on soil biota (earthworms, bacteria).

Research Projects

BBioNets

Nutri2Cycle

Novafert

Grant No.: 101133904 Grant No.: 773682 Grant No.: 101060835

Bio-Based Fertilisers & RENURE — recycling nutrients in the local bioeconomy

Donal Kinsella[1]; Shaun Connolly;[1] Patrick Forrestal[1]

[1]Environment, Soils and Land Use Department, Teagasc, Johnstown Castle, Co. Wexford.

Summary:

- Bio-based fertilisers (BBFs) are made from nutrients recovered from waste streams such as slurry, manure, municipal, food and dairy processing waste streams for example. They return these nutrients to agricultural land to support crop growth and production.
- Long-term Teagasc trials at Johnstown Castle have shown that several BBFs can match or exceed chemical fertiliser plant P availability over a 3-year period.
- Annual grass yields were maintained at 14.6–15.2 t DM/ha when BBFs are included as part of the fertiliser programme compared to 14.6 t DM/ha using chemical fertiliser only. Struvite was the highest-yielding treatment at 15.2 t DM/ha.
- Some BBFs boost soil biology, earthworm biomass under cattle slurry was 1,039 kg/ha vs 450 kg/ha under mineral NPKS in the same trial.
- What is RENURE? REcovered Nitrogen from manURE. A new amendment to the nitrates directive establishes criteria allowing certain processed livestock manures to be used as chemical fertiliser substitutes. It includes N recovered from manure through ammonia stripping or ultrafiltration that behaves like mineral N. To qualify TAN TN ratio ≥ 90%, C N ratio ≤ 3, plus lab testing. Struvite is also included.
- Where the RENURE legislation stands: On February 9, 2026, the European Commission formally adopted legislation amending the Nitrates Directive to allow for the use of RENURE. It is up to national governments including in Ireland to transpose this amendment into national law to give effect to this new option. This has not happened in Ireland.
- The bigger picture: recycled fertilisers hold potential to reduce import dependence, turn local nutrient concentration challenges into opportunity, to lower costs over time, and support a circular nutrient bioeconomy in rural communities.
- RENURE approved products derived from manure would not count against the farm organic-N stocking rate but would rather displace mineral fertilisers. RENURE could potentially enable Irish farmers to partially displace imported mineral fertilisers with recovered N when the legislative framework is in place nationally.

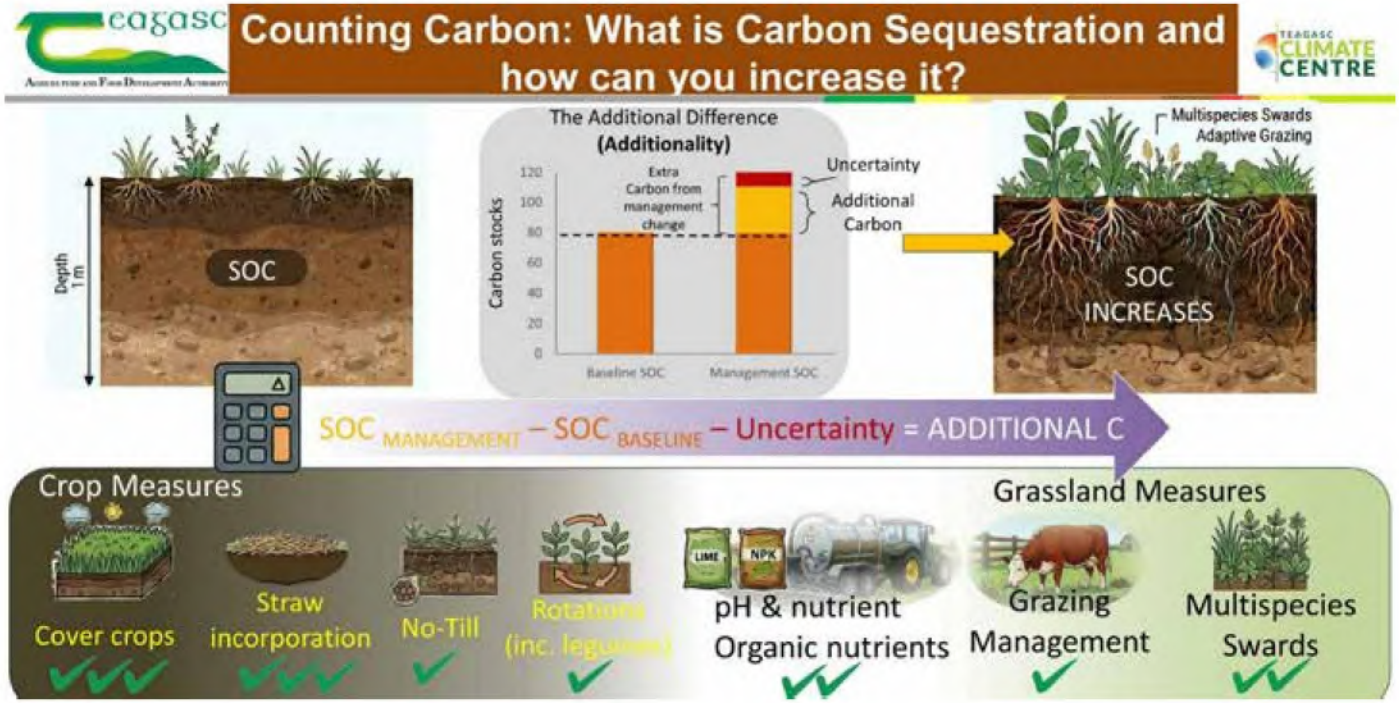
Other resources & online information

Novafert lighthouse demos: www.novafert.eu

Teagasc BioBased Fertilisers: https://teagasc.ie/news--events/daily/can-bio-fertilisers-from-dairy-processing-waste-become-the-next-generation-phosphorus-bio-fertiliser/

EU Nitrates Directive and RENURE updates: https://environment.ec.europa.eu/news/fresh-measures-reduce-farmers-dependency-imported-fertilisers-2026-02-09_en

Email: patrick.forrestal@teagasc.ie


Counting Carbon: What is Carbon Sequestration and how can you increase it?
TEAGASC CLIMATE CENTRE
Depth 1 m
SOC
The Additional Difference
(Additionality)
Carbon stocks
120
100
80
60
40
20
0
Extra Carbon from management change
Uncertainty
Additional Carbon
Baseline SOC
Management SOC
Multispecies Swards
Adaptive Grazing
SOC INCREASES
SOC MANAGEMENT – SOC BASELINE – Uncertainty = ADDITIONAL C
Crop Measures
Cover crops
Straw incorporation
No-Till
Rotations (inc. legumes)
LIME
NPK
pH & nutrient Organic nutrients
Grassland Measures
Grazing Management
Multispecies Swards

Counting Carbon: What is Carbon Sequestration and how can you increase it?

Rachael Murphy[1]; James Rambaud[1]; Kate Devereux[1] ; Ryan Burger[1]; Jack Bishop[1]; Alessandro Righetti[1]; Lyubov Bragina[1]; Gary Lanigan[1]

[1]Teagasc, Johnstown Castle

Summary:

- The soil organic carbon (SOC) stock is the amount of carbon stored in the soil.
- Carbon sequestration is the process by which additional organic carbon is stored in soil.
- SOC can be reduced by increased soil disturbance, poor plant growth and overstocking
- Increased SOC can enhance nutrient availability, improve both buffering and water holding capacity and reduce compaction and erosion.
- Crop-based actions that help build SOC include cover crops, straw incorporation, reduced or no-till systems, and diverse crop rotations with legumes.
- Grassland management practices such as adaptive grazing and multispecies swards can increase root growth and long-term carbon storage in pasture soils.
- Good nutrient and soil management including maintaining pH and using organic nutrients supports higher productivity while helping increase SOC stocks over time.

Other resources & online information

Teagasc Website:

https://teagasc.ie/environment/climate-change-air-quality/signpost-programme/research-updates/soil-carbon-sequestration/

https://teagasc.ie/environment/climate-change-air-quality/soil-carbon/national-agricultural-soil-carbon-observatory/

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Making the most of hedgerow carbon

Background

- Hedgerows and non-forest woody biomass enhance terrestrial carbon sequestration and biodiversity on farms
- Method to assess carbon stock changes over time needed

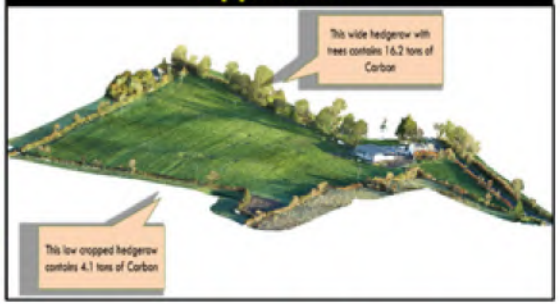
Approach

- Establish relationship between remote measurements and direct measurement to quantify carbon stocks.

Results

- Equations generated that can be used to assess carbon stock changes of biomass between two time steps.
- Carbon concentration of dry biomass was consistent across all pools measured (living, dead above and below ground).
- Management impact - higher mean carbon stock for low versus high management intensity - 75.4 t C/ha versus 34.6 t C/ha

Application



Take home messages

- Remote measurements can be used to quantify above ground carbon stocks
- Management regime impacts C stocks – reduced management = more C

Above ground carbon storage and sequestration of hedgerows and non-forest woody biomass

Lilian O'Sullivan[1], Gary Lanigan[1], Daire Ó hUallacháin[1] and Stuart Green[2]

[1] Teagasc, Environment Soil and Land Use Department, Johnstown Castle, Co. Wexford;

[2] Agribusiness and Spatial Analysis Department, Teagasc Research Centre Ashtown, Dublin

Summary:

- Ireland is committed to reducing emissions and removing greenhouse gases from the atmosphere.
- Hedgerows are a prominent feature in Irish landscapes that can enhance terrestrial carbon sinks.
- Hedgerows and other non-forest woody biomass can sequester carbon, storing it in woody growth, roots, leaf litter and soil organic matter beneath the ground.
- Relationships between remote and direct measurements of hedgerow biomass were established and used to generate equations.
- Equations can be used to assess carbon stock changes between time steps.
- A baseline survey of hedgerows was conducted across 92 Signpost farms over two years.
- Results highlight variations in carbon stocks are dependent upon width, height, species and structure of hedgerows. In particular, the management regime shows to have a strong effect on carbon stocks
- New hedgerow planting can enhance the terrestrial carbon sink with wider irregular hedgerows having a higher biomass sequestration potential than intensively managed hedgerows.
- Less intensively managed hedgerows having higher biomass sequestration potential than intensively managed hedgerows.
- The results from signpost demonstrate the impact of managing hedgerows for carbon and the maps and reports can form the basis for designing plans to increase carbon stocks in hedgerows.

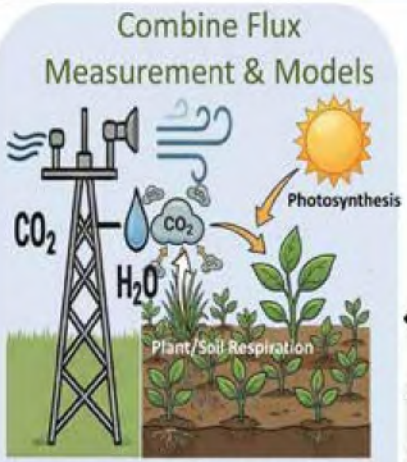
Other resources & online information

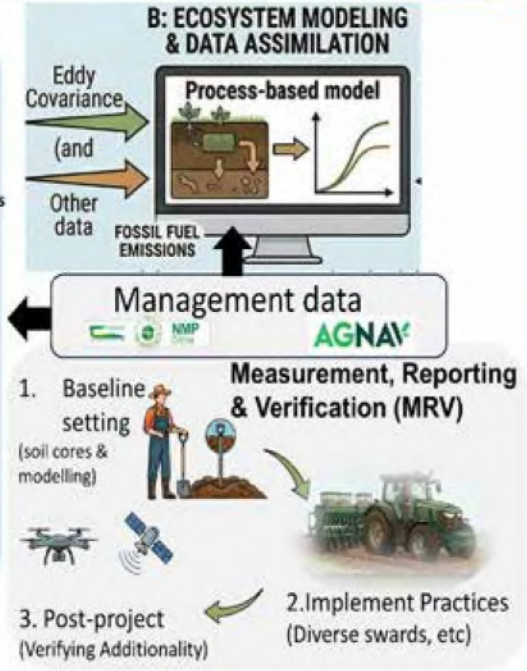
Farm Carbon Project Report 454: https://www.epa.ie/publications/research/climate-change/Research_Report-454.pdf

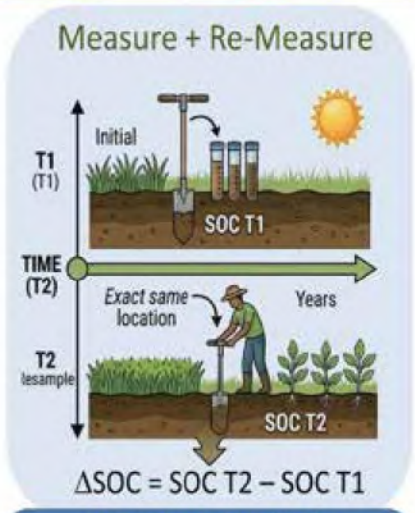
Signpost programme: https://teagasc.ie/environment/climate-change-air-quality/signpost-programme/

Email: Lilian.OSullivan@teagasc.ie; Gary.Lanigan@teagasc.ie; Daire.OHuallachain@teagasc.ie; Stuart.Green@teagasc.ie

Measuring Carbon: How do we measure Carbon Sequestration?







Why is MRV Crucial?
Ensures Real, Quantifiable Climate Benefits & Builds confidence in C markets

Measuring and Verifying Carbon Sequestration

Rachael Murphy, Giulia Bondi, James Rambaud, Lyubov Bragina, Suman Sourav, Gary Lanigan

[1]Teagasc, Johnstown Castle

Summary:

- Measurement, Reporting and Verification (MRV) of Soil Carbon sequestration will need to balance the cost of verification and measurement precision
- The National Agricultural Soil Carbon Observatory (NASCO) and SignPost Farm Soil Carbon sampling will form the backbone for calibrating soil models
- Soil sampling will be required to set baselines
- Once measures are put in place, modelling approaches should be used as much as possible to minimise cost while robustly estimating the future carbon sequestration based on local soil type and management.
- Models will be supplemented by Earth Observation data
- At a national level, MRV models will be incorporated into AgNav
- Ultimately, uptake will depend on the Carbon Price and the cost of measure implementation

Other resources & online information

Teagasc Website:

https://teagasc.ie/environment/climate-change-air-quality/soil-carbon/national-agricultural-soil-carbon-observatory/

Google “MARVIC Project” This will guide users to the Measurement, Reporting and Verification Project MARVIC

Email: rachael.murphy@teagasc.ie gary.lanigan@teagasc.ie

Impact of management intensity of agricultural systems and soil intrinsic characteristics on soil organic carbon stocks

CONTEXT

Enhancing Soil Organic Carbon (SOC) helps to combat climate change and improve soil health. However, we need to understand:

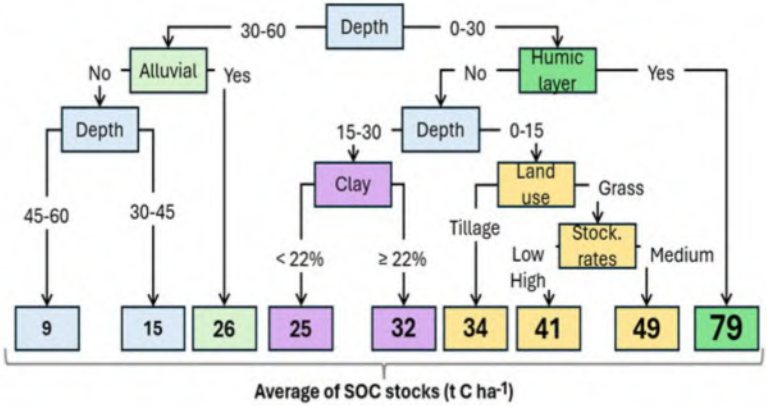
How intrinsic soil properties and management practices impact SOC stocks in depth ?

KEY FINDINGS

Combining a deep soil sampling campaign (60 cm depth) with a Regression Tree analysis showed:

- Intrinsic characteristics set the size of the sinks (notorious in soils with humic layers)
- Clay content plays an important role in lower topsoil, especially when clay ≥ 22%
- Management regimes shift the trends. The cumulative effect is crucial to turn soils into sinks
- Knowing your soils is the first step to design climate-smart strategies and policies, and enhance soil health

Regression Tree Analysis
Pathways of SOC stocks across soil-management combinations



Impact of management intensity of agricultural systems and soil intrinsic characteristics on soil organic carbon stocks

Alex Castellón Meyrat [1, 2, 3], Lilian O'Sullivan [1], Paul Holloway [2, 3], David Wall [1], Giulia Bondi [1]

[1] Teagasc, Crops Environment and Land Use Programme, Johnstown Castle, Wexford Y35 TC97, Ireland.

[2] Department of Geography, University College Cork, Cork, Ireland

[3] Sustainability Institute, University College Cork, Cork, Ireland

Summary:

- Ireland is committed to transitioning toward climate-smart food production, reducing the emissions and removing greenhouse gases from the atmosphere.
- Soil Organic Carbon (SOC) sequestration in agricultural lands is considered a key pathway to help meet these goals
- However, some uncertainties need to be answered:
- To what extent do intrinsic characteristics influence SOC storage capacity?
- Which soil-management combinations stand out for enhancing SOC stocks?
- Which drivers influence SOC storage in depth?
- The Signpost deep soil sampling campaign allowed measuring the SOC stocks under a wide range of combinations of soil-management regimes.
- The use of a regression tree model (RT) made it possible to establish a clear hierarchy of predictors and quantify the contribution of soil properties and land-management factors on SOC stocks.
- The RT model explains 67 % of SOC stock variations across the evaluated scenarios
- Intrinsic characteristics set the size of the sinks (notorious in soils with humic layers)
- Clay content plays an important role in lower topsoil, especially when clay ≥ 22%
- Management regimes shift the trends. The cumulative effect is crucial to turn soils into sinks
- Knowing your soils is the first step to design climate-smart strategies and policies. Implementing sustained and complementary measures is crucial to protect and improve SOC stocks and soil performance over time.

Other resources & online information

Bondi. ., Castellon, A., O'Sullivan, ., O'Dwyer, T., Daly, K., 2024. How Much Soil Carbon is Stored Under the Signpost Farms, in: Teagasc, Signpost Conference & General Assembly 2024, Tipperary, pp. 44-47. https://teagasc.ie/wp-content/uploads/2025/05/How-Much-Soil-Carbon-is-Stored-Under-the-Signpost-Farms.pdf

Castellon-Meyrat, A., O'Sullivan, ., Holloway, P., Wall, D., Bondi, ., 2026. Impact of management intensity of agricultural systems and soil intrinsic characteristics on soil organic carbon stocks. [Manuscript under review for Agriculture, Ecosystems & Environment].

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Actions to support farmland biodiversity

Farmland biodiversity is an important national resource.

Ireland has roughly 31,500 species living within 117 habitats. How can you enhance biodiversity on your farm?

Allow hedgerows to flower	Create nesting sites for solitary bees	Identify and protect species-rich grasslands	Plant native trees	Dig a wildlife pond	Avoid using herbicides and fertilisers under hedgerows
					

Three steps to protect farmland biodiversity while maintaining a productive farm business.

1. Identify what is already there
2. Maintain, enhance, diversify and connect existing habitat
3. Create new habitat (not on existing wildlife habitat)

Farmland Biodiversity: Actions to maintain, enhance, diversify, and connect existing habitats and create new habitats

Saorla Kavanagh, Claudia Barry, Meritxell Grau, Niall Walshe, John Finn, Fiona Brennan, Daire Ó hUallacháin

Teagasc, Johnstown Castle

Biodiversity provides us with clean air, fresh water, healthy soil, fuel, fibres and the food we eat. It can help us to mitigate against and adapt to climate change. Despite the many benefits of biodiversity, it continues to decline and biodiversity loss has far-reaching consequences for future generations. Farmland has the capacity to make a big difference in halting biodiversity loss. The key message for managing farmland biodiversity is to, maintain first, enhance second and create if not already in existence.

Protecting farmland biodiversity, while maintaining a productive farm business is achievable by following these three key steps:

1. Identify what habitats are already present

2. Maintain, enhance, diversify and connect existing habitats

3. Where there are few existing habitats, create new habitats (but not on existing wildlife habitats)

Every farm has some value for biodiversity, but some farms offer more value than others. One way to enhance biodiversity on your farm is to manage hedgerows less intensively. Maintaining a diversity of habitats is important, as different habitats support different species. Different pollinators have different traits, thus supporting a larger number of species of pollinators can contribute to increased pollination and pest control, which in turn increases crop seed yield and economic value. If invasive alien species are present, aim to remove them because they displace native species. Linear farmland features such as hedgerows, field margins and watercourses, managed appropriately can act as corridors for nature through the landscape, allowing farming and biodiversity to co-exist. No matter what biodiversity-friendly areas are on the farm, it is vital that evidence-based actions are used to manage these, to protect and enhance farmland biodiversity. It is important that new habitats such as planting trees or incorporating a pond, are located in the right part of the farm and that they do not replace existing habitats.

Six actions farmers can take that will allow biodiversity to coexist within a productive farming system include:

1. Allow hedgerows to flower
2. Create nesting sites for solitary bees
3. Identify species rich grassland
4. Plant native trees
5. Dig a wildlife pond
6. Avoid using herbicides or fertilisers under hedgerows

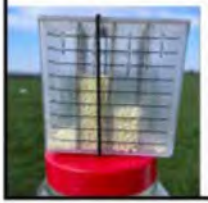
Nitrogen Losses to Air and Water

Nitrogen Management

Key Factors

- **Machine setting and wear**
  - Check vanes,
  - Agitator, Shutter opening (equal?)
- **Fertiliser**
  - Type - Urea v CAN
  - Granule size and strength
- **Operator**
  - Adjust vanes, working width, GPS, PTO speed, height and angle of spreader
- **Weather / environment**
  - Wind, headland management, buffer zone

Tray Test



- **GPS option**
- **TAMS**

Fertiliser Spreader Setup and Calibration

Francis Quigley[1]

[1]**Teagasc Kildalton Agricultural College, Piltown, Co. Kilkenny**

Correct calibration maximizes fertiliser efficiency while reducing the risks of over-or under-application, which can lead to yield losses, environmental pollution, and increased production costs.

How can the accuracy of fertiliser application be improved?

- Correct setup and calibration of fertiliser spreaders is essential for even fertiliser distribution, accurate application rates, and uniform crop coverage. Poor calibration can lead to yield loss, higher costs, and environmental pollution.
- Regular maintenance, including cleaning, lubrication, and inspection of parts, ensures proper operation. Worn vanes should be replaced promptly as they can cause uneven spreading and inaccurate application.
- Different fertilisers vary in particle size and density, so spreader settings must be adjusted for each product to maintain correct spread width and flow rate. This is especially important when changing between heavier fertilisers like CAN and lighter products such as Urea.
- Headland control systems help reduce overlap and over-application at field edges, protecting hedgerows and watercourses from pollution.
- Technologies such as tray testing, GPS guidance and section-controlled spreaders improve application accuracy, helping farmers reduce waste, improve efficiency, lower costs, and support sustainable agricultural practices.

Other resources & online information

Teagasc Website: https://teagasc.ie/environment/soil/soil-fertility/fertiliser-advice/fertiliser-spreaders/

Email: francis.quigley@teagasc.ie

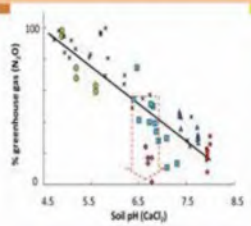
Steps to reducing N losses and improving farm sustainability

Have you a fertiliser plan?

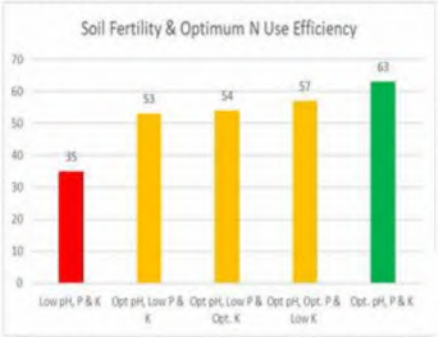
- Basis to fertiliser planning
- Field by field advice for Lime, N, P, K & S

Benefits of improving Soil pH ?

- Reduces greenhouse gas emissions
- Improves nitrogen use efficiency
- Grow an extra 20% more grass
- Reduces farm N req. & costs by €140/ha/yr



Soil Fertility & Nitrogen Use Efficiency



How to Make Best Use of Slurry?

What?
Test Slurry

When?
Spring & Weather

Where?
Silage Fields

How ?
LESS / Adjust N Rate

Sulphur (S)

- Reduces N leaching by 22 to 50kgN/ha/yr
- Apply 15 to 20kg S/ha/year

Fertiliser N Type – Protected Urea

Most efficient & sustainable N form
Produces highest grass yields
Cheaper per kilo of N €€€€!
Reduces total farm emission by 4 to 8%

Take Home Messages

Lime releases up to 70kgN/ha/yr
Cattle slurry valubale N, P & K
Sustainable N Fertilisers
Protected Urea & 18-6-12 + S
Efficient N use Reduces GHG's

Steps to reducing nitrogen (N) losses and improving farm sustainability

Mark Plunkett[1]; David Wall[1]

[1]Teagasc, Johnstown Castle;

Summary:

- Optimising soil pH increases N supply annually by up to 70kgN/ha/yr
- Correcting soil fertility (pH, P & K) increases farm N use efficiency from 35 to 63%
- Targeted spring cattle slurry application to 1st cut silage fields at 33 m³/ha (3,000 gals/ac) supplies 33 kgN/ha thus reducing chemical N requirements by 33%
- Make adjustment for soil N supply and N supplied in animal manures to reduce N emissions while reducing farm costs
- Changing from nitrate-based N (e.g., CAN / High N's 24's 27's) to urea-based N (Urea + NBPT, NPPT) supplies a more efficient and stable form of N. On drystock and dairy farms total farm emissions can be reduced by up to 4 to 8%, respectively.
- Select sustainable fertiliser blends such as 18-6-12+S / 10-10-20 as they are most cost-effective N, P & K sources and further reduce fertiliser GHG emissions
- Balanced seasonal crop sulphur (S) supply reduces N losses by 22 to 50 kg N/ha/yr
- Soil cultivations (ploughing) increase soil mineral N supply thus increasing the loss of nitrate to water
- Aim to adopt minimal soil cultivations to reduce N losses to water and air at the right time of the year
- When applying fertilisers *(organic / chemical)* adopt the 5 R's for example *Right Product*, at the *Right Time*, at the Right *Rate* and in the *Right Place* with the *Right Method* (e.g., LESS)
- Improving N use efficiency reduces potential N losses which delivers co-benefits for air and water quality and reduces our reliance on imported chemical N on the farm

Other resources & online information

Teagasc Website:

Signpost Programme https://teagasc.ie/environment/climate-change--air-quality/signpost-programme/publications-/

Email: mark.plunkett@teagasc.ie; david.wall@teagasc.ie

Finding Pinch Points To Prevent Nutrient and Sediment Losses to Water from Open drains & Farm roadways

Main Points

- Open Drains and Internal Farm Roadways can be pathways for mobilised nutrient and sediment loss to waters. Need to find these "pinch points".

MAP OPEN DRAIN RISK

RED	Category 1	Farmyard Connection
PURPLE	Category 2	Outlet
ORANGE	Category 3	Outflow
YELLOW	Category 4	Secondary
GREEN	Category 5	Disconnected

MAP ROADWAY RUNOFF RISK

- Soiled roadway Runoff has same profile as dairy soiled water
- Losses also occur from roadway materials that store nutrients
- Look for connections at underpasses, farmyards, bridges
- Look for connections directly into rivers or open drains

Prioritise Pinch Points for Management

Funding

- EPA Research Programme 2014-2022.
  - Roadrunner & WaterMark

Take home messages

- Open drains where present need to be ranked in terms of their connectivity risk for P & N loss to waters.
- Highest ranked risk are open drains connected to the farmyard and roadway runoff.
- Roadway runoff is rich in nutrients and sediment & connectivity with waters must be prevented all year.
- Need right measure right place

Finding Pinch Points to Prevent Nutrient and Sediment Losses to Water from Open Drains and Farm Roadways

Owen Fenton[1]; Karen Daly[1]; Patrick Tuohy[2]; John Murnane[3]

[1]Teagasc, Johnstown Castle; [2] Teagasc, Moorepark; [3]University of Limerick

Summary:

- Connectivity between farm roadway runoff, open drains and waters must be broken (by law) on *all* farms.
- Farm roadway runoff and open drain waters contain nutrients and sediment that negatively affect water quality during both the open and closed periods of the year.
- Connectivity between roadway runoff and waters occurs during rainfall and is worst nearer the farmyard where the source of nutrients is highest.
- Connectivity only occurs at a few locations on any roadway network such as direct runoff into waters (open drains, rivers, streams) or indirect runoff (underpasses, main roads, farmyards).
- Breaking roadway runoff connectivity at each location will require a bespoke solution.
- There are five categories of open drains: farm connection; outlet; outflow; secondary and disconnected. The farmyard connection presents the highest risk in terms of nutrient and sediment loss.

Other resources & online information

Twitter: @ROADRUNNER_Project

Teagasc Website:

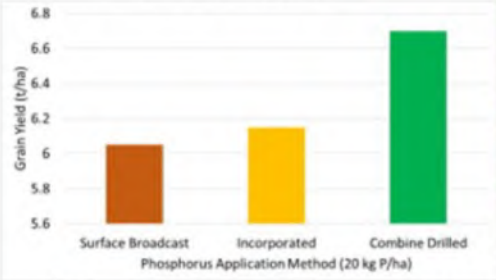
Google “Roadway Runoff Visual Assessment Booklet”. This will guide the user of the booklet to locate connectivity points between roadway runoff and waters on any farm.

Email: owen.fenton@teagasc.ie; karen.daly@teagasc.ie

Placement of Phosphorus (P) in Cereals

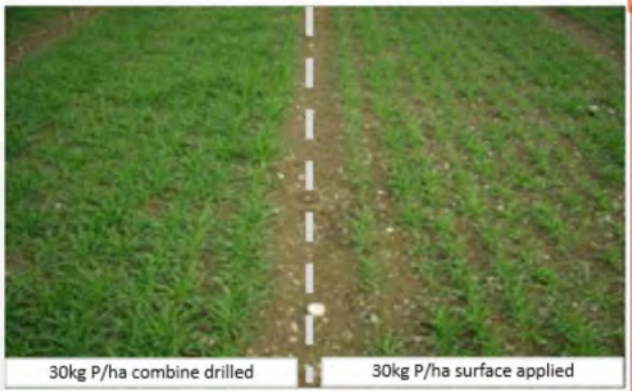
Key Facts:

- Phosphorus is relatively immobile in soil
- Less than 1% of total soil P is immediately plant-available
- P fixation can occur quickly in low P soils especially high clay soils, or soils where pH is outside the pH6.3 – pH 7 range



Spring Barley Grain yield response to Phosphorus (P index 1 and 2 soils)

PLACED P vs BROADCAST P



Trial plot on the left received 30kg P/ha combined drilled compared 30kg P/ha surface applied on the plot on the right

Take home messages

Target cereal soils at P Index 3

Correct soil pH before increasing P rates

Combine-drilled P is more efficient on low P and P-fixing soils improving early crop establishment, nutrient use efficiency and crop performance.

Placement of Phosphorus (P) in Cereals: Combined Seed & Fertiliser Drill vs Surface Broadcast

Veronica Nyhan[1], David Wall[2], Mark Plunkett[2],

[1]Teagasc, Oak Park, [2]Teagasc Johnstown Castle, Wexford

Summary:

- Phosphorus is relatively immobile in soil and less than 1% of total soil P is immediately plant-available, making soil testing essential for fertiliser planning.
- Phosphorus availability is greatest at soil pH 6.3–7.0. Liming acidic soils improves P availability and reduces fixation.
- Added P is quickly locked up in mineral soils, within 60–90 days, but on high clay soils, on soils with a high or low pH, and low P index soils, fixation occurs more rapidly.
- Placed P, using a combined seed and fertiliser drill, improves fertiliser efficiency by positioning P directly in the rooting zone.
- Surface-broadcast P is more prone to fixation and less effective on low P or P-fixing soils.
- Winter cereals on P Index 1 and 2 soils should receive 10–20 kg P/ha placed at sowing, before 31st October, with remaining P broadcast in early spring.
- Spring cereals, particularly spring barley, respond strongly to combine-drilled P because crops require a readily available P source during the first 3–6 weeks after sowing.
- Placed P improves root growth, tillering, early vigour and overall crop establishment while reducing the risk of nutrient loss to water.

Key Technical Messages:

- Target cereal soils at P Index 3 for optimum crop performance.
- Correct soil pH before increasing P fertiliser rates.
- Combine-drilled P is more efficient than broadcast P on spring barley and winter cereals grown on P Index 1 and 2 soils.

Other resources & online information

Plunkett, M., Wall, D. and Sheil, T. (2019) The Efficient Use of Phosphorus in Agricultural Soils. Technical Bulletin Series No. 4. Fertilizer Association of Ireland in association with Teagasc, Johnstown Castle, Co. Wexford.

D. P. Wall, M. Plunkett, R. Hackett, S. T. J. Lalor, (2013). Phosphorus fertiliser applications to cereals: comparing different methods for phosphorus use efficiency. International Fertiliser Society Proceedings, 2013, No.739, 1-28 ref. 49.

Email: veronica.nyhan@teagasc.ie

The Carbon Footprint of Irish Grain

Life Cycle Assessment (LCA)

Carbon Footprint (kg CO_2e/tonne)

Wheat, Barley Oats

Irish Grain Imports (GLFI)

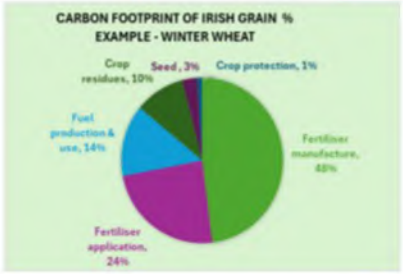
200- 250 kg 330 -400 kg

Irish Grain ~30% lower than imports

Irish Oats + straw incorporated

~ NET Zero

Teagasc/Tirlan pilot study 2022



Benefits of Native grains in concentrates

Ingredients All Imported 64% LCA 0.82 co2e/kg

Ingredients 64% Native 0.42 kg co2e/kg

50% LCA reduction

Components - 16% CP DM; UFL 1.14; ME 11.7

Native Grain v Imports in Dairy diet (LCA)

Feeding 1.25t concentrate / cow / year

Reduction of 520 kg CO_2e / cow / yr

Reduction of 7.4% kg CO_2e / kg FPCM

MACC measures identified to reduce GHG in dairy herds

- Switch to protected urea: 6 to 8%
- Improved N use/clover: 3 to 5%

Take Home Messages AGNAV

1. AgNav essential to prove Irish grain low carbon credentials

2. Irish Grain can be Carbon Net Zero

3. Inclusion of Irish grain can reduce LCA of meat and milk products

The Carbon Footprint of Irish Grain

John Mahon[3], Donal O Brien[1], Jonathan Herron[2], John Spink[3], Michael Hennessy[3]

[1] Teagasc, Johnstown Castle, Wexford, [2] Teagasc, Moorepark, Cork, [3] Teagasc, Oakpark, Carlow

Summary:

1. Irish grains (wheat, barley, oats) have a carbon footprint of 200–250 kg CO_2e per tonne, significantly lower than imported grain equivalents.
2. Imported grain (Ref GLFI figures) carries a carbon footprint of 330–400 kg CO_2e per tonne, making it a considerably more emissions-intensive feed source.
3. Irish grain has approximately a 30% lower carbon footprint compared to similar imported grain, based on Life Cycle Assessment (LCA) methodology.
4. Irish oats, with straw incorporated, can achieve approximately Net Zero carbon, making them an exceptionally low-emissions crop option.
5. An example concentrate feed made from all-imported ingredients carries an LCA of 0.82 kg CO_2e/kg, compared to just 0.42 kg CO_2e/kg when 64% native grain is used.
6. Feeding 1.25 tonnes of native-grain concentrate per cow per year can reduce emissions by 520 kg CO_2e per cow annually. Resulting in a 7.4% reduction in kg CO_2e per kg of Fat and Protein Corrected Milk (FPCM) — a meaningful improvement in dairy sustainability metrics.
7. AgNav calculates the LCA for Irish grain and a large number of farms must be assessed each year to underpin the low carbon credentials of Irish grain.

5 Take-Home Messages

1. AgNav (Digital sustainability platform) is essential to verify and communicate the low-carbon credentials of Irish grain in the marketplace.
2. Irish grain can achieve carbon net zero status
3. Including Irish grain in animal feed concentrates can significantly reduce the LCA of both meat and milk products produced in Ireland.
4. Native grain is a powerful lever for dairy farm decarbonisation — a single dietary swap can cut over half a tonne of CO_2e per cow per year.

Other resources & online information

O'Brien, D., anigan, ., Tresise, M., Wynn, S., Kealy, J., Ryan, P. and Spink, J., 2025. A life cycle assessment model of Irish grain cropping systems focused on carbon footprint. Irish Journal of Agricultural and Food Research, 64(1), pp.1-21.

Carbon Foot Printing of Irish grain. https://teagasc.ie/environment/climate-change-air-quality/signpost-programme/events/farming-for-a-better-climate-2025-practical-and-emerging-solutions/

Organic Farming Systems

FARMING FOR A BETTER FUTURE

Organic Tillage & Vegetables EIP

Demo Day 18th June A67 T660

Better weeding through shared machinery

- Innovative farmer-led collaboration
- Practical weed management solutions
- Enabling machinery sharing
- Trials and demonstrations on project farms
- Knowledge sharing & supporting adoption

An Roinn Talmhaíochta, Bia agus Mara
Department of Agriculture, Food and the Marine

Co-funded by the European Union

Organic Tillage & Vegetables Integrated Weed Management (OTV-IWM) Developing Practical Weed Control Through Shared Machinery and Innovation

Participating Farmers[1], Martin Bourke[2], William Deasy[3], Vijaya Bhaskar[2], Ruth Fennell[4], John Hendrick [5], and Cathal Redmond[5].

[1]Operational Group Farmers,[2]Teagasc, Oak Park, [3]Teagasc, Ennis, [4]Teagasc, Kildalton, [5] Teagasc Johnstown Castle.

Summary:

- Four-year European Innovation Partnership (EIP) project funded by the Department of Agriculture, Food and the Marine.
- Seven farmers are working together to share machinery, reduce costs and improve access to modern equipment.
- The project focuses on developing practical, non-chemical weed control systems for organic tillage and vegetable production.
- Organic crops for 2026 including oats, maize, beet, legumes (soya and lupins) and a range of vegetables are being trialled under Irish farm conditions to test establishment and weed control systems.
- A range of machinery and technologies are being evaluated including precision drills, precision weed harrows, camera-guided systems, bio-film systems, autonomous and AI assisted weeders and drills.
- Machinery sharing models are being explored to improve efficiency, reduce labour demands and support wider adoption.
- Demonstration days, events and knowledge exchange activities will allow farmers to see systems in action, share experiences and learn what works in practice.

Other resources & online information

Project Website: organictv.ie

Instagram: @organictv.ie

Teagasc Website: https://teagasc.ie/rural-economy/organics/

Email: admin@organictv.ie

Project Funding

OTV-IWM is funded under the uropean Innovation Partnerships (IP) initiative as part of Ireland's CAP Strategic Plan 2023–2027, co-funded by the Irish Government and the European Union.

Co-created Organic Field Trials

Legume intercrop ratios (pea–bean)
Apr 2026

Low-disturbance establishment of multi-species swards
May 2026

Agronomy of organic forage maize
May 2026

Details of trials in event booklet

Co-creation of Organic Field Trials: Collaboration between Teagasc, EU OH-FINE and Organic Tillage and Vegetables EIP

Martin Bourke[1, 2, 3], Joe Kelleher[1, 2, 3], Elaine Leavy[1, 2, 3], John Hendrick[1, 2], Cathal Redmond[1, 2], Kevin Kilcline[1,3], Lori Rae van Laren[3], Mary Ryan[1,3]

[1]Teagasc, [2] OrganicTV, [3]OH-FINE

In January 2026, farmers participating in the EU OH-FINE (Organic Farm Innovation Networks Europe) and the OrganicTV (Organic Tillage & Vegetables) European Innovation Partnership undertook a co-creation process with Teagasc Organic Specialists to identify trials that address particular knowledge gaps, by:

- choosing trials that had most relevance to their cropping systems and markets
- discarding the least interesting/relevant options
- identifying growers interested and willing to conduct any of the on-farm trials.

Three trials were selected and sown this spring:

1. Legume intercrop ratios (pea–bean) (April 2026)

- Intercropping system
- Three Pea:Bean seed ratios: (20:80, 40:60, 60:40)
- Evaluated on two farms in Wicklow (0.2 ha plots)

Measurements

- Yield (per plot), grain separation, protein content and moisture,
- Weed competitiveness (mid-season scoring)
- Standability and harvest performance observations

2. Low-disturbance establishment of multi-species swards (May 2026)

- Grassland establishment system
- Comparison of three low-disturbance reseeding methods (Güttler seeder, one-pass system, Einböck grass harrow) across 3 farms

Measurements

- Baseline soil and sward composition (pH, P, K, organic matter, species mix)
- Seedling emergence and establishment rates
- Weed regrowth and sward development (0–8 weeks)
- Operational conditions and seed rates

3. Organic forage maize agronomy (May 2026)

- Crop management system
- Evaluation of seeding depth, sowing date, variety selection, and mechanical weed control

Measurements

- Crop establishment and weed pressure (multi-stage mechanical control)
- Biomass yield (hand-cut samples)
- Silage quality (DM, protein, starch, fibre, digestibility, energy)
- Observations on pest pressure (e.g. crow damage)

For further information on the trials:

Teagasc: www.teagasc.ie/organics OH-FINE OrganicTV

First Look at Comparing Organic & Conventional

Insights shown are drawn from initial 2024 Teagasc National Farm Survey (NFS) data - a larger organic sample will be included in the 2025 survey results.

Beef Finishing Farms

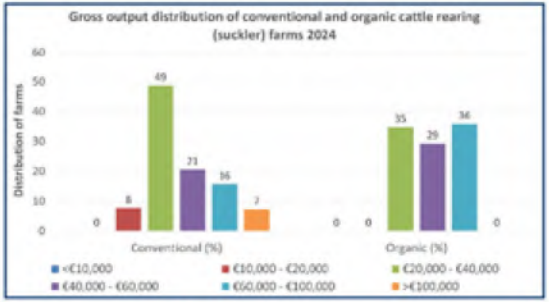
- Organic farms are larger (about +66% UAA), carry more stock overall but have lower stocking rates and more land in tillage / other uses.
- Gross output is 48% larger per organic farm (incl. subsidies) & family farm income is more than double (€36,825 vs €17,650).
- Organic farms have lower input costs per hectare and livestock unit, leading to greater gross margins (up to 75%). Direct payments make up a greater share of output (43% vs 24%).

Suckler Farms

- Organic farms are larger than conventional (43 ha vs 31 ha) but operate at lower stocking rates and fewer livestock units.
- Organic systems generate higher output per livestock unit, but market output is lower.
- Direct costs are ~28% lower (feed, fertiliser, veterinary inputs) lifting gross margins.
- Family Farm Income is higher (€19,635 vs €13,442), driven by stronger direct payments.

Dairy Farms

- Organic farms are larger (77 ha vs 70 ha) with fewer livestock units (121 vs 142) and are more diversified with land in tillage / forestry.
- Conventional farms produce a 39% higher gross output and family farm income (€110,398 vs €53,964).
- Organic farms have 30-37% lower direct costs, rely more on direct payments (18% vs 7% of gross output) and about 80% of households have a source of off-farm income.



Take home messages

- ✓ Organic farms operate at lower intensity with fewer inputs, while conventional systems achieve higher output per hectare through higher stocking rates and inputs.
- ✓ Organic farm income are more reliant on CAP supports, while conventional farms achieve stronger market returns.
- ✓ Organic farms face less exposure to input price volatility and rely more on off-farm income, supporting resilience but needing continued policy backing and strong markets.

An Roinn Talmhaíochta, Bia agus Mara
Department of Agriculture, Food and the Marine

A First Look: Comparing Organic and Conventional Farms Using 2024 Teagasc National Farm Survey Data

Kevin Kilcline[1]; Mary Ryan[1]; Tara Gilna[1, 2]

[1]Teagasc, Rural Economy Development Programme, [2] University College Dublin

The insights presented are based on initial data collected by the 2024 Teagasc National Farm Survey (NFS) as part of the Growing Resilient Organic Farm Systems (GROFarmS) project funded by the Department of Agriculture, Food & Marine. The project is led by Teagasc, with partners from University College Dublin. These results provide early insights into the financial performance and socio-economic background of organic farms across key systems in Ireland, offering a useful starting point for understanding sectoral opportunities and challenges. The Teagasc 2024 NFS dataset also includes organic sheep and tillage farms and the 2025 NFS will contain a larger sample of organic farms.

Summary:

- There are clear differences between organic and conventional farms in terms of structure and financial performance.
- Organic farms generally run at lower intensity with lower output per hectare and fewer inputs (e.g. feed, fertiliser and chemicals), though overhead costs can be higher in some cases. Conventional systems tend to achieve higher market output through higher stocking rates and input use.
- Organic farms often achieve a similar or higher total income when supports are included but varies by enterprise. Pillar II payments under CAP are a key part of organic farm income.
- Organic systems show less exposure to rising input costs and may be more resilient in volatile input markets. They also tend to have more diversified farm income sources, with more households earning off-farm income.
- Continued support of the organic sector will depend on sustained policy support (especially for income stability and adoption), alongside stronger market development and improved system efficiency.

Other resources & online information

Teagasc Website: https://teagasc.ie/rural-economy/organics/research/

Email: Kevin Kilcline (kevin.kilcline@teagasc.ie); Mary Ryan (mary.ryan@teagasc.ie)

Tara Gilna is a student on the Teagasc/UCD Master's in Agricultural Innovation Support

Teagasc
Agriculture and Food Development Authority

UCD Dublin

GROFarmS
Growing Resilient Organic Farming Systems

An Roinn Talmhaíochta, Bia agus Mara
Department of Agriculture, Food and the Marine

Organic farming target:

10% of land area by 2030 (currently 5% area & 5% of farmers)

Novel demonstration trials (beef, sheep, tillage, mixed farming)

Organic Finishing Research Trials

- **Beef** – Johnstown Castle (Kildavin farm in-conversion) & Grange trials for developing technically & financially efficient organic beef production systems
- **Hill & lowland sheep** – Athenry

Environmental impact of organic production systems

- Nitrogen balance, Greenhouse gas emissions
- Soil health, biodiversity and carbon turnover

Measure organic sustainability-Teagasc National Farm Survey

Keep up to date on organic research:
www.Teagasc.ie/GROFarmS

Research in Organics – GROFarmS: Growing Resilient Organic Farming Systems

GROFarmS Project Summary

Following the trebling of the area in organic farming and ambitions to grow the sector further, GROFarmS, funded by DAFM and Teagasc addresses a pressing need for scientific research on organic farming practices to support evidence based best practice adoption and demonstrating technically efficient systems of production.

- Two production research tasks aim to develop evidence on best practice technologies to support profitable and sustainable organic beef and lamb finishing systems. The sustainable organic beef research is taking place on Teagasc research farms in Grange and Kildavin/Johnstown Castle, with the lamb research at Athenry.
- The beef finishing research being led by Dr Paul Crosson, Teagasc Beef Enterprise Leader in collaboration with Teagasc colleagues including Dr David Wall, Johnstown Castle and Dr Alan Kelly, UCD on a 98.8-acre organic beef finishing research farm in Kildavin. The Kildavin farm will be a fully certified organic holding which will develop clear guidelines for efficient and profitable organic-beef finishing systems.
- Research lead for the trials in Teagasc Athenry investigating finishing options and management systems for organic hill and lowland lambs is Dr Philip Creigthon, Teagasc Sheep Enterprise Leader. The research is in collaboration with colleagues in Teagasc and Professor Tommy Boland in UCD. They will take into account effects on animal performance, environmental impact and economic returns.
- The Project Lead is Dr Kevin Kilcine with a cross-cutting research task lead by Prof Mary Ryan in the Rural Economy and Development Programme (REDP) Athenry, who along with Teagasc colleagues and UCD collaborators, Dr. Edel Kelly and Dr. Brian Leonard will develop the Teagasc National Farm Survey to include a sizeable sample of organic farms. These commercial organic farms will provide in-depth socioeconomic and environmental sustainability benchmarking data to compare the performance of organic and conventional farms nationally but also to benchmark farm performance internationally. Supplementary surveys will be used to identify the behavioural drivers of conversion to organics or in the case of conventional farmers the barriers to conversion.
- The project has ambitious dissemination plans with a cross-cutting research dissemination and stakeholder engagement task being led by organic specialist Joe Kelleher in conjunction with the organic specialist team. This task brings on board industry input whilst also providing a forum to communicate progress and key research outputs consistently over the course of the project. International expertise will also be brought in to learn from the experiences of leading organic research institutes and networks. Teagasc is uniquely positioned to leverage its well-developed extension and education resources to effectively disseminate the research outputs and trials to farmers and industry.

Other resources & online information

Or Email: Kevin Kilcline (kevin.kilcline@teagasc.ie);
Mary Ryan (mary.ryan@teagasc.ie)

Kildavin Farm Johnstown Castle Organic Update

Background

- Limited organic finishing research
- Suckler weanling-to-beef trials to determine the most efficient finishing ages for each breed maturity (19, 23, 26 month)
- Calculating profitability and environmental benchmarking

System design

Early-maturing **Late-maturing**

Serial finishing age

19-month 23-month 26-month

Measurements

Animal performance
- Average daily gain, carcass traits

Herbage
- Production, sward composition, quality

Farm system modelling
- Economic & environmental outputs

Silage Swards

MS Silage **RC Silage**

First Winter Study

Treatment	Start Weight (1/12/25)	Final Weight (2/3/26)	Average Daily Gain Kg/day
Red Clover-Early Maturing	298 kg	371 kg	0.80 kg
Multi-species-Early Maturing	298 kg	371 kg	0.80 kg
Red Clover-Late Maturing	341 kg	412 kg	0.77 kg
Multi-species-Late Maturing	343 kg	408 kg	0.70 kg

Finishing Performance

Treatment	Carcass Weight	Carcass Conformation	Carcass Fat
19 month	301.5 kg	R=	2+
23 month	359 kg	R+	3=
26 month			

Kildavin Farm - Organic Finishing System Update

David Flynn[1], David Wall[1], Rioch Fox[1], Paul Crosson[2], Mark McGee[2], Peter Doyle[2], Marianne Mulhall[3]

[1]Teagasc, Crops, Environment and Land-use Programme, Johnstown Castle, Co. Wexford

[2]Teagasc, Grange Animal & Grassland Research and Innovation Centre, Dunsany, Co. Meath

[3]Teagasc, Wicklow, Carlow, Wexford Regional Management Unit

Introduction:

The Climate Action Plan (2024) has set ambitious targets to increase land farmed according to organic standards from the current area of 225,000 ha (5% of total farmed area) to 450,000 ha (10%) by 2030. The largest organic sector in Ireland is beef cattle production. There are an estimated 20,000 organically farmed suckler cows in Ireland with 12,500 cattle finished for organic beef production. This highlights that a major issue for the organic beef sector is the high 'leakage' rate between organic suckler cow systems and finished beef output, estimated at 30%. To address this leakage, research is needed to demonstrate the financial viability and sustainability of efficient finishing system to support best practice adoption by farmers. Kildavin farm at Johnstown Castle in s being developed as an organic weanling-to-beef systems research and demonstration farm to assess a range of beef production options, and develop clear guidelines for efficient and profitable organic-beef systems.

Summary:

- The Kildavin farm at Johnstown Castle is 48.27 hectares (ha). The farm is in its second year of conversion to organics.
- Eighty spring-born, early-maturing (40) and late-maturing (40) breed weanling steers, are purchased directly from organic farms in autumn.
- The 'first-winter' study was a comparison of the two animal breed types offered either grass-red clover silage or multi-species silage supplemented with 1.5kg per head daily of an organic concentrate until turnout to pasture in spring.
- The two suckler steer breed types will be reared in an organic farming system and finished at three time points.
    - end of the second grazing season (19 months of age)
    - end of the second winter (23 months of age)
    - during the third grazing season (26 months of age)
- Key measurements include pasture production, nutritive value and agronomy, animal live weight and carcass traits, and economic analysis of the system.

Other resources & online information

Scan the GROFarmS project QR code to keep up with project trials:
Email: David Flynn (david.flynn@teagasc.ie); David Wall (david.wall@teagasc.ie)

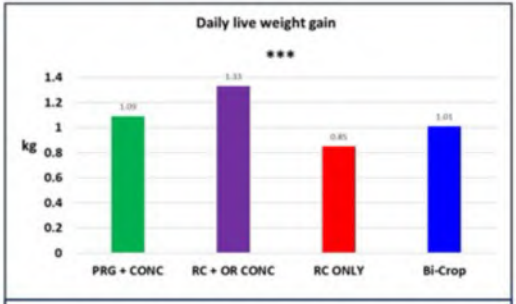
Organic Beef Finishing Diets

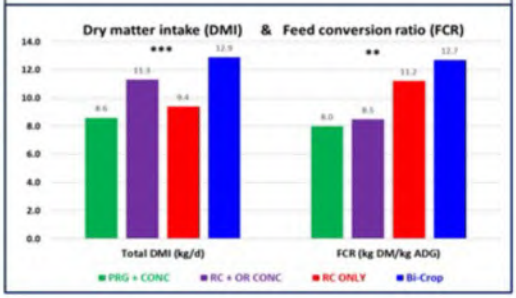
Animal finishing study

- 60 Charolais steers (~595 kg) assigned to **four** different diets
  1. 'Conventional' feed. Perennial ryegrass silage + 3.0 kg barley-based concentrate dry matter (PRG + CONC)
  2. Red clover silage + 3 kg organic concentrate dry matter (barley/pea mix) (RC + OR CONC)
  3. Red clover silage without supplementation (RC ONLY)
  4. Barley-Pea silage (Bi-Crop)
- Feeding duration: 98 days
- Housed on straw-bedded pens: 8 m^2/ animal

Take home messages

- Feed efficiency: best for PRG + CONC & RC + OR CONC and worst for RC ONLY & Bi-Crop
- Margins: highest for RC + OR CONC and lowest for Bi-Crop (Spring 2025 prices)





Organic Beef Finishing Diets

Marie McFadden, Mark McGee, Paul Crosson

Teagasc, Grange Animal & Grassland Research and Innovation Centre, Dunsany, Co. Meath

Introduction:

- The largest organic sector in Ireland is beef cattle production. Given the recent large influx of farms into organic beef systems, it is paramount to develop guidelines for efficient and profitable systems. A current concern with organic beef farming is the high 'leakage' between organic suckler cow systems and beef output. Finishing cattle indoors is the most expensive feeding phase of beef production.
- In this regard, there is a need to evaluate alternative organic finishing diets for beef cattle, particularly those incorporating lower-cost, home-grown feeds (both energy and protein sources), to minimise the importation of expensive supplementary concentrates.
- Intake, growth, feed efficiency and carcass traits of late-maturing suckler steers offered one of four experimental diets over a 98-day finishing period were examined. The four diets were: 1) perennial ryegrass silage *ad libitum* + 3.0 kg barley-based concentrate dry matter (DM) per animal daily (conventional feedstuffs - 'control' diet), 2) Baled red clover silage *ad libitum* + 3.0 kg Bi-crop (barley + pea) grain DM per animal daily, 3) Baled red clover silage only *ad libitum*, and 4) Bi-crop (barley + pea) silage *ad libitum*. Animals were accommodated in pens in a straw-bedded (over a porous membrane) slatted floor shed at a stocking density of 8 m2 per animal.
- Daily live weight gain and carcass weight was greatest for Red clover + organic concentrate and lowest for Red clover-only, with Perennial ryegrass silage + concentrate and Bi-crop being intermediate. Feed efficiency was best for Perennial ryegrass silage + concentrate and Red clover + organic concentrate, and worst for Red clover-only and Bi-crop. Carcass fat score was greater for Red clover + organic concentrate than Perennial ryegrass silage + concentrate and Bi-crop, with Red clover-only intermediate. Kill-out proportion or carcass conformation score did not differ between the four diets.
- Financial margins were highest for Red clover + organic concentrate and lowest for Bi-crop. Overall, economics of the finishing system was extremely sensitive to store cattle price and beef carcass price.

Water Quality

FARMING FOR A BETTER FUTURE

How to Manage Overland Flow on Farm

Reduce Phosphorus & Sediment Loss to Water

Break the Pathway Measures

Slaney Catchment Water Quality

Phosphorus & Sediment Loss

Through overland flow pathways, leading to water quality decline

Locate Overland Flow Pathway

On Farm Solutions & Measures

Type of insect found indicates Water Quality in a stream

Take home messages

- ✓ Phosphorus & sediment impacts the water quality of rivers
- ✓ When rain falls, identify flow paths & point of entry to river
- ✓ Break the pathway with measures
- ✓ Invertebrates are good indicators

How to Manage Overland Flow on Farm
Reduce Phosphorus & Sediment Loss to Water

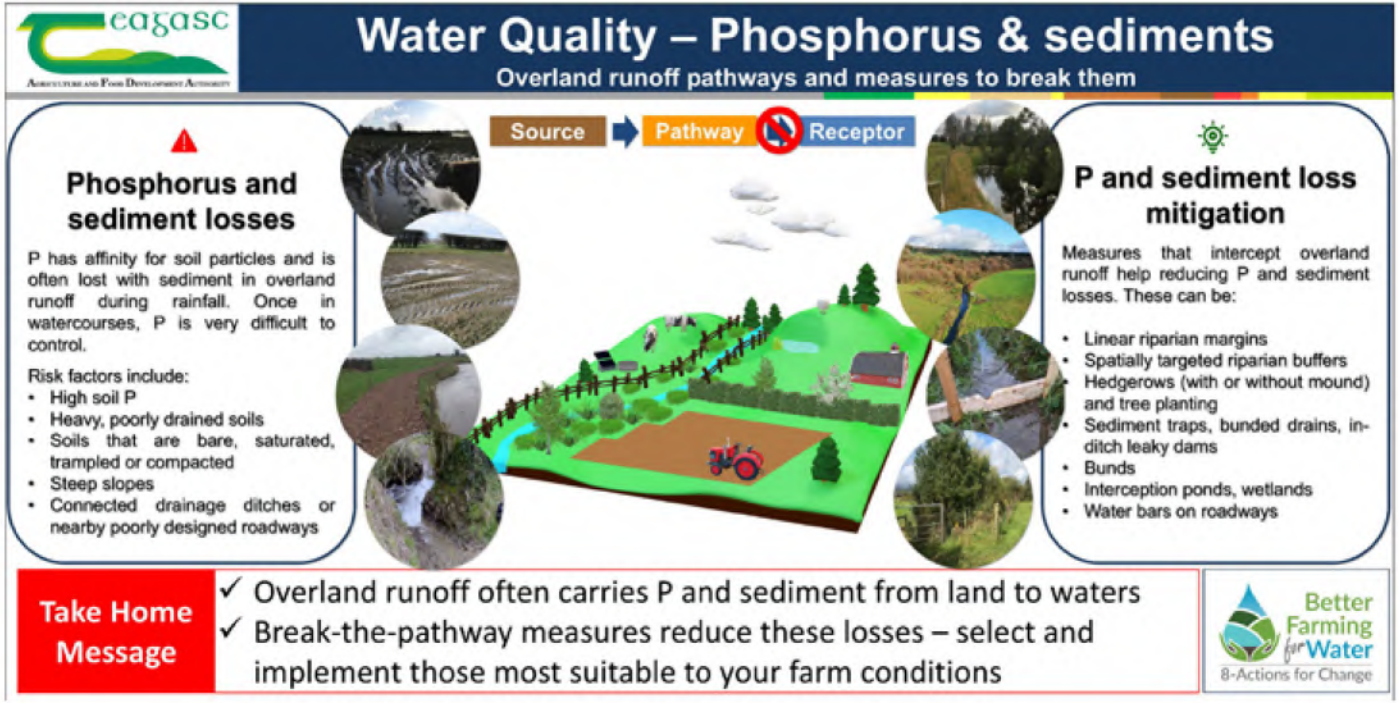
Cathal Somers[1], Patricia Oliveira Antunes[2], Neilus Nunan[1],
[1]Teagasc, Johnstown Castle; [2]Teagasc, Oakpark

Protecting water quality requires understanding how overland flow moves phosphorus and sediment from fields to rivers. By identifying flow pathways, monitoring entry points to waters and applying targeted on farm measures, farmers can break pollution pathways and improve water quality. Invertebrate species also provide clear indicators of stream condition and overall catchment health.

- Overland flow pathways transport phosphorus (P) and sediment during rainfall events, especially where soils are saturated, unprotected or compacted, creating direct connections between fields and streams or drains.
- River Slaney catchment mapping shows variation in water quality, helping target priority areas where water quality is not meeting the required standard and identifies areas to focus mitigation measures.
- Walking the farm with the aid of Pollution Impact Potential maps (catchments.ie) can identify critical source areas, natural depressions, tramlines and gateways where runoff concentrates before entering drains or watercourses.
- Rain event sampling captures P and sediment pulses, sometimes revealing significant losses in a short time period.
- Sensitive invertebrates such as mayfly, cased caddisfly and stonefly thrive in clean, well oxygenated water, making them reliable indicators of high ecological status. Tolerant species like freshwater shrimp, leeches and blackfly larvae increase where sediment and nutrient pressures degrade stream conditions.
- On farm mitigation measures to break the flow pathway includes buffer zones, riparian margins, roadway management, fencing off watercourses, appropriate placement of water troughs, cover crops, hedgerows, tree planting, earthen bunds, nature-based solutions and redirecting runoff away from watercourses.
- Using soil samples to generate a nutrient management plan is important, index 4 soils for P can lead to increased P loss to water.
- ASSAP advisors support farmers with the aid of the Farming for Water EIP to implement appropriate measures to reduce losses.
- The Slaney catchment is one of the focus catchments for the Teagasc Better Farming for Water campaign.

Better Farming for Water
8-Actions for Change

ASSAP
Farming for Water Quality


teagasc
Agriculture and Food Development Authority
Water Quality – Phosphorus & sediments
Overland runoff pathways and measures to break them
Phosphorus and sediment losses
P has affinity for soil particles and is often lost with sediment in overland runoff during rainfall. Once in watercourses, P is very difficult to control.
Risk factors include:
• High soil P
• Heavy, poorly drained soils
• Soils that are bare, saturated, trampled or compacted
• Steep slopes
• Connected drainage ditches or nearby poorly designed roadways
Source
Pathway
Receptor
P and sediment loss mitigation
Measures that intercept overland runoff help reducing P and sediment losses. These can be:
• Linear riparian margins
• Spatially targeted riparian buffers
• Hedgerows (with or without mound) and tree planting
• Sediment traps, bunded drains, in-ditch leaky dams
• Bunds
• Interception ponds, wetlands
• Water bars on roadways
Take Home Message
✓ Overland runoff often carries P and sediment from land to waters
✓ Break-the-pathway measures reduce these losses – select and implement those most suitable to your farm conditions
Better Farming for Water
8-Actions for Change

Water Quality – Phosphorus & Sediment
Overland runoff pathways and measures to break them

Cathal Somers[1], Patricia Oliveira Antunes[2], Neilus Nunan[1],

[1]Teagasc, Johnstown Castle; [2]Teagasc, Oakpark

Summary:

- Phosphorus (P) has high affinity for soil particles (such as clays) and so it is often mobilised and transported along with sediments to watercourses via overland runoff associated with rainfall events.
- Some factors favour overland runoff formation and delivery of high P and sediments concentrations to waters, for example:
    - Soils that are high in P
    - Heavy, poorly drained soils
    - Soils that are bare, saturated, trampled or compacted
    - Steep slopes
    - Drainage ditches connected to streams or nearby, poorly designer roadways
- Once in watercourses, P and sediments are difficult to control. P can build up in sediments over time, and may be released back to the water under certain conditions, often long after it reached the watercourse (legacy P).
- Measures that intercept runoff pathways retain P and sediments before they reach waters thus contributing to improved water quality. There is a variety of measures that can be implemented in different parts of the farm to achieve this, for example:
    - Linear riparian margins, spatially targeted riparian buffers
    - Hedgerows (with or without mound) and tree planting
    - Sediment traps and bunds, bunded drains, in-ditch leaky dams
    - Interception ponds, wetlands
    - Water bars on roadways
- **What to do**: with your farm advisor, identify overland runoff pathways in your farm, as well as areas where these converge or accumulate, then select and implement suitable break-the-pathway measures. Often, a combination of measures working together will deliver the best results

Other resources & online information

Better Farming for Water Campaign: https://teagasc.ie/environment/water-quality/better-farming-for-water/

Smarter_BufferZ Project, led by Teagasc on riparian management and mitigation measures: https://teagasc.ie/news--events/daily-archive/smarterbufferz-right-measureright-place/. Project decision support tool for riparian management: https://measure-selection-tool.hutton.ac.uk/smarterbuffer.html

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Extra Slurry & Soiled Water Storage

Changes from October 1st. 2028

- Dairy Cow Slurry Storage requirement increases by 21% to 0.4 m^3/cow/week
- Plan early
- The volume of parlour washings to be stored increases to 0.3 m^3/cow/week (from 0.21)
- Add c :ollecting/return yards
- 15 days storage required (31 days if milking through December)

Main Storage Options (cost of gross capacity)

- Slatted tanks €140 to €220/m^3
- Open concrete tank €91/m^3
- Overground steel tank €90/m^3
- Lined Lagoons €40/m^3

Planning Exemptions SI 649 of 2025-

- Size limit of proposed new store 1,000m^3
- Aggregate size limit of existing and proposed storage 1,500m^3
- For TAMS grant aid need a Section 5 Declaration of Exemption or Full Planning
- Scan the QR Code for full details

Slurry & Soiled Water Storage — New Rules from October 2028

Tom Fallon[1], Shaun Connolly[2]

[1]Teagasc, Kildalton College; [2]Teagasc, Johnstown Castle

Summary:

- From 1st October 2028, slurry storage requirement rises 21% — from 0.33 m³/cow/week to 0.40 m³/cow/week.
- Parlour washings storage volume rises from 0.21 to 0.30 m³/cow/week (+43%). 15 days soiled water storage is required (31 days if milking through December), and rainfall on open collecting/return yards must be accounted for.
- Plan early. It will take time to decide what to do, get planning permission and TAMS grant approval etc.
- Storage cost benchmarks slatted tanks €140–€220/m³ (incl. the slats); open concrete tank €91/m³; overground steel tank €90/m³; lined lagoon €40/m³ (gross capacity).
- Planning exemptions (SI 649 of 2025): new store size limit 1,000 m³; aggregate (existing + new) 1,500 m³. For TAMS grant aid, a Section 5 Declaration of Exemption or Full Planning is required.
- Parlour washings work well mixed with slurry, they dilute DM, making slurry easier to pump and spread. But the extra volume must be designed into storage calculations.
- Outfarm storage is a practical option. Where silage is cut on an outfarm, transporting slurry there during winter and spreading by umbilical when closing in spring can be cost-effective. Storage must comply with the same regulations as the main yard.
- Cover your tank. A floating cover or fixed roof cuts ammonia losses 40–80%. More N retained means more N available for spring spreading. All new slurry storage facilities constructed since 2022 are required to be covered, however, allowing a natural crust to form on older slurry tanks is also very helpful
- What's in your tank? Slurry has real value. Teagasc hydrometer table gives available nutrient content per 1,000 gallons by dry matter (LESS application, springtime): 6% DM = 9-5-32 (€33); 7% DM (€34); 10% DM (~€50).
- Practical payoff. A 3,000 gal/acre application of 6% DM slurry by LESS in spring delivers ~27 units N, 15 units P and 96 units K per acre, worth ~€87/acre. That covers essentially all P and K for 1st-cut silage; the only top-up needed is protected urea. Providing extra slurry storage will allow you to spread slurry on ground where the nutrients are needed.

Other resources & online information

Teagasc nitrates and storage information: https://teagasc.ie/environment/schemes-regulations/nitrates-derogation/

TAMS grant aid: https://www.gov.ie/en/department-of-agriculture-food-and-the-marine/collections/tams-3/

SI 649 of 2025 (planning exemptions): https://teagasc.ie/wp-content/uploads/uploads/media/website/rural-economy/farm-management/farm-buildings/Changes-to-Exempted-Development-Statutory-Instrument-649-of-2025.pdf

Email: tom.fallon@teagasc.ie

Slurry Spreading

Right applicator · Right place · Right time · Right rate

When to spread

- ✓ Soil trafficable; not waterlogged, frozen, or flooded
- ✓ No heavy rain in 48 hours
- ✓ Soil temp above 6°C and rising
- ✓ Cool, calm, overcast — less N loss
- ✓ Grass actively growing (spring ideal)
- ✗ Never spread on saturated, flooded, or frozen ground

Example of ground that is waterlogged

Where to spread

- Fields with P & K demand (silage ground first)
- Correct pH — nutrients locked up in acidic soil
- Drier fields, away from streams & drains
- Avoid fields highly connected to drainage

How much to spread

- Early spring: 1,500–2,000 gal/acre
- Silage ground: up to 3,000 gal/acre covers most P & K + up to 24 Units N
- Match rate to crop growth
- Test your slurry for NPK status **OR** use a hydrometer and adjust rate

Buffer zones

5 m	from surface water (drain, ditch)
10 m	where slope >10% OR 2 wks before/after closed period
15 m	from karst features
20 m	from a well or borehole

Teagasc Calibration Tool

Apply the correct amount of slurry.

No guessing involved.

Quick and easy.

Get the right forward speed for your tanker.

Forward Farming with LESS

Compulsory on farms stocked at ≥100 kg N/ha.

Dribble bar
~30% less Nitrogen loss

Trailing shoe
~45% less Nitrogen loss

Injection
~80% less Nitrogen loss

Slurry value

Timing	Method	Available N per 1,000 gal	N value / unit
Spring	Trailing shoe	9 units	€13.30
Summer	Trailing shoe	5–6 units	€8.15
Spring	Splash plate	5–6 units	€8.15
Summer	Splash plate	3–4 units	€5.15

Take home messages

Conditions

- Soil trafficable, not waterlogged.
- No heavy rain forecast.
- Soil temp above 6°C and rising.

Rate

- 1,500–2,000 gal/acre early spring.
- 3,000 gal/acre on silage ground.
- Use the Calibration Tool — scan QR.

Buffers

- 5 m from drains/ditches.
- 10 m if slope >10% or near closed period.

Slurry Spreading: Right Conditions, Right Time, Right Tools

Shaun Connolly[1]; Mark Plunkett[1]; Cathal Somers[1]

[1]Teagasc, Johnstown Castle

Summary:

- Conditions checklist before you fill the tanker: Is the soil trafficable? (not waterlogged, frozen or flooded); Has there been heavy rain forecast in 48 h? is the soil temperature above 6°C and rising; Are conditions cool, calm and overcast?; Is the grass actively growing?
- Never spread on saturated, flooded or frozen ground. Ammonia losses roughly double for every 5°C above 10°C, cool conditions keep more N in the soil.
- Where to spread: fields with P and K demand first (silage ground is the priority), good pH (nutrients lock up in acid soil), drier fields away from streams and drains.
- How much to spread: 1,500–2,000 gal/acre in early spring; up to 3,000 gal/acre on silage ground covers most P and K requirements. Match the rate to crop growth, excess runs to water.
- Use a hydrometer to know your DM% before deciding the rate **OR** get your slurry tested and adjust application rate accordingly.
- Buffer zones: 5 m from surface water (drains, ditches); 10 m where slope exceeds 10% or within 2 weeks before/after the closed period; 15 m from karst features (swallow holes, exposed rock); 20 m from wells or boreholes.
- Evening spreading: Teagasc research shows applying slurry in the evening cuts ammonia losses substantially vs morning and afternoon applications. Lower temperatures, higher humidity, less wind, and dew formation all work in your favour.
- Evening spreading reduces N losses on 88% of spreading days.
- Recommended to spread at or after 7pm. Evening spreading amplifies the benefit of LESS, it doesn't replace it. Machine choice, weather window and ground conditions still make the biggest differences.
- Tomorrow's best spreading hours on your phone. The Teagasc Slurry Spreading Forecast Tool is currently in development and combines ammonia-loss risk + ground-conditions + weather forecast for your farm.

Other resources & online information

Teagasc spreading guidelines from ASSAP Search Teagasc "Best ractice ith Slurr Sprea ing"

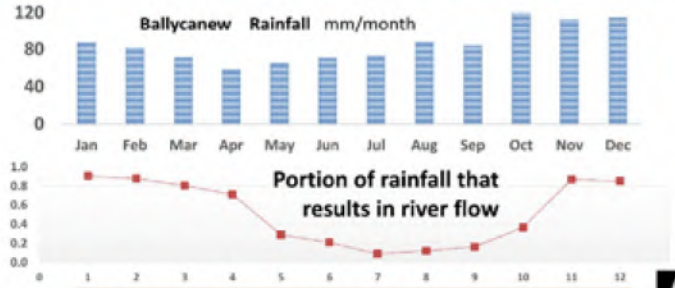
Teagasc spreading guidelines from Signpost Search Teagasc " etting the most rom our slurr "

Teagasc Youtube – " icient nutrient use o slurr – a cost saving approach" – Scan the QR code below

Email: shaun.connolly@teagasc.ie

Reasons for the "CLOSED PERIOD"

Crop nutrient uptake and water movement through the soil are very seasonal



Rainfall generated 6 times more river flow in winter

												Annual Average
N Kg/ha:	1.82	1.47	1.35	0.86	0.59	0.38	0.16	0.35	0.43	1.60	2.66	2.56	14.2 N
% of Annual:	13%	10%	9%	6%	4%	3%	1%	2%	3%	11%	19%	18%	kg/ha/yr
P Kg/ha:	0.131	0.111	0.101	0.076	0.041	0.038	0.016	0.067	0.046	0.167	0.238	0.217	1.25 P
% of Annual:	10%	9%	8%	6%	3%	3%	1%	5%	4%	13%	19%	17%	

Key Points

- Higher amounts of N & P impact the biology and ecology of our waterbodies
  Rivers - Lakes - Estuaries
- Surplus nutrients are transported by water moving over and / or through the soil
- 2 key factors
  - Nutrient surplus to crop demand
  - Water contributing to river flow
- Rainfall amount contributing to river flow & crop nutrient response are both seasonal

8 times more N & 5 times more P losses in closed period months

Nutrient Loss to Water During the Closed Period for Slurry Spreading

Per-Erik Mellander[1]; Edward Burgess[1]; Golnaz Ezzati[1]

[1]Agricultural Catchments Programme, Teagasc, Johnstown Castle;

Summary:

- Higher concentration of nutrients (N and P) is water is one of the main causes of poor water quality
- Surplus nutrients, above crop requirements at a particular time, are available for loss to water
- Water moving down through soil or by surface run-off is the main way excess nutrients above crop requirement are lost to rivers, lakes and estuaries
- "Storage capacity" and the "closed period" are not the same thing
- Growth rates determine the amount of nutrient uptake
- Response to N fertiliser:
    - ◊ Spring application: 10kg grass DM/kg N
    - ◊ Mid-season N response: 20–35 kg DM/kg N
- Evapotranspiration rates determine the amount of rainfall contributing to river flow
- Both Evapotranspiration and Growth rates are seasonal
- N loss is 7 times higher in winter months than during the summer
- P loss is 5 times higher in winter months than during the summer
- Shifts in weather patterns can change river flow & increase the risk of nutrient losses

Other resources & online information

ACP Website: https://teagasc.ie/environment/water-quality/agricultural-catchments/

ACP weather station data: www.acpmet.ie

Email PerErik.Mellander@teagasc.ie ; Golnaz.Ezzati@teagasc.ie ; edward.burgss@teagasc.ie

Ammonia & Your Health

What happens when nitrogen hits the air.

The Pathway: Slurry → Ammonia → PM2.5 → Lungs

Ammonia
Ammonia gas released from slurry

→ **Reacts**
with SO_2 & NO_x in the atmosphere

→ **PM2.5**
Fine particulate matter forms (< 2.5 µm)

→ **Inhaled**
Deep into lungs → bloodstream

Health Impacts

Oxidative stress
PM2.5 triggers inflammation and cell damage deep in lung tissue.

Respiratory disease
Worsens asthma, COPD, and bronchitis — especially in children and older adults.

Cardiovascular risk
Fine particles enter the bloodstream. Linked to heart disease and stroke.

Rural exposure
Farming communities face higher peak exposure during spreading season.

Choose low emission strategies. Support cleaner air and healthier communities

Ammonia & Sensitive Habitats

When nitrogen falls where it shouldn't.

The Pathway: Ammonia → Deposition → Habitat Damage

Ammonia released
from slurry, housing, storage

→ N deposited
settles on soil, plants & water within kms of source

→ Habitat shifts
sensitive species replaced by N-tolerant ones

HEALTHY LICHENS

N-DAMAGED LICHEN

What's At Risk

- Lichens — early-warning indicators of air quality
- Raised bogs & heathland — adapted to low-N conditions
- Mosses & liverworts — smothered by N-tolerant grasses
- Freshwater; algal blooms from excess N runoff

What Reduces Ammonia

- ✓ LESS — trailing shoe cuts NH_3 by ~45%
- ✓ Spring & evening spreading — reduces NH_3
- ✓ Cover your tank — 40–80% less NH_3 from storage
- ✓ Protected urea – 80% less NH_3 from spreading

Every low emission choice on the farm helps safeguard Ireland's natural habitats

Ammonia: Impacts on Human Health and Sensitive Ecosystems

Shaun Connolly[1]; IzuchukwuMartin Aroh[1,2], Dominika Krol[1]

[1]Teagasc, Johnstown Castle, [2]Teagasc Oak Park

Summary:

- Ammonia (NH_3) is colourless, but it doesn't disappear. Once volatilised from slurry, manure or fertiliser, it travels with the wind and lands somewhere, this can be your soil, your neighbour's bog, the lungs of a community downwind.
- Human health pathway NH_3 released into the air reacts with sulphur and nitrogen oxides to form particulate matter 2.5 (PM2.5), fine matter that is smaller than a red blood cell. PM2.5 is small enough to be inhaled deep into lung tissue and pass into the bloodstream.
- Health impacts of PM2.5: oxidative stress in lung tissue, worsened respiratory disease (asthma, COPD, bronchitis, especially in children and older adults), and increased cardiovascular risk (heart disease and stroke).
- Rural exposure is highest during slurry-spreading season. Farming communities, and farm workers themselves carry the highest peak exposure to agricultural ammonia emissions in Ireland as well as inhaling dangerous slurry gases.
- Habitat impacts: deposited N falls within kilometres of farms. Sensitive ecosystems adapted to low-N conditions (raised bogs, heathland, lichen communities, freshwater systems) are shifted by excess N, sensitive species are replaced by N-tolerant grasses.
- Lichens are the early-warning indicator, diverse, sensitive lichen communities collapse first under N deposition pressure. They die back and are replaced by a small number of N-tolerant species.
- Ireland has 59 SACs and SPAs (Special Areas of Conservation and Special Protection Areas) sensitive to nitrogen deposition. Protecting them is a regulatory obligation and a farming-licence issue.
- What reduces ammonia SS (e.g. trailing shoe) cuts NH_3 losses ~45% vs splash plate. Spring spreading evening application cut volatilisation further. Tank covers cut storage NH_3 by 40–80%. Protected urea reduces emissions by 78%. Applying the right rate to the right field finishes the job.
- By reducing ammonia emissions on your farm, you are contributing to healthier air and healthier ecosystems.

Other resources & online information

Teagasc ammonia research and resources: https://teagasc.ie/environment/climate-change-air-quality/ammonia/

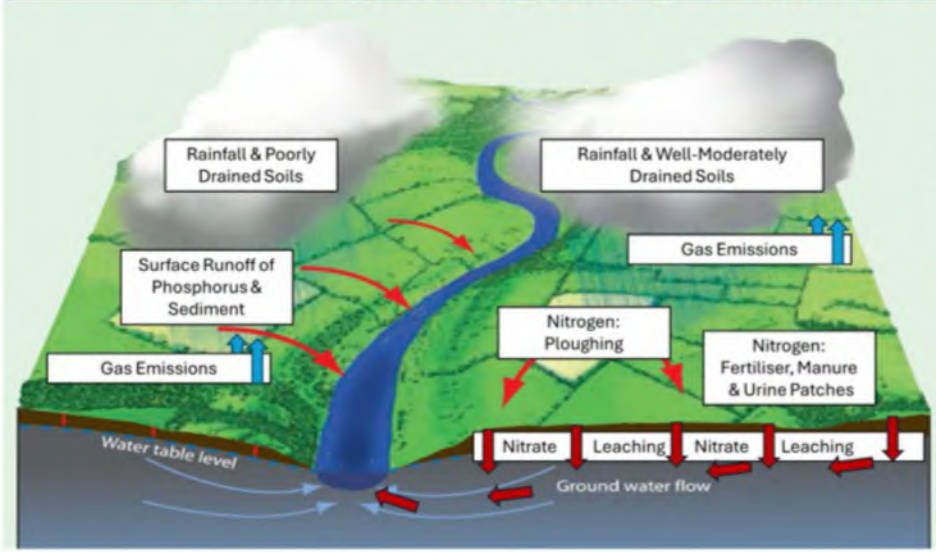
COPD Support Ireland - lung health: copd.ie

Email: shaun.connolly@teagasc.ie

Nitrogen Losses to Air and Water

Nitrogen Management

Understanding how nitrogen management affects climate and water quality



Importance: Use of nitrogen in agriculture can impact both water quality and quality of climate and air. Awareness of loss pathways is essential to reduce these losses and increase nitrogen use efficiency.

Take home messages

- ✓ Know your farm landscape and how your soils react to nitrogen inputs
- ✓ Be aware how time of year and weather conditions can affect losses associated with nitrogen management

Understanding How Nitrogen Management Affects Climate and Water Quality

Dominika Krol[1,2]; Owen Fenton[1]; Cathal Somers[1], Mark Plunkett[1]

[1,2] Teagasc, Johnstown Castle, [2] Teagasc Climate Centre

Summary:

- Nitrogen enters farmland from organic and inorganic sources: urine patches from grazing animals, slurry, synthetic fertilisers and mineralised soil organic matter after ploughing. In soil it occurs in many forms, but plant-available inorganic nitrogen is mainly ammonium and nitrate. These can be lost to the environment as nitrate leaching to groundwater, ammonia emissions to air, and nitrous oxide, a potent greenhouse gas. Nitrate is the mobile form that percolates vertically to groundwater, then to surface waters and estuaries, linking field management to water quality.
- Free- and moderately-draining soils are most susceptible to nitrate leaching. Leaching requires two simultaneous conditions: nitrate present in the root zone and downward drainage. In pasture systems, urine patches are the dominant source of nitrogen loss: cows excrete roughly 70–95% of ingested nitrogen, mostly in urine, and single patches can contain 200–1,000 kg Nitrogen/ha—far exceeding plant uptake and creating hotspots for leaching and gaseous losses. Leaching risk is highest when urine falls on free-draining soils shortly before rain; nitrous oxide losses are largest on wet, poorly-draining soils. These risks peak in late autumn and early winter due to high drainage and low plant uptake.
- Synthetic fertilisers vary in loss profiles. Calcium ammonium nitrate (CAN) contains roughly equal ammonium and nitrate; nitrate is readily lost with drainage while ammonium is more soil stable. Protected urea converts to ammonium in soil, reducing leaching risk and ammonia emissions compared with unprotected urea; nitrous oxide emissions are generally higher from CAN than from protected urea. Nitrogen released after ploughing also poses leaching risk, so tillage timing and rapid re-establishment of plant cover matter.
- Mitigation research includes reducing dietary crude protein via low-N supplements in autumn and winter to lower urinary N concentrations, though increasing stocking rates can negate benefits. Housing or off-paddock systems let farmers collect and store excreta for application when soils are drier and plants demand N, reducing high-risk losses.

Other resources & online information

www.teagasc.ie Search for Environment/Water Quality or Climate Change and Air Quality.

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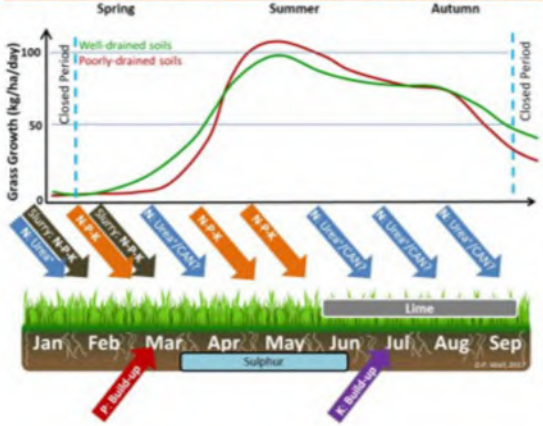
How To Reduce Nitrogen (N) Losses

Nitrogen Management

What can you do on farm to improve crop uptake & reduce losses

Nitrogen can build up in soil throughout the year, leading to a surplus if not taken up by the crop



Solutions

- NMP & identify crop requirements
- Application of sulphur reduces N leaching
- Reduce crude protein in feed
- Use protected urea
- Reduce chemical N with organic manures & clover
- Catch crops are a key tool to reduce N loss in tillage
- Technology (e.g. GPS)

5 R's

- **Right Time**
- **Right Place**
- **Right Rate**
- **Right Product**
- **Right Method**

Take home messages

- ✓ Ensure appropriate fertility & pH for crop requirements
- ✓ Ploughing releases nitrogen
- ✓ Urine is a source of N
- ✓ Surplus N in autumn can lead to loss of N (temperature/light)

How to Reduce Nitrogen Losses

Cathal Somers[1], Mark Plunkett[1], Dominika Krol[1,2], Owen Fenton[1], David Wall[1]

[1,2] Teagasc, Johnstown Castle, [2] Teagasc Climate Centre

Johnstown Castle is located in the southeast of Ireland in the Slaney catchment. The southeast of the country has productive free draining soils, which can often be prone to nitrate leaching through soil, to groundwater, which eventually joins surface water. As part of the Teagasc Better Farming for Water campaign, collaborators are working towards reducing the nitrate load leaving the catchment. Other farming practices and soil types can lead to gaseous nitrogen losses, such as nitrous oxide and ammonia. Many mitigation measures have been identified to reduce both gaseous emission loss and nitrate leaching.

Top tips to reduce nitrogen loss

- Improve nitrogen use efficiency in moderate to intensive farms with a nutrient management plan: soil test, correct pH with lime, reach Index 3 for P and K, and calibrate spreaders/GPS for accurate rates and timing.
- Match N application to growth and weather: only apply when soils are >6°C and rising, ground is trafficable, no heavy rain forecast and reduce/stop N during drought; split applications and delay early N until active growth.
- Use protected urea and Low Emission Slurry Spreading (LESS): switch to protected urea to lower nitrate leaching, ammonia and N2O while maintaining yield; spread slurry in spring with LESS and adjust chemical N accordingly.
- Incorporate clover/legumes white clover in swards can replace ~100 kg N/ha (≈40%) without yield loss.
- Sow cover/catch crops to trap soil nitrate over the winter and minimise leaching.
- Reduce surplus N, especially in autumn, through targeted nutrient application and grazing management. Avoid high-risk practices: cut overall chemical N where possible, avoid spreading during closed periods, keep buffers to stop runoff of nutrients into watercourses.
- Manure management: ensure plenty of slurry storage is available, including a buffer for longer housing periods due to weather conditions.
- Apply sulphur where soils are deficient to improve grass nitrogen use efficiency and reduce nitrate leaching risk; on responsive/light soils use 20 kg S/ha per year for grazed swards and 20 kg S/ha per silage cut, ideally applied March–June, using S-containing fertilisers.
- Reduce crude protein in livestock rations to cut ammonia and nitrogen excretion while maintaining performance

Nutrient Balance

What is Farm-Gate Nutrient Balance?

- Indicator for risk of nutrient loss
- Calculated on a yearly basis
- Higher figure = higher risk for nutrient loss

$$\frac{\left(\text{Nutrients imported (kg)} - \text{Nutrient exported (kg)}\right)}{\text{Total farm area (ha)}} = \text{Nutrient balance (kg/ha/year)}$$

National Averages

Dairy farms (kg N/ha/year)	**136.8 [5.4 to 257]**
Beef farms (kg N/ha/year)	**55.7 [-9.0 to 35.8]**

These figures represent the 2024 national average nitrogen nutrient balance [± 95% confidence interval] figures from farms on AgNav.

Take home messages

- ✓ Nutrient balance should be considered alongside soil fertility
- ✓ Log-in to AgNav to find out your farm's nutrient balances

Understaning our Farm's Nutrient Balance with AgNav

Sarah McPherson[1]; Laurence Shalloo[1]; Siobhán Jordan[2]; Donal O'Brien[3]; Natasha Browne[1]; Linda Omodara[1]; Oyinlola Ogunpaimo[4]; Jonathan Herron[4]

[1]Teagasc, Moorepark; [2]Teagasc, Oak Park; [3]Teagasc, Johnstown Castle; [4]Teagasc, Athenry

Summary:

- Nitrogen (N) and phosphorus (P) are essential nutrients for plant growth, but excess nutrients can be lost to water through runoff and leaching.
- Free-draining soils are more prone to nitrogen loss, while heavy or poorly drained soils are more prone to phosphorus runoff.
- Excess nitrogen and phosphorus in water can damage aquatic ecosystems by causing overgrowth of algae and plants.
- Nutrient balance is an indicator of nutrient loss risk and is calculated as nutrients imported minus nutrients exported, divided by farm area. It is calculated on a yearly basis.
- Nutrients are imported onto farms through fertiliser, feed, livestock, slurry, and milk replacer, and exported through milk, livestock, fodder, and manure.
- Reducing nutrient surplus lowers the risk of nutrient loss to the environment.
- Nutrient balance figures should always be considered alongside soil fertility levels and farm stocking rate.
- Dairy and beef farmers can access nutrient balance figures and detailed breakdowns through AgNav. Future developments will add nitrogen and phosphorus nutrient balances to the sustainability metrics available for tillage farmers.
- AgNav is a free, voluntary sustainability platform available to farmers and advisors across Ireland and was developed by Teagasc, Bord Bia, and ICBF, with support from the Department of Agriculture, Food and the Marine.

Other resources & online information

AgNav website: www.agnav.ie

Teagasc Website: www.teagasc.ie/agnav

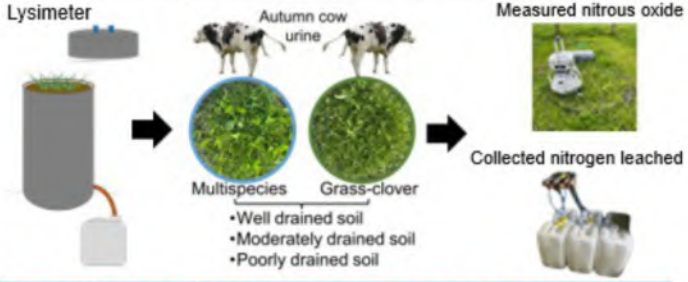
For free advisory help completing AgNav, sign up for the Signpost Advisory Programme: https://teagasc.ie/environment/climate-change--air-quality/signpost-programme/signpost-advisory-programme/sign-up/

Environmental Protection Agency (EPA) Targeting Agriculture Measures and Pollution Impact Potential maps: https://gis.epa.ie/EPAMaps/agriculture

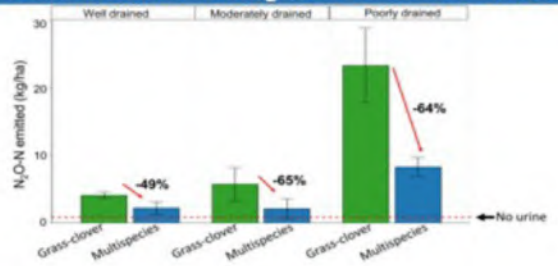
Email: jonathan.herron@teagasc.ie

Nitrogen losses from urine patches

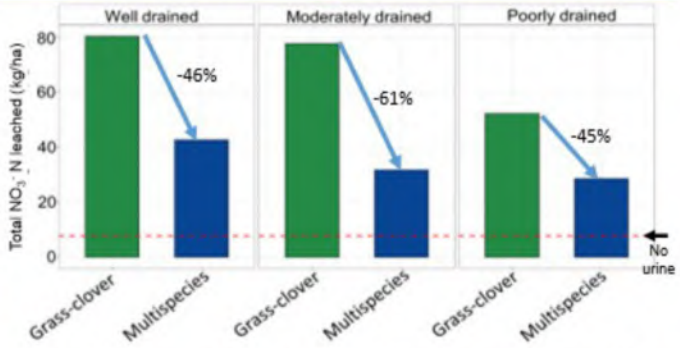
Methods: lysimeters to test swards and soils



Nitrous oxide: strong sward and soil effects



Nitrate leached: strong sward and soil effects



➢ Soil nitrates: strong sward effects, also affected by time/soil type

Take home messages

➢ Moderately draining soils leached ↑ concentrations of nitrate
➢ Nitrate leached: multispecies ↓ than grass-clover (year 2)
➢ Nitrous oxide losses: multispecies ↓ than grass clover
➢ Research required on plantain establishment and persistency

Nitrogen Losses from Urine Patches

Yahaya Jebril Amanor[1]; Orla Mattimoe[1,2]; John Finn[1]; Dominika Krol[1]; Patrick Forrestal[1]; Karina Pierce[2]; Karl Richards[1]; Bridget Lynch[1].

[1]Teagasc, Johnstown Castle; [2]University College Dublin, School of Agriculture and Food Science

Summary:

- EU environmental policy requires Ireland's agricultural sector to reduce greenhouse gas emissions by 25% by 2030 while also reducing nitrogen losses to water.
- The high nitrogen in dairy cow urine deposited during grazing is a major source of both nitrous oxide, a potent greenhouse gas, and nitrate, a water quality pollutant.
- These nitrogen losses are greatest in autumn, when plant nitrogen uptake is low and rainfall is high.
- Multispecies containing grasses, red and white clover, chicory and plantain offer potential to mitigate greenhouse gas emissions and nitrate leaching from grazed systems.
- Ingested forage from multispecies can reduce urine nitrogen concentration, lowering nitrogen susceptible to nitrous oxide production and nitrate leaching.
- Plantain in multispecies releases compounds that slow the conversion of urine nitrogen to nitrate.
- Research is currently being undertaken evaluating multispecies swards across soils with contrasting drainage, which shows that multispecies reduced nitrogen losses compared with conventional grass-clover systems in following autumn urine deposition.
- Multispecies reduced nitrous oxide emissions across the different soil types, with the greatest reductions observed in poorly drained soils where emissions were highest.
- Multispecies swards also reduced cumulative nitrate leaching across all soil types by an average of 51%, with the greatest reduction occurring in moderately drained soils.
- These findings highlight the potential of multispecies to reduce environmental losses, although improving plantain persistence requires further work.

Other resources & online information

Teagasc Website:

BNIPasture - Teagasc | Agriculture and Food Development Authority.

Email: orla.mattimoe@teagasc.ie, bridget.lynch@teagasc.ie; yahayajebril.amanor@teagasc.ie

Livestock Systems

FARMING FOR A BETTER FUTURE

Principles of successful calf rearing

Introduction

- Calf health and nutrition drive growth and lifetime performance
- Target growth rate ⟹ 0.7 - 0.8 kg/day

Sourcing healthy calves

- ✓Farm to farm purchases preferable
- ✓Health and vaccination status on source farm
- ✓Colostrum management
- ✓Bright, alert healthy calves free from injury or disease

Milk feeding

Feed high quality milk replacer:

Protein 20-22%

Fat 18–20%

- ➢ 12.5% concentration
- ➢ Fed twice daily
- ➢ <28 days old ⟹ 6 L per day
- ➢ >28 days old ⟹ 4 L per day

Solid feed intake

- Solid feed intake promotes rumen development
- Offer a high quality (17-18% crude protein) calf ration
- Feed straw as a roughage source

Weaning

>70 days old	85-90 kg
>1kg concentrate/day	Wean gradually

Transition to grass

- 1-1.5 kg concentrate offered for 3 weeks post turnout
- Offer straw ⟹ ease the transition to grass
- Covers of 1200 kg DM/ha ⟹ initially
- 1400-1600 kg DM/ha ⟹ once calves are acclimatised to grazing

The principles of successful calf rearing

Ellen Fitzpatrick[1] and Nicky Byrne[2]

[1]Teagasc, Johnstown Castle, Co. Wexford

[2]Teagasc, Grange Animal & Grassland Research and Innovation Centre, Dunsany, Co. Meath

Efficient calf rearing is essential for maximising growth, profitability, and sustainability in dairy-beef systems. Calves have a feed conversion efficiency estimated to be 2–3 times greater than adult cattle, making early life an important period for efficient liveweight gain. Poor growth during this stage can negatively affect lifetime performance, resulting in delayed finishing ages, lighter carcass weights, increased feed costs, and greater greenhouse gas emissions. Achieving strong growth rates early in life is therefore critical to ensure calves reach target weights at key stages such as weaning and housing.

Sourcing healthy calves is a key factor in successful calf rearing. Calves should ideally be purchased directly from the birth farm to minimise disease risk associated with additional transport and mixing. The health status of the source herd, calf genetic merit, and previous liveweight performance should all be considered. Farms with strong vaccination programmes and good colostrum management practices are particularly valuable sources. Calves should receive at least 3 litres of high-quality colostrum within two hours of birth to ensure adequate immunity transfer. Before purchase, calves should be examined to ensure they are healthy, alert, free from disease, and suitable for transport, which generally occurs at 3–4 weeks of age when calves weigh more than 50 kg.

During the pre-weaning period, calves should achieve growth rates of 0.6–0.7 kg/day. Typically, calves are fed 6 L of milk replacer daily up to four weeks of age before milk allowance is reduced to encourage concentrate intake and rumen development. Research at Teagasc Grange found that reducing milk allowance from 8 L to 4 L/day after four weeks had no negative effect on lifetime growth or carcass traits, while reducing calf-rearing costs by €33 per head. As a result, this reduced milk feeding strategy is now widely used on Teagasc research and demonstration farms. Calves should receive a high-quality milk replacer containing 20–23% crude protein and 18–20% fat, with consistent feeding temperature and hygiene standards maintained.

Solid feed and water are also critical for rumen development. A high-quality calf starter ration should be offered from the beginning of the rearing period alongside fresh water and straw. Restricting milk intake while encouraging concentrate consumption promotes development of the rumen and improves the calf's ability to digest solid feed efficiently.

Housing conditions greatly influence calf health and welfare. Calves require warm, dry bedding, adequate space, and good ventilation to reduce disease risk, particularly respiratory disease. Group housing provides a balance between labour efficiency and calf welfare, with a minimum allowance of 1.5 m^2 per calf recommended.

Weaning generally occurs between 8–12 weeks of age and should be gradual to minimise stress and maintain performance. Calves should be consuming sufficient concentrate and weigh approximately 85–90 kg before weaning. Following weaning, calves should transition gradually to high-quality pasture with continued concentrate supplementation to support growth and adaptation to grazing systems.

DairyBeef500 - Demo farm profitability

Net Profit of demo farms €/ha (excl Direct Payments)

Year	Output €/ha	Var costs €/ha	Gross margin €/ha	Fixed costs €/ha	Net profit €/ ha excl direct payments
2025	4181	1870	2311	846	1465
2024	3405	1856	1548	831	717
2023	3330	1990	1341	799	542
2022	3187	1913	1274	774	500

Profitability of top 1/3 vs bottom 1/3 demo farms

Category	Output €/ha	Var costs €/ha	Gross margin €/ha	Fixed costs €/ha	Net profit €/ha excl direct payments
Top 1/3	5130	1916	3214	968	2246
Bottom 1/3	3085	1664	1421	755	666

DairyBeef500 farms: Top 1/3 v Botton 1/3 comparison 2025

	Variable costs €/ha	Fixed costs €/ha	Gross output €/ha	Gross output kg/Ha	Gross output kg/LU	Stocking rate LU/ ha
Top 1/3	1916	968	5130	1383	592	2.36
Botton 1/3	1663	755	3114	1031	561	1.85
% Difference bottom v top	-13.2%	-22%	-39.2%	-25.4%	-5%	-29.7%

Top performer characteristics

- Top farmers tended to be full time with larger holdings (56 ha vs 42 ha)
- Had a higher output per livestock unit (592kg vs 561kg) and higher stocking rate (2.36 vs 1.85 LU/ha)
- Higher variable costs and fixed costs- continually investing
- Didn't always buy the top calf- focus on value

Take home messages

- Higher beef price drove profits in 2025
- Weather and input prices were favourable
- High calf prices and falling beef prices - major threat to margins in 2026

An analysis of the 2025 Teagasc DairyBeef500 Profit Monitor results

Alan Dillon, Gordon Peppard, Fergal McGuire and Tommy Cox

Teagasc, Grange Animal & Grassland Research and Innovation Centre, Dunsany, Co. Meath

Introduction

The Teagasc DairyBeef500 Programme was developed to promote profitable and sustainable dairy calf-to-beef systems in Ireland. Using annual Profit Monitor data, the programme benchmarks farm performance and encourages improvements in technical and financial efficiency. The 2025 results marked a particularly strong year for participating farms due to rising beef prices and improved production performance. However, the findings also showed major differences in profitability between farms, emphasising the importance of management practices and efficiency.

Profitability trends in 2025

Average net margins rose to €1,465/ha in 2025, compared to €717/ha in 2024 and €542/ha in 2023. ross output increased from €3,405/ha in 2024 to €4,181/ha in 2025, mainly due to stronger beef prices and improved animal performance. Variable costs remained relatively stable (€1,870/ha), allowing most of the increased output to convert directly into profit. Gross margins rose sharply to €2,311/ha, while fixed costs increased only slightly. Overall, 2025 was an exceptionally profitable year for dairy-beef systems

Key drivers of profitability

Beef prices: Higher beef prices were the main external factor influencing profitability. Farms that sold cattle at favourable times achieved significantly higher returns.

Output and technical performance: Top-performing farms produced higher liveweight output per LU (592 kg/LU versus 562 kg/LU on lower-performing farms). Better genetics, herd health, grassland management, and feeding strategies all contributed to improved efficiency.

Stocking rate: More profitable farms operated at higher stocking rates (2.36 LU/ha compared to 1.85 LU/ha), while maintaining strong grassland and animal performance.

Cost control fficient farms achieved lower production costs per kg of liveweight (€1.38/kg compared to €1.62/kg), demonstrating the continued importance of efficient feed use, input management, and minimising waste.

Variation between farms

Large differences existed between the top and bottom-performing farms. The top third achieved net margins of €2,246/ha, while the bottom third achieved €666/ha. Top-performing farms consistently recorded: higher output per ha, better technical efficiency, higher but well managed stocking rates and lower cost per unit of production. These results highlight the value of benchmarking and continuous improvement through tools such as the Teagasc Profit Monitor.

Sustainability and future challenges

Although 2025 was highly profitable, much of the success depended on favourable beef prices. Future profitability may be threatened by lower beef prices, rising feed and fertiliser costs and increasing calf purchase price. The results suggest that farms with strong technical efficiency and cost control are more resilient to future market volatility.

Commercial

- **Commercial beef value (CBV)** was developed to identify potentially more profitable beef animals

Grange Steer Research

	CBV (€)	ADG (kg/day)	Slaughter age (months)	Carcass weight (kg)	Conformation	Profit per head
High CBV	€133	0.91	20.7	312	O+/O=	€423
Low CBV	€92	0.87	20.8	294	O=	€337
Difference	+€41	+0.04	−0.1	+18 kg	O= → O+/O=	+€86

73% of High CBV steers were "**in-spec**", vs **53%** of Low CBV.

Commercial Beef Value (CBV): Making Genetics Work in the Dairy-Beef System

Cliona Ryan[1], Niall Kilrane[2], David Kelly2 O' [3]

[1] Teagasc, Moorepark Animal & Grassland Research and Innovation Centre, Fermoy, Co. Cork. [2]Irish Cattle Breeding Federation, Ballincollig, Co Cork. [3]Teagasc, Grange Animal & Grassland Research and Innovation Centre, Dunsany, Co. Meath

The Commercial Beef Value (CBV) is a €-based genetic index developed by ICBF to help beef farmers identify dairy-beef calves with superior profit potential. Like the EBI and Euro-Star systems, the CBV encompasses traits of economic importance to a beef farmer, such as carcass weight, conformation, feed intake and age at finish. In practical terms a calf with a CBV of €120 should deliver €75 more profit than one with a CBV of €45, through increased carcass performance and better feed efficiency.

Dairy-beef now accounts for 62% of Irish beef production, and between 2019 and 2025, beef AI usage on dairy cows more than doubled, while conventional dairy AI usage declined significantly. This shift has resulted in more dairy-beef calves being produced than dairy-dairy calves since 2023. At the same time, the genetic merit of beef sires used on dairy cows has improved substantially across all major breeds. The beef genetic merit of Angus sire for example, has improved by 57% since 2010 without compromising calving ease, demonstrating that modern beef sires can generate higher CBV calves, without increasing calving risk.

Research from Teagasc Grange has demonstrated the economic value of selecting calves with higher CBV. Under identical management conditions, high CBV (4-5 star) Angus-sired steers produced carcasses 18 kg heavier, finished three days earlier, and returned €86 more profit per head compared to lower CBV (1-3 star) Angus steers. very €1 increase in CBV was associated with approximately €1.85 additional net profit at slaughter. High CBV animals also achieved better carcass conformation scores, and a greater proportion met carcass specifications. Additionally, data from the ICBF database from almost 46,000 Angus × dairy steers finished in Ireland further supports these findings. Calves ranked in the top 20% for CBV sold for €55 more at the mart and returned €170 more at slaughter than calves in the bottom 20%.

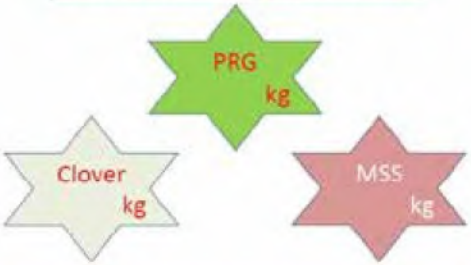
Importantly, selecting sires which produce higher CBV claves does not necessarily increase calving difficulty once they are selected using a balanced index such as the Dairy-Beef-Index. A national comparison of two Angus bulls widely used on dairy cows was conducted. Bull A had a DBI of €170, beef sub-index of €92 (2 kg carcass, 0.98 conformation, −18 days to finish) and calving sub-index of €66 (2.2% difficult calvings, −3.5 days gestation). Bull B had a DBI of €179, beef sub-index of €112 (+13.8 kg carcass, 0.95 conformation, −19 days to finish) and calving sub-index of €58 (2.8% difficult calvings, −3.4 days gestation). The two bulls are similar in overall DBI but differ meaningfully in beef merit, and this is reflected in their progeny: compared to Bull A, Bull B's calves had €20 CBV, returned €108 more in carcass value, sold for €11.50 more as calves, and saved €63 per head on finishing costs from 18 fewer days to slaughter, which is worth over €15,000 across 100 cattle. Overall, the evidence shows that CBV is a reliable and validated tool for improving profitability in the dairy-beef sector. Higher CBV calves consistently deliver better carcass traits, improved feed efficiency, earlier finishing, and greater economic returns, making CBV an important selection criterion for dairy-beef farmers

Dairy-beef heifer production systems

22 month dairy beef heifer system performance

	PRG EM	PRG LM	CLOVER EM	CLOVER LM	MSS EM	MSS LM
Average daily gain (kg/day)						
First grazing season	0.73	0.66	0.68	0.63	0.76	0.71
First winter	0.63	0.55	0.66	0.59	0.67	0.56
Second grazing season	0.95	0.91	0.97	0.94	0.97	0.96
Finishing period	1.12	0.95	0.98	0.88	1.1	0.90
Carcass performance						
Carcass weight (kg)	269	268	259	265	275	275
Carcass conformation	O+	R-	O+	R-	O+	R-
Carcass fat	4-	3-	3+	3-	4-	3-
Farm system						
Net margin (€/ha)						
GHG emissions (kg CO_{2e}/kg carcass)						

Current heifer performance



Take home message

- Inclusion of legumes and herbs in grazing swards increasing animal performance while reducing Chemical N use.
- Animal maturity had no effect on carcass weight, but influenced carcass fat & conformation.
- Achieving carcass specification was a challenge at young finishing ages tested.

Effect of animal maturity, finishing age and pasture type on dairy-beef heifer performance

Pauric Coleman[1], Ellen Fitzpatrick[1] and Nicky Byrne[2]

[1]Teagasc National Agriculture Sustainability Research and Innovation Centre, Johnstown Castle, Co. Wexford

[2]Teagasc Animal and Grassland Research and Innovation Centre, Dunsany, Co. Meath

Introduction

Nationally, dairy-beef heifers have the highest probability of failing to meet carcass specifications, with carcass weight and conformation presenting the greatest challenges. Dairy-beef cattle sired by late-maturing beef breeds generally have superior carcass merit compared to those sired by early-maturing breeds; however, their performance within forage-based systems at significantly reduced finishing ages, compared to the current national average, remains largely unknown. Increasing sward diversity through the inclusion of clovers and herbs has been shown to enhance animal performance while reducing dependence on chemical nitrogen (N) fertiliser. In addition, reducing finishing age has been identified as a key strategy for lowering greenhouse gas emissions from agriculture, however its impact on carcass performance and farm system profitability of dairy-beef heifers is largely unknow.

Summary

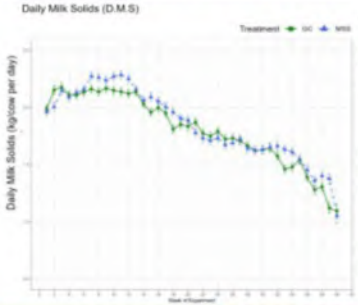
- Each sward type produced similar annual dry matter (DM) yields, despite clover (CL) and multispecies swards (MSS) receiving only half the chemical nitrogen (N) application rate of perennial ryegrass (PRG) swards (75 vs. 150 kg N/ha).
- Despite similar annual tonnage, spring herbage availability was a challenge on MSS swards.
- Multispecies swards improved animal performance, producing an additional 11 and 12 kg carcass weight per animal compared to PRG and CL swards, respectively.
- Sward type had no effect on carcass conformation; however, cattle grazing MSS achieved higher carcass fat scores compared to those grazing PRG and CL swards.
- Finishing age significantly influenced all carcass performance parameters. Across all pasture types, carcass weight, carcass fat, and carcass conformation increased progressively with finishing age, resulting in a greater proportion of animals meeting minimum carcass specifications.
- Only animals finished at 22 months of age on the MSS treatment achieved the target minimum carcass weight of 270 kg, with all other failing to meet the minimum threshold.
- Late-maturing heifers consistently achieved higher carcass conformation scores than early-maturing heifers, with the difference increasing at each finishing age.
- While carcass weight did not differ between early- and late-maturing animals, late-maturing heifers were less capable of achieving desirable carcass fat scores from a pasture-only diet and only reached sufficient fat cover within the 22-month indoor finishing system.

Multispecies Swards - Dairy

Experiment 2020 – 2022

- PRG with ~10% white clover (GC) vs. Multispecies 6-species mixtures (MSS)
- MSS mixture (2019) included perennial ryegrass, timothy, white-clover, red-clover, chicory and plantain
- Stocking 2.64 LU per ha
- No oversowing occurred, to evaluate persistency

Milk and Herbage production



	GC	MSS
Cumulative herbage production (kg DM/ha)	14,441	13,780
Cumulative milk yield (kg/cow)	6151	6451
Cumulative milk solids (kg/cow)	485	500
Chemical fertiliser Nitrogen (kg/ha)	178	66

Experiment 2024 - 2025

		Herbage grown kg DM/ha	Grazed T DM/ha	Chemical N kg/ha	Kg MS/cow
2024	GC	12,574	9,329	120	479
2024	MSS	11,797	8,941	60	448
2025	GC	11,801	9,516	120	467
2025	MSS	10,374	8,081	60	419

- Stocking rate reduced to 2.38 LU per ha.
- 2025, 45% replacement rate due to TB incidence.
- GC sward legume proportion 13%, MSS legume proportion 15% and herb component 22%.

Take Home Message

- In the first 3 years after establishment, MSS offered benefits (compared to GC swards) in milk performance with a significant reduction in chemical nitrogen input
- An increase in legume component of sward is required to support low chemical nitrogen systems
- Over sowing of clover and herb component required 4-5 years post establishment

Multispecies Swards – Dairy production systems

Ó.Mattimoe[1,2], A. Lawless[1], J. Finn[1], M.Dineen[3], K. Pierce[2], M.B Lynch[1]

[1]Environment Research Centre, Teagasc, Johnstown Castle, Wexford, Ireland; [2]School of Agriculture and Food Science, University College Dublin, Belfield, Dublin 4, Ireland. [3]Teagasc, Animal and Grassland Research and Innovation Centre, Moorepark, Fermoy, Co. Cork, Ireland

Summary

- Grassland farmers have become increasingly interested in the utilisation of multispecies swards (MSS) to reduce their chemical fertiliser nitrogen (N) input and environmental impact.
- A comparison of perennial ryegrass with ~10% white clover (GC) vs. a 6-species MSS has been undertaken at Johnstown Castle Dairy unit in the spring calving herd since 2020.
- The MSS mixture included perennial ryegrass, timothy, white-clover, red-clover, chicory and plantain.
- The first experiment ran from 2020-2022, with 20 cows per farmlet at a stocking rate of 2.64 LU per ha. No over sowing occurred from during this period, to evaluate the persistency of swards, with 30% then reseeded in 2023.
- The second experiment ran from 2024 – 2025, with 18 cows per farmlet at a stocking rate of 2.38 LU per ha.
- The primary objective of these experiments was to investigate the effect of diversifying sward type and reducing chemical fertiliser N on herbage and milk production in an intensive grass-based, spring-milk production system.
- A sward with good MSS composition has been shown to match or even outperform grass clover swards receiving higher chemical nitrogen levels.
- Focus on the legume component (>20%) of sward is required to support low chemical nitrogen systems.
- Over sowing of clover and herb component is required 4 -5 years post establishment in order to maintain sward composition.

Other resources & online information

Email: orla.mattimoe@teagasc.ie, bridget.lynch@teagasc.ie, aidan.lawless@teagasc.ie

JC Winter-Milk Herd

Herd Profile

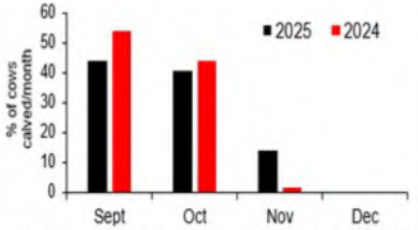
- Split-calving herd:
  - 90 autumn-calving cows
  - 40 spring-calving cows
- No cow recycled between seasons
- Same genetic selection criteria:

High fertility (>€70)	High milk solids (>25 kg)
Positive for milk kg	Functional cows

Mar, 2026	JC Aut.	Nat. Ave.
EBI	**166**	**114**
Milk	48	22
Fertility	70	42
Carbon	0	9
Calving	25	17
Beef	19	0
Maintenance	-5	20
Management	10	-1
Health	-1	10

Autumn Calving & Fertility

- Calving season starts mid Sept
- Mean calving date 5th Oct



- 10-wk breeding season starts 12th Dec

5-year average 2022-26	JC Aut.	Target
21-d submission rate (%)	84	>90
Preg. rate to 1st service (%)	59	>60
6-wk in calf rate (%)	74	>80
10-wk empty rate (%)	14	<10
Calving interval (d)	370	<370
Replacement rate (%)	23	20-22

Cumulative Milk Production

5-year average 2021-25	JC Aut.
Milk yield (kg)	7,268
Fat (%)	4.52
Protein (%)	3.68
Milk solids (kg)	594
Body weight (kg)	604
Milk solids (kg/kg BW)	0.98
Concentrate fed (kg)	1,659

Take Home Messages

- Focus on high EBI cow that can also deliver from pasture
- Optimum concentrate usage essential
- Pasture utilisation and conserved forage digestibility key drivers of winter-milk sustainability

Johnstown Castle Winter-Milk Herd Update: Increasing the Sustainability of Winter-Milk

Aidan Lawless[1]; Ciaran Murphy[1,2]; James Dunne[2]; Michael Dineen[2]

[1]Teagasc, Johnstown Castle; [2]Teagasc, Moorepark

Summary

- The Teagasc Winter Milk herd consists of 90 high- BI (€166) Holstein Friesian cows managed within a winter-milk production system.
- The herd currently operates with a 370-day calving interval and a 74% six-week in-calf rate.
- Over the past five years, the herd has averaged 7,268 kg of milk/cow, with 3.68% protein, 4.52% fat and 594 kg of milk solids produced annually.
- Average concentrate supplementation is approximately 1,659 kg per cow annually, with around 1,000 kg fed during winter housing and 600 kg during the grazing season.
- Breeding management practices, including a 10-week breeding season and no recycling of cows between seasons, are used to maintain a compact calving pattern and support feed efficiency within the system while reducing annual feed costs and minimising the amount of surplus to contract milk sold during November to February.
- The farm places a strong focus on maximising the proportion of high-quality grazed pasture in the cow's diet.
- Maintaining a high-EBI herd suited to grazing conditions is an important component of the production system.
- Optimizing concentrate supplementation while increasing pasture utilisation and conserved forage digestibility are important factors that influence herd performance and system sustainability.

Other resources & online information

Teagasc National Winter-Milk Week 2025: https://teagasc.ie/animals/dairy/winter-milk/winter-milk-week/

Teagasc National Winter-Milk Open Day 2023: https://www.teagasc.ie/animals/dairy/winter-milk/winter-milk-open-day/

TResearch Winter 2023 article (pp. 34-35): https://www.teagasc.ie/media/website/publications/2023/TResearch-Winter-2023.pdf

Improving Profit and Sustainability on Winter Milk Farms - Key Management Practices: https://teagasc.ie/wp-content/uploads/2025/05/Booklet-2019-Improving-Profit-and-Sustainability-on-Winter-Milk-Farms.pdf

Email: Michael.Dineen@teagasc.ie; Aidan.Lawless@teagasc.ie; James.Dunne@teagasc.ie

Concentrate Feeding Rate - Winter-Milk Systems

Introduction

- Essential to maintain a consistent supply of quality fresh milk for our domestic market
- Winter-milk production is reliant on conserved forages and concentrate
- This typically increases cost of production and environmental emissions
- Crucial to investigate optimal concentrate feeding rate

Experimental Design

- 9-wk indoor feeding experimental period
- 42 cows/treatment
- 6 kg/d (Low 6) or 9 kg/d (High 9) concentrate feeding rates
- Forage base consisting of 50% grass silage and 50% maize silage

Animal Performance

	Low 6	High 9
Grass silage (kg DM/d)	7.8	7.0
Maize silage (kg DM/d)	8.4	7.6
Parlour conc. (kg DM/d)	5.4	8.1
Total DMI (kg DM/d)	21.6	22.7
Milk yield (kg/d)	28.0	29.1
Fat (%)	4.54	4.44
Protein (%)	3.51	3.56
Fat yield (kg/d)	1.26	1.29
Protein yield (kg/d)	0.98	1.03
Milk solids yield (kg/d)	2.24	2.32
Bodyweight (kg)	590	592
Body Condition Score	3.10	3.11

Implications

- Grass silage DMD = 76%
- Maize silage starch = 31%
- Cows fed High 9 had a forage substitution rate of 0.59 kg/kg
- Cows fed High 9 had a milk response of 0.41 kg/kg (DM basis)

Take Home Messages

- When cows were fed high quality forages, milk response to additional concentrate was low
- Likely due to the high forage substitution rate
- Generating high quality forages is crucial in winter-milk systems
- Consideration is required when selecting concentrate feeding rate

Investigating the Optimal Concentrate Feeding Rate in Winter-Milk Systems

Ciaran Murphy[1,2]; Aidan Lawless[1]; Michael Dineen[2]

[1]Teagasc, Johnstown Castle; [2]Teagasc, Moorepark

Summary

- Winter-milk producers are a vital component of the dairy sector, ensuring a consistent daily supply of high-quality fresh milk for the domestic market.
- These producers also supply the volume of winter milk required for the manufacture of specific dairy products and commodities.
- However, winter-milk production relies heavily on indoor feeding of conserved forages and concentrate feeds, typically resulting in higher production costs and greater environmental emissions compared with spring-calving systems.
- Therefore, it is important to determine the optimal concentrate feeding rate for winter-milk systems.
- Treatments consisted of cows offered a basal forage diet comprising 50% grass silage and 50% maize silage, supplemented with either 6 kg/d or 9 kg/d of concentrate.
- The forages offered during the experiment were of excellent quality, with the grass silage having a dry matter digestibility of 76% and the maize silage containing 31% starch.
- Cows offered 9 kg/d of concentrate had a forage substitution rate of 0.59 kg/kg and a milk yield response of 0.41 kg/kg DM compared with cows offered 6 kg/d of concentrate.
- Overall, when cows were offered high-quality forages, the milk yield response to additional concentrate supplementation was low, likely due to the high forage substitution rate.
- Producing high-quality forages is critical in winter-milk systems.
- Careful consideration is required when determining the optimal concentrate feeding rate.

Other resources & online information

Teagasc National Winter-Milk Week 2025: https://teagasc.ie/animals/dairy/winter-milk/winter-milk-week/

Examining the costs of winter milk production: https://www.teagasc.ie/news--events/daily/dairy/examining-the-costs-of-winter-milk-production.php

Improving Profit and Sustainability on Winter Milk Farms - Key Management Practices: https://teagasc.ie/wp-content/uploads/2025/05/Booklet-2019-Improving-Profit-and-Sustainability-on-Winter-Milk-Farms.pdf

Email: Michael.Dineen@teagasc.ie; Aidan.Lawless@teagasc.ie

Advisory, Education & Policy

FARMING FOR A BETTER FUTURE


MixMax

Teagasc Advice and Training - supporting the Farming Community

Ger Shortle

Manager, Teagasc Wicklow/Carlow/Wexford Advisory Region

Introduction

The 2026 Johnstown Castle Open day is an ideal opportunity to see Teagasc working together to show the best and newest ways to increase the sustainability of farming.

What do we mean by 'Sustainability'

By sustainability we mean environmental, financial, and social sustainability – in other words, for farming to have a viable future it must:

1. Protect and improve the environment for everyone.
2. Provide a good living for farm families and farm workers.
3. Promote the health and well-being of farming people.

The main aim of Teagasc advisory and training services is to provide support and knowledge to farming people to improve the sustainability of the sector. The Teagasc model for doing this combines research, advice, and training in one organisation to make the flow of information to farmers as efficient as we can. This approach is one of our great strengths as it gets the latest information from researchers to farmers with the minimum of steps in between.

How we deliver advice and training

Our advisory and training service is delivered in many ways, from one-to-one consultations to discussion groups, full-time courses, short courses, distance learning, and a wide variety of events - like this Open Day.

We operate the advisory service through annual contracts under which each client can have office and phone consultations and on-farm visits when needed. Discussion Groups, facilitated by an advisor work well for many farmers who value them as an excellent way to learn and exchange knowledge with other farmers who are in a similar situation to themselves. Some discussion groups focus on the needs of specific groups, such as women farmers, or young farmers. All clients receive regular digital newsletters with practical and timely advice for their specific enterprises and the Teagasc Today's Farm magazine four times a year. Further education and training can be accessed through our adult farmer education courses and programmes which range from half-day courses up to the part-time Green Cert.

We provide advice and support on all aspects of farming: schemes; animal and crop production, environmental management; farm infrastructure; finances; alternative enterprises and the challenges of generational renewal.

Come and see us at the Open Day where you can chat with an advisor, teacher or education officer who can help you on journey towards a better farming life.

AGNAV Digital Sustainability Platform

An Roinn Talmhaíochta, Bia agus Mara
Department of Agriculture, Food and the Marine

Teagasc Climate Action Strategy

- AgNav is part of Teagasc's Climate Action Strategy, alongside the Climate Centre and the Signpost Advisory Programme

What is AgNav?

- A free, digital platform for Irish farmers to help them understand and improve their farm's sustainability
- Uses robust models developed within Teagasc and maximises use of existing databases
- **Assess** your farm's environmental performance: GHG emissions, ammonia emissions, nutrient balances
- **Analyse** the impact of different management scenarios using the forecaster
- **Act** using tailored action plans

Top Actions Chosen by Farmers

Use protected urea

Apply lime

Optimise soil fertility (P & K)

Take home messages

- ✓ Join over 18,000 farmers who have already signed-up to AgNav
- ✓ Find out your farm's emissions, soil carbon and nutrient balance
- ✓ AgNav is available for dairy, beef, and tillage farms

AgNav: Digital Sustainability Platform

Sarah McPherson[1]; Laurence Shalloo[1]; Siobhán Jordan[2]; Donal O'Brien[3]; Natasha Browne[1]; Linda Omodara[1]; Oyinlola Ogunpaimo[4]; Jonathan Herron[4]

[1]Teagasc, Moorepark; [2]Teagasc, Oakpark; [3]Teagasc, Johnstown Castle; [4]Teagasc, Athenry

Summary:

- AgNav is a free, voluntary sustainability platform available to farmers and advisors across Ireland and was developed by Teagasc, Bord Bia, and ICBF, with support from the Department of Agriculture, Food and the Marine.
- AgNav helps farmers understand and improve the sustainability of their farms using verified farm data and science-based guidance.
- The platform is built around the principles of Assess, Analyse, and Act to help farmers improve farm sustainability:
    - Assess AgNav uses your farm's data to determine your sustainability metrics, including greenhouse gas emissions, ammonia emissions, and nutrient balance.
    - Analyse You can test how management changes could affect your farm's sustainability metrics through the Forecaster.
    - Act: You can create a tailored sustainability action plan for your farm.
- AgNav is available for Irish farmers with dairy, beef, and tillage enterprises. Over 18,000 farmers have registered with AgNav.
- The most commonly selected sustainability actions relate to fertiliser use, slurry management, and soil fertility improvement.
- Future developments will include sheep, pigs, poultry, horticulture, forestry, biodiversity indicators, enhanced forecasting tools, and economic and social indicators.

Other resources & online information

AgNav website: www.agnav.ie

Teagasc AgNav Website: www.teagasc.ie/agnav

For free advisory help completing AgNav, sign up for the Signpost Advisory Programme: https://teagasc.ie/environment/climate-change--air-quality/signpost-programme/signpost-advisory-programme/sign-up/

Email: jonathan.herron@teagasc.ie

NASRIC - National Agricultural Sustainability Research & Innovation Centre

New State-of-the-Art Laboratory
Supports lab and field based research on Soil, Crop, Environment and Land-Use








Support Range of National Projects

Agricultural Catchments Program

Teagasc Signpost Program

National Soil Carbon Observatory

Teagasc Climate Centre

Take Home Messages

- **2000m² of new and refurbed labs**
- **Over 100,000 samples tested annually**
- **Expanded capacity to support research and innovation**
- Help to develop technologies and best practices to protect **Water Quality**, improve **Soil Fertility, Soil Health and Crop Nutrient Efficiency**, reduce **Gaseous Emissions** and enhance farm **Biodiversity**

NASRIC: National Agricultural Sustainability Research and Innovation Centre

The National Agricultural Sustainability Research and Innovation Centre was officially opened on November 13th, 2025, by the Minister for Agriculture, Food and the Marine Martin Heydon. This new state of the art facility, equipped with purpose-built laboratories and state-of-the-art equipment is being used for research and technology development to meet environmental and sustainability challenges facing the Irish agricultural sector.

Summary:

- New €12.7 million research facility based at Teagasc, Johnstown Castle, Wexford
- €9 million provided by the Department of Agriculture, Food and the Marine with the remaining €3.7 million contributed by Teagasc from its own income
- Purpose-built high-tech laboratories support research and innovation to improve water quality, soil health, decrease greenhouse-gas emissions, develop carbon farming, and increase nutrient efficiency, and farmland biodiversity
- Over 100,000 research soil, crop, water and gas samples analysed annually
- Constantly adapting and improving methodologies to meet changing research needs
- Support national projects including the Agricultural Catchments Program and the National Soil Carbon Observatory and the Signpost Farm Programme.
- Supports postgraduate and postdoctoral training at Teagasc in partnership with Higher Education Institutes with over 140 staff and students at Johnstown Castle research and farm facilities.
- Teagasc Johnstown labs also provides internship positions (of up to 6 month's duration) to undergraduate students. Each year 6-8 students are awarded internship positions from various Irish universities

Acknowledgements:

Thank you to the all the technical and support staff who directly work in the research labs at NASRIC, Johnstown Castle. Several more contract and permanent lab and field technical staff and farm staff help facilitate research activity in the lab and the field. All their hard work and dedication in support of our research programme and the generation of scientific information which supports the agricultural sector is greatly appreciated.

Other resources & online information

Teagasc Website: https://www.teagasc.ie/environment/johnstown/

Email: linda.moloneyfinn@teagasc.ie (Lab Manager)

There is a forest for you!

teagasc

An Roinn Talmhaíochta, Bia agus Mara
Department of Agriculture, Food and the Marine

Trees - for biodiversity and water

- Native forests
- Forests for water
- Native Tree Area Scheme (1ha)

Integrating farming and trees

Agroforestry - 3 options

- Silvopasture (trees and grass)
- Silvoarable (trees and crops)
- Forest Garden

Multiple use forests - growing timber

- Broadleaf forests for timber
- Continuous cover forests
- Mixed High Forests with conifers

Talk to your Teagasc Forestry Advisor about what trees can suit you and your farm

Attractive forestry measures to enhance water quality and soil health on the farm

Tom Houlihan[1]; Frances McHugh[1],

[1]Teagasc Forestry Development Department

Summary

- The **DAFM Forestry Programme 2023-2027** provides highly attractive supports for a range of forests with varying objectives, including protecting water quality and enhancing soil health.
- The Native Tree Area (NTA) Scheme supports the creation of small native forests (up to 1 hectare) on farmed land and has 2 scenarios to consider.
    - **NTA 1 –** supports the creation of small native forests
    - **NTA 2 –** supports the creation of new native forests in appropriate locations alongside streams, rivers and lakes that can protect and enhance water and aquatic habitats.
- Under the Afforestation Scheme, all of the **Forestry Type options** incorporate measures to protect water quality, such as setback distances from water bodies and specific guidance on drainage. Forest Types with a specific focus on water quality include the following.
- Forests for Water (Forest Type 2) - supports the creation of new native forests in strategic locations where the land use change can deliver specific ecosystem services regarding the protection of water and aquatic ecosystems or can reinforce and expand areas of alluvial woodland.
    - Planting details are guided by the Native Forest Framework which identifies the most appropriate forest type.
- **Agroforestry** is the integration of trees with either crops or livestock on the same land. It aims to deliver many additional on-farm benefits through this integration including enhancing grass growth, biodiversity, water quality with improved shelter, soil health, nutrient capture, trafficability and animal welfare**.** Agroforestry is supported via three specific Forest Types under the under Afforestation Scheme.
    - **Silvopasture** (**Forest Type 8) –** supports the integration of trees with grass / silage and/or livestock
    - **Silvoarable – Pilot (Forest Type 13) –** supports trees grown with crops of cereals, fruit and vegetables. Crops are normally grown amongst single or multiple rows of trees.
    - **Forest Garden (Forest Type 14) –** supports the creation of small forest holdings using forest gardening principles - diverse, low-maintenance system of combining food producing understory comprising of fruit and nut trees, shrubs, herbs and vegetables and a forest overstory forest layer.
- Your **local Teagasc Forestry advisor** is available to provide comprehensive decision supports on all forest options appropriate on your land.

Other resources & online information

Teagasc Website: www.teagasc.ie/forestry;

Email: forestry@teagasc.ie

Keep right up to date by subscribing to our e-newsletter: www.teagasc.ie/forestrynews

National Farm Survey (NFS)

Giving Irish Farmers a strong Data-Driven Voice

What is the National Farm Survey?

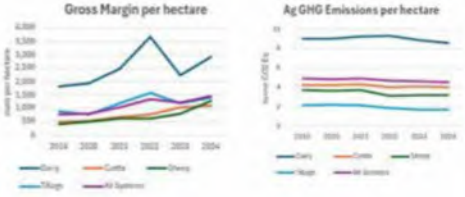
- The National Farm Survey is annual survey of farms across Ireland carried out by Teagasc to collect information on farm incomes, costs, production, and environmental sustainability.
- The survey provides trusted data to help farmers, policymakers, and researchers understand how farming is performing and to support better farm and agricultural policy decisions at national and EU level.

Your Data. Your Voice.

- Stronger evidence to maintain farm supports and highlight key concerns
- Better visibility of Farmers' views during policy debates.
- Better research, advisory and gross margin data.
- Support the long-term sustainability of the farming sector in Ireland.

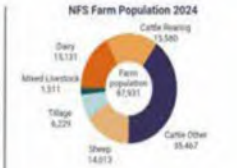
Inside the National Farm Survey: A Guide for Irish Farmers

Gross Margin and Agricultural GHG Emissions



Spring Slurry Spreading and Use of Protected Urea

Scan here for full Teagasc NFS Sustainability Dashboard.



The National Farm Survey and Sustainability Report

Michael Sweetman[1]

[1]**Teagasc Johnstown Castle**

Agricultural Economics and Farm Surveys Department, Rural Economy and Development Programme, Teagasc, Athenry, Co. Galway

About the Teagasc National Farm Survey

The Teagasc National Farm Survey (NFS) is Ireland's official farm-level data collection system and forms part of the wider EU Farm Sustainability Data Network (FSDN). Each year, a representative sample of farms is scientifically selected from across Ireland to reflect the diversity of Irish agriculture, including dairy, cattle, sheep, and tillage systems, as well as differences in farm size, enterprise type, and geographic region. Farms are chosen to ensure the survey accurately represents commercial farming nationally, making it one of the most important tools for assessing the economic, social, and environmental sustainability of Irish agriculture.

Participation in the NFS is entirely voluntary, and confidentiality is a core principle of the survey. Individual farm data is treated with strict privacy and is never shared in a way that could identify a participant or their business. All information collected is anonymised and used only for research, national statistics, and policy development purposes. Results are published in aggregated form, meaning no individual farmer or farm can be recognised. This confidentiality encourages honest participation and ensures farmers can share detailed financial and operational information with confidence.

The survey is conducted annually, and results are published in the summer of the following year. The 2024 NFS highlighted strong improvements in farm incomes and viability after a challenging 2023, with dairy continuing to lead economically, while cattle and sheep farms also showed notable gains. Environmental data showed reductions in greenhouse gas and ammonia emissions, alongside growing adoption of sustainable technologies such as protected urea and Low Emission Slurry Spreading (LESS).

For participating farmers, the NFS offers important benefits beyond contributing to national research. Participants can avail of valuable farm benchmarking opportunities, allowing them to compare their farm's performance with similar enterprises and identify strengths or areas for improvement. The survey supports better business planning, informs policy decisions that directly affect Irish farmers, and ensures that real farm experiences shape agricultural supports, sustainability initiatives, and future sectoral development.

Other resources & online information

https://teagasc.ie/rural-economy/rural-economy/national-farm-survey/

Enterprise Dashboards and Factsheets:

https://teagasc.ie/rural-economy/rural-economy/national-farm-survey/enterprise-factsheets-and-dashboards/

Sustainability Reports:

https://teagasc.ie/rural-economy/rural-economy/national-farm-survey/sustainability-reports/

Education Pathways for Agriculture and the Land-based Sector: Teagasc Options for School Leavers, Adult Learners and Career Changers

Brian Morrissey, Carmel Finlay and Tara Fitzsimons

Teagasc, Curriculum Development & Standards Unit, Grange, Dunsany, Co. Meath

Summary

- Teagasc is the primary provider of accredited further (vocational) education for the agricultural and land-based sectors with options for school leavers, adult learners and career changers.
- Teagasc provides pathways through range of courses in agriculture, horticulture, equine and forestry and some of these courses meet the qualification requirement to become a ''trained farmer.''
- For the 2026 and following academic cycles, applicants for Teagasc Full-Time Level 5 must meet specific entry requirements.
- Teagasc has adopted the ALTITUDE charter, the national charter for universal design in Tertiary Education.
- The Adult Green Cert programme is offered at Teagasc Regional Education Centres and Agricultural Colleges on a part-time basis or distance education basis.
- The Distance Education Green Cert course has been developed to meet the training requirements of graduates from other non-agricultural award programmes who are interested in farming and meeting the educational requirements of being a "trained farmer."
- Teagasc introduced four apprenticeship programmes for the land-based sector in 2023, with certification by QQI.
- Anyone planning to pursue a higher education course and who wishes to achieve trained farmer status should ensure that the course is included on the current list of approved trained farmer qualifications.
- Teagasc has a substantial involvement in providing short courses and continuous professional development across the agricultural, land-based and food sectors.

Introduction

Teagasc is the primary provider of accredited further (vocational) education for the agricultural and land-based sectors. Teagasc has a major input into higher education and postgraduate education delivery through its extensive partnerships. Teagasc introduced four new apprenticeship programmes for the land-based sector in 2023 and welcomes applications for apprenticeships due to start in September 2026. Teagasc also has a substantial involvement in providing short courses and continuous professional development across the agricultural, land-based and food sectors.

Become a "Trained Farmer"

Teagasc provides pathways through range of courses in agriculture, horticulture, equine and forestry and some of these courses meet the qualification requirement to become a ''trained farmer.'' National policy has prioritised ''trained farmers'' for various farm schemes and incentives. Graduates of specified Teagasc training courses meet the training qualification to become a ''trained farmer''. It is expected that future CAP reform will have additional benefits for trained farmers. Note that educational requirements for schemes are subject to change and applicants are required to meet terms and conditions when applying for various schemes.

Undertake a course or seek equivalence

The education pathways available to anyone seeking trained farmer status depend on their starting point. For example, a person finishing secondary school should consider attending an agricultural college and completing a Teagasc full-time Level 6 course in agriculture, horticulture, equine, or forestry. Someone who already holds a Level 6 or higher major award in a non-agricultural discipline can pursue a Level 6 Specific Purpose Certificate in Farming by Distance Education. Anyone over the age of 23 can undertake the Level 6 Specific Purpose Certificate in Farming as a part-time course at a regional education centre. And a person who holds qualification from other jurisdictions such as Northern Ireland or the United Kingdom can apply for adjudication to determine if the award is equivalent to the minimum requirement for trained farmer status.

Equivalence

Persons who already hold a qualification (including qualifications from outside of Ireland) may apply to determine if their qualification meets the educational criteria for trained farmer status. This process involves a detailed review of the qualification, including content, learning outcomes and level. The level of equivalent level on the National Framework of Qualifications alone is not sufficient to determine equivalence for trained farmer status. For more details, please refer to https://teagasc.ie/education/teagasc-graduate-queries-faq/

Recognition of Prior Learning

Applicants to Teagasc courses may apply for recognition of prior learning to gain exemptions from certain modules based on qualifications they already hold. For more details, please refer to https://teagasc.ie/education/going-to-college/recognition-of-prior-learning/

School leavers – preparing for careers in the land-based sector

In a competitive sector, new entrants to farming, horse production, forestry and horticulture will have to master fresh challenges to progress in the industry. Training with Teagasc will give you the skills you require to prosper in your chosen career. Courses include:

QQI Level 5 Certificate Courses

- Certificate in Agriculture / Horticulture / Horsemanship/ Forestry

QQI Level 6 Advanced Certificate Courses

- Advanced Certificate in Agriculture (Dairy Herd Management)
- Advanced Certificate in Agriculture (Drystock Management)
- Advanced Certificate in Agriculture (Agricultural Mechanisation)
- Advanced Certificate in Agriculture (Crops & Machinery Management)
- Advanced Certificate in Horsemanship
- Advanced Certificate in Equine Breeding (Stud Management)
- Advanced Certificate in Forestry
- Advanced Certificate in Pig Management
- Advanced Certificate in Poultry Management

Learners who wish to gain entry to a Level 6 Advanced Certificate course must first successfully complete a relevant Level 5 Certificate in Agriculture / Horticulture / Horsemanship/ Forestry or an equivalent course. The Teagasc Level 6 Advanced Certificate courses confer ''trained farmer'' status on those who successfully completed the courses.

Entry requirements for Teagasc Full-time Level 5 courses

For the 2026 and following academic cycles, applicants for Teagasc Full-Time Level 5 courses must satisfy at least one of the following four entry criteria:

>>> Junior Cycle Profile of Achievement (JCPA) - Applicants must be 18 years of age on the 1st September on the year of entry and meet the "Achieved" standard in four subjects.

>>> Leaving Certificate - Applicants must be 17 years of age on the 1st January following the year of entry to the Teagasc programme, and meet at least one of the following criteria:

>>>> Leaving Certificate Established with minimum grades of O6/H7 in at least four subjects or

>>>> Leaving Certificate Vocational Programme (LCVP) with minimum grades of O6/H7 in at least two subjects and achieved a 'Pass' in at least two link modules or

>>>> Leaving Certificate Applied with a minimum 'Pass' grade achieved.

>>> QQI Level 4 (or higher) Major award - Applicants must be 17 years of age on the 1st January following the year of entry to the Teagasc programme and hold a QQI Level 4 or higher major award.

>>> Adult Learners - Applicants must be 23 years of age or olderolder on the 1st September on the year of entry.

Applicants who do not meet one of the above criteria will be required to attend for interview as part of the application process application process.

For additional information, please refer to https://teagasc.ie/education/going-to-college/teagasc-course-entry-requirements/

Adoption of ALTITUDE charter

On 02 April 2026, Teagasc announced that it has adopted the ALTITUDE charter, the national charter for universal design in Tertiary Education. Teagasc recognise the importance of UDL (universal design for learning). To build on progress to date, Teagasc has committed to adopting the processes and principles of the ALTITUDE charter. For more information, visit https://www.ahead.ie/altitude

Adult Green Cert Programmes – Part-Time and Distance Education

The Teagasc Adult Green Cert programme confers ''trained farmer'' status on those who successfully complete the programme through either part time or distance education.

Part-Time Green Cert

The Part-Time Green Cert programme is offered at Teagasc Regional Education Centres and Agricultural Colleges for learners who wish to complete the course on a part-time basis. This course, accredited by QQI, is 2-to-2.5 years in duration. The qualifications gained are the Level 5 Certificate in Agriculture 5M20454 and the Level 6 Specific Purpose in Farming 6S20487. To enter this programme, applicants must be 23 years of age or older when starting. Enquires should be made locally to Teagasc colleges and centres. Subsequently applications are made online through the Teagasc public website: www.teagasc.ie/agriculture-courses/

Distance Education Green Cert

The Distance Education Green Cert course has been developed to meet the training requirements of graduates from other non-agricultural award programmes who are interested in farming and in achieving ''trained farmer'' status. The course extends over a minimum of 15 to 18 months. The qualifications gained are the Level 5 Certificate in Agriculture 5M20454 and Level 6 Specific Purpose Certificate in Farming 6S20487. Applicants must be a holder of a Level 6 or higher major award in a non-agricultural discipline. Applicants must also have continuous access to a commercial farm in the

Republic of Ireland (home-farm or approved nominated farm) to develop proficiency in farm tasks and complete farm-based assignment and projects. They must have access to all farm details, including financial details, on the nominated farm, and are expected to spend time weekly on this farm and be involved in its operation and management. Applications are made online through the Teagasc public website: www.teagasc.ie/agriculture-courses/

Teagasc Apprenticeship Programmes

The next intake of Teagasc apprentices will take place in August/September 2026. Teagasc currently operate four apprenticeship programmes for the land-based sector, which lead to QQI awards at Level 6 and Level 7, as follows:

>>> Farm Technician (NFQ Level 6 Higher Certificate)

>>> Farm Manager (NFQ Level 7 Ordinary Bachelor Degree)

>>> Sportsturf Technician (NFQ Level 6 Higher Certificate)

>>> Horticulturist (NFQ Level 6 Higher Certificate)

Apprentices are required to meet the entry requirements of the specific apprenticeships, to be employed by a SOLAS approved employer and to be registered as an apprentice with SOLAS.

For further information visit https://teagasc.ie/education/apprenticeships/ or email apprenticeships@teagasc.ie

Higher Education Links

The Higher Education Links Scheme enables holders of further education awards to apply for a quota of higher education courses. Specific further education courses are linked with specific higher education courses. Applicants for a higher education course, covered by the Scheme, are made through the standard CAO form. Applicants should check the current details of the Higher Education Links Scheme with the relevant higher education institution and on the CAO website.

Higher Education options

Some higher education qualifications are approved for trained farmer status. Applicants should check the current approved qualifications list and scheme terms before applying. For more information, refer to the Revenue list of trained farmer qualifications on Teagasc website at https://www.teagasc.ie/education/approved-trained-farmer-qualifications/ or DAFM Resources for the National Reserve and the Complementary Income Support for Young Farmers at https://www.gov.ie/en/organisation/department-of-agriculture-food-and-the-marine/ Please note that the DAFM list of trained farmer qualifications is contained in Appendix A of the terms and conditions document for the respective scheme.

Teagasc Higher Education Partnerships

Teagasc has a longstanding and substantial involvement in higher education provision. There is a wide range of higher-level programmes for the agricultural and land-based sectors available through the Central Applications Office (CAO). Many of these courses are conducted jointly between Teagasc and higher education institutions which allows learners access to the best core competencies of each of the partner institutions. Direct recruitment to the courses is through the CAO system with a number of places reserved for mature learners and holders of designated further education awards. There are also a number of advanced entry routes which allow Teagasc learners to progress from further education into second year of certain higher level programmes. Places are limited and learners make applications directly to higher level institutions. Additional information can be obtained on relevant technical university websites.

Lifelong Learning & Continuous Professional Development

Teagasc offer a wide range of courses for adults and agri-food sector employees. Please contact your Teagasc Education Officer or your Teagasc Advisory Region or college for advice on courses in your region. Courses are provided subject to demand, and staff resources. Some of the courses include Farm Safety, Crop Nutrition Management, Discussion Groups, Dairy Production, Grass10 Grazing Management, Forestry, Business, Organic Farming, and Welfare of Animals during Transport.

Teagasc Food Industry Training

Teagasc provides specialist training to the food processing and retail sector in the areas of food safety and quality systems, food legislation, food innovation and new product development. These training programmes are delivered from Teagasc Centres in Ashtown, Dublin and Moorepark, Cork, as well as from other locations around the country or in-company. They address specific industry needs and skills gaps and are developed in consultation with industry. Our training programmes operate to best quality assurance standards. In addition, businesses can avail of assistance from consultants either at Teagasc locations or in-company to address the individual company development needs or for problem solving.

Locations countrywide

Teagasc have a team of education officers based in all counties, so if you wish to discuss your training needs, you can find their contact details at www.teagasc.ie/education/local-education-centres/

Teagasc agricultural and horticultural colleges and Teagasc partner/private colleges hold college open days each autumn and spring for potential applicants and their families. Further information can be obtained from the college of your choice or by visiting www.teagasc.ie/education

College of Amenity Horticulture, Botanic Gardens	john.mulhern@teagasc.ie
Gurteen Agricultural College	jparry@gurteencollege.ie
Ballyhaise Agricultural College	john.kelly@teagasc.ie
Kildalton Agricultural & Horticultural College	tim.ashmore@teagasc.ie
Mountbellew Agricultural College	edna.curley@mountbellewagri.com
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Pallaskenry Agricultural College	derek.odonoghue@pallaskenry.com

Teagasc land-based apprenticeships: earn while you learn

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Summary

- If you are interested in learning about land-based enterprises and earning a salary while you learn, then check out the four apprenticeship programmes that Teagasc operate.
- The fourth cohort of land-based apprentices are due to commence their apprenticeship in September 2026.
- The Farm Technician Apprenticeship (Higher Certificate in Technical Farm Operations – NFQ Level 6) trains apprentices to operate successfully within Irish farming systems, gaining skills in daily operations, compliance with industry standards and regulatory measures.
- The Farm Manager Apprenticeship (Bachelor of Science in Professional Sustainable Farm Management – NFQ Level 7) creates a pathway to a managerial career in the agricultural sector, equipping the apprentice with the latest research and best practice management knowledge to successfully run a commercial farm business.
- The Horticulturist Apprenticeship (Higher Certificate in Horticulture – NFQ Level 6) equips apprentices with the knowledge, skills and competence to work in their chosen field of horticulture - nursery stock production, parks and garden maintenance, fruit production, vegetable production, landscape construction and garden centre operations.
- The Sportsturf Apprenticeship (Higher Certificate in Sportsturf Management – NFQ Level 6) is designed for anyone who wishes to pursue a career in the sportsturf sector or existing personnel employed in a sportsturf facility that would like to gain a recognised qualification.
- The next generation of farm operatives and managers, horticulturists, and sportsturf managers should avail of every available training opportunity in order to acquire knowledge, skills and experience to secure the long-term future of their career or business.
- For more details about Teagasc Apprenticeships, visit https://teagasc.ie/education/apprenticeships/

Introduction

If you are interested in learning about land-based enterprises and earning a salary while you learn, then you should look into the four apprenticeship programmes that Teagasc operate: Farm Technician, Farm Manager, Horticulturist, and Sportsturf Management (https://teagasc.ie/education/apprenticeships/). The Fourth cohort of land-based apprentices due to commence their apprenticeship in September 2026.

Farm Technician Apprenticeship

The Farm Technician Apprenticeship (Higher Certificate in Technical Farm Operations – NFQ Level 6) trains apprentices to operate successfully within Irish farming systems, gaining skills in daily operations,

compliance with industry standards and regulatory measures. The programme provides individuals with the knowledge and technical skills required to operate within farming systems. Individuals who successfully complete the Farm Technician Apprenticeship will be skilled in compliance with industry standards and regulatory measures. Learners will be equipped with skills to manage the daily operations (e.g. animal and grassland management) as well as recording and administrative activities, farm planning and business performance evaluation. The Farm Technician Apprenticeship is coordinated from Teagasc Clonakilty Agricultural College, Cork. Progression from the Level 6 programme includes the Teagasc Farm Manager Apprenticeship.

Farm Manager Apprenticeship

The Farm Manager Apprenticeship (Bachelor of Science in Professional Sustainable Farm Management – NFQ Level 7) creates a pathway to a managerial career in the agricultural sector, equipping the apprentice with the latest research and best practice management knowledge to successfully run a commercial farm business. The programme aims to equip trainee farmers with management skills to successfully run farm enterprises. Successful completion of this programme will see individuals take responsibility for all farming activities including work organisation, income and expenditure, strategic planning, compliance, safety, health and welfare management, and human resource management. The Farm Manager apprenticeship is coordinated from Teagasc Kildalton College, Piltown, Kilkenny.

Horticulturist Apprenticeship

The Horticulturist Apprenticeship (Higher Certificate in Horticulture – NFQ Level 6) is coordinated from Teagasc College of Amenity Horticulture in the Botanic Gardens in Dublin. The Horticulturist Apprenticeship equips apprentices with the knowledge, skills and competence to work in their chosen field of horticulture - nursery stock production, parks and garden maintenance, fruit production, vegetable production, landscape construction and garden centre operations.

Sportsturf Apprenticeship

The Sportsturf Apprenticeship (Higher Certificate in Sportsturf Management – NFQ Level 6) is designed for anyone who wishes to pursue a career in the sportsturf sector or existing personnel employed in a sportsturf facility that would like to gain a recognised qualification. Apprentices will be trained in a progressive manner and will get to put their skills into practice during both on and off the job training stages. On successful completion, the apprentice will be fully competent in the role of a Sportsturf Technician.

Programme duration

Each of the four apprenticeship programmes is two years in length and leads to a major award on the National Framework of Qualifications. The first step with apprenticeships is the approval process of employers for the relevant apprenticeship prior to the registration of apprentices with the approved employer. This process is completed by SOLAS in collaboration with Teagasc.

Apprenticeship learning experience

The main component of the Teagasc apprenticeship programmes is two years of work-based learning employment, where apprentices are in full-time employment on one farm or unit in Ireland, in their sector of choice. Apprenticeship employers must be screened and approved by SOLAS in collaboration with Teagasc. During these two years, there are approximately 10 weeks of block release days per year where apprentices further develop a broad range of skills in technical farming and farm business planning. Block release days will be delivered at the coordinating Teagasc College, industry locations, and online. It will incorporate both formal lectures and informal discussion groups and practical skills training, delivered by an integrated team of highly specialised Teagasc staff, including researchers, college teachers and specialists. Guest lecturers will also be invited, such as key industry stakeholders and successful commercial farmers.

Joining a Teagasc Apprenticeship Programme

The apprentice is required to secure their own full-time employment with the SOLAS approved employer and agree employment terms and conditions with the employer. The employer pays the apprentice employee a salary for the duration of the programme, inclusive of when the apprentice is on block release. The employer may apply for an employer grant of Euro 2000 per apprentice per year of the programme. Apprentice entry requirements for the apprenticeships and employer requirements are published on www.apprenticeship.ie Employer approval and apprentice registration is completed by SOLAS in collaboration with Teagasc.

Conclusion

As land-based industries navigate current and future sustainability challenges and regulations, it is essential that operators and managers are highly skilled. The Irish land-based sector is reliant on skilled farmers and operatives who have the ability to cope with such challenges as well as managing day-to-day productions task, work with people and meet business objectives. The next generation of farm operatives and managers, horticulturists, and sportsturf managers should avail of every available training opportunity in order to acquire knowledge, skills and experience to secure the long-term future of their career or business. Experience with excellent farm and business operators reinforces learning experiences and offers a network of people and mentors that can make a significant positive contribution throughout a future farmers' career. For more details about Teagasc Apprenticeships, visit https://teagasc.ie/education/apprenticeships/) or contact apprenticeships@teagasc.ie

Farming Lifestyle

FARMING FOR A BETTER FUTURE

Health and safety for a better future.

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Summary

- Farm accidents and ill health cause tragedy, suffering and long-term disability. These can also jeopardise a person's capacity to farm effectively and hence jeopardise farm income. Therefore, it is in everyone's best interest to give practical safety and health management adequate attention.
- In 2025, twenty-five fatal accidents occurred associated with farming. An estimated 4500 serious accidents take place each year.
- Research suggests that farmers need to give more attention to their health, including having a regular medical check-up with their GP.
- Considerable grant aid support for farm safety improvements is currently available through the Targeted Agricultural Modernisation Scheme (TAMS3). Farmers need to consider how to make optimum use of this scheme.
- Managing health and safety is vital for farming sustainability. More awareness of health promotion practices is needed among the farming community.

Introduction

Farming is one of the most dangerous work sectors in Ireland. Typically, about 20 workplace deaths occur in the agriculture sector annually. In 2025, the number of farm deaths was 25. In 2026, two deaths (provisional figure) have been reported up to May 21st. Farm accidents causing serious injury occur at the high level of 4500 per year. An accident can lead to a permanent disability and interfere with a person's capacity to farm effectively. Farmers as an occupational group have been identified with having high levels of preventable ill health. Ill health affects quality of life and a person's capacity to farm effectively. Therefore, managing health and safety is vital for farm sustainability. More awareness of health promotion practices is needed among the farming community.

Legal duty to complete a Risk Assessment

All workplaces, including farms, have a legal duty under Safety, Health and Welfare at Work (SHWW) legislation to conduct a Risk Assessment to ensure that work is carried out safely. The 'green covered' Risk Assessment Document is available to accompany the Farm Safety Code of Practice. It is a legal requirement to complete this document annually, and when major changes occur to farming systems. The HAS's website https://www.besmart.ie/ provides an online means of completing a safety statement.

Safety of children on farms

The following precautions need to be considered when children are present on a farm:

- • Provide a safe and secure play area for children away from all work activities. Where children

are not in a secure play area a high level of adult supervision is needed.

- Children should not be allowed to access heights.
- Action should be taken to keep children away from dangerous areas such as slurry tanks. All open water tanks, wells and slurry tanks should be fenced off.
- Give children clear instruction on farm safety issues.
- Children to be carried in the tractor cab (aged 7 or older) need to wear a seat belt.
- For a child friendly way of discussing farm safety with children the booklet "Stay Safe with Jesse" is a key reference. https://www.hsa.ie/media/mwmbrd0u/103581-hsa-stay-safe-on-the-farm-2022-v2.pdf

Preventing farm vehicle and machinery accidents

Vehicle and machinery-related deaths account for 46% of all farm deaths. The fatality data shows that most accidents occur due to being crushed or struck. Vehicles and machinery must be well maintained. When vehicles are stopped handbrakes must be applied and safe stop procedure implemented to avoid rolling.

Mandatory Training for all users of telescopic telehandlers on farms.

As per the Code of Practice for the Safe Use of Industrial Trucks all users of telescopic telehandlers on farms must have formal training complete. The HSA warns against using non-integrated platforms or "baskets" for lifting people. Only integrated working platforms, where the controls are in the basket, should be used for working at height, and only when necessary.

All Terrain Vehicle (ATV) safety

Between 2014 and 2024 there have been 10 farm fatalities involving quads. Before purchasing or replacing an ATV check the market to identify alternative options. There is an increasing trend towards people considering a slightly larger Utility Vehicle (UTV) with a cab or roll over protection that will carry two people.

In terms of legal requirements, under Regulation: S.I. No. 619 of 2021, all operators using an ATV/ quad for work must have undergone an ATV training course provided by a registered provider to a QQI standard or equivalent before using it. The law also places a requirement on the operator to carry out a risk assessment of ATV operation and to wear personal protective equipment (including a helmet).

Preventing deaths with slurry

Farm deaths associated with slurry and water account for 10% of farm deaths with the majority of these being drowning. Particular care is needed when slurry access points are open and physical guarding needs to be put in place. Slurry gases are a lethal hazard on cattle farms. Hydrogen sulphide is released when slurry is agitated and in calm weather can be present at lethal levels.

Preventing accidents with cattle

On Irish farms, livestock deaths make up 19% of all deaths and 42% of farm non fatal injuries. Farmers are advised to keep a bull's temperament under constant review, have a ring and chain fitted, always keep a bull in view and always have a means of escape or refuge. Managing cows and heifers at calving is a high-risk period. Use calving facilities and always always keep a physical barrier between you and the animal. Breeding decisions liked to improving docility should always be considered.

Farmer Health

Irish farmers face significant health challenges that deserve attention. Irish research has found that farmers (15-64 years) have seven times higher risk for premature mortality from heart disease compared to salaried workers.

Lung health

The 2016 Irish Farmers Lung Health Study showed 66% of participating farmers reporting respiratory symptoms and about 12–13% having lung obstruction, even among non-smokers. A more recent survey found that 16% farmers reported breathing problems and 13% allergies, supporting that these conditions are common and linked to farm exposures. This highlights that everyday exposure to dusts, animal dander and chemicals on the farm carries a real risk to lung health.

Diet and exercise

Among male farmers, 86% were found to be overweight or obese, yet just 27% believed that they were too heavy. Research has shown that male farmers who live with obesity have three times the risk of injury and five times the risk of recurring injuries. Farmers have been shown to achieve an adequate number of steps daily; however, the level of moderate-intensity exercise achieved, which is essential for cardiovascular health, is inadequate. This increases the risk of heart disease, diabetes, and high blood pressure. It shows the need for better health awareness, yearly health checks, and more moderate activity, such as brisk walking on the farm.

Poor health can increase risk of an accident

These health conditions are not just a concern in themselves; poor cardiovascular health, obesity, respiratory disease and musculoskeletal problems all independently increase the risk of a farm accident.

Looking after your wellbeing

Farming can be demanding, and it is common for farmers to experience stress or feel pressured. Most farmers manage these periods of stress well. A smaller group experience these feelings persistently. It is important to recognise the signs in yourself, such as feeling down for a prolonged period, disconnecting from others, sleep problems or fatigue, and to seek support early.

Physical and mental health are closely connected.

Looking after your physical health can help reduce the risk of stress and burnout, while managing stress can support safer working and reduce the risk of accidents. Research shows that strong social support from family, neighbours, or advisors can help reduce stress.

Tips to help reduce stress.

Managing workload, taking regular breaks, staying physically active, and talking to someone you trust – such as a Teagasc advisor, family member, or GP – can all support wellbeing. Recognising the signs early and seeking support is important.

The Teagasc website hosts the 'Positive Mental Health uidance for the Farming Community' at https://teagasc.ie/publications/sowing-seeds-of-support-positive-mental-health-guidance-for-the-farming-community-php/.

National organisations such as Mental Health Ireland and Samaritans Ireland offer support, and Embrace FARM supports farm families following accidents or ill health. Information on these and other services is available online.

Agricultural Vehicle Standards for Public Roads

Standards for use of agricultural vehicles on public roads are in place. In addition to the vehicle, the standards include both trailers and attached machines. The purpose of the standards is to enhance the safety of road users. A booklet on the revised standard can be downloaded from the RSA website at:

http://www.rsa.ie/en/RSA/Your-Vehicle/Vehicle-Standards/Agricultural-Vehicles/

Key requirements of the new legislation include:

Braking: More powerful brake systems will be required for agricultural vehicles operating at speeds in excess of 40 km/h. Most of the correctly maintained tractors which have come into use in the past 30 years already meet these requirements.

Lighting and visibility: Agricultural vehicles will need to be equipped with appropriate lighting systems, flashing amber beacons and reflective markings.

Weights, dimensions and coupling: New national weight limits have been introduced. These will enable tractor and trailer combinations which are un-plated to continue in use at limits which are safe for such vehicles. Plated tractors and trailer combinations can operate at higher weight limits of up to 24 and 34 tonnes for tandem and triaxle agricultural trailers, respectively, that meet certain additional requirements.

Accelerated Capital Allowances for Farm Safety Equipment

An accelerated capital allowance programme for farm safety and disability adaptation equipment is in place. This scheme allows for accelerated capital allowances of 50% per annum over two years for certain eligible equipment. The accelerated capital allowance scheme now complements the 60% grant aid on listed items which is available under TAMS 3. This eligible equipment includes; fixed livestock handling equipment, calving gates, anti-backing gates, livestock monitors, sliding doors, chemical storage cabinets, big-bag lifters, quick hitch mechanisms for rear and front three-point linkage to enable hitching of implements without need to descend from tractor, as well as adaptive equipment to

assist farmers with disabilities. More information can be found on the Department of Agriculture Food and marine webpage.

https://www.gov.ie/en/publication/4133b-farm-safety/?referrer=http://www.gov.ie /farmsafety/

Sustainable Sustainable Use of Pesticides Directive

The purpose of the EU Sustainable Use Directive is to put a legislative system in place to ensure that farm pesticides are used responsibly, safely and effectively while safeguarding the environment. Professional pesticide users (PU) must be registered with DAFM and have a PU Number. Famers are classified as professional pesticide users. To register, a farmer must have completed a training course provided by an approved training provider. A list of training agencies is provided on the DAFM web site at http://www.pcs.agriculture.gov.ie/sud/. In the event of a DAFM inspection, a farmer will be required to produce evidence of having completed appropriate training.
All boom sprayers greater than 3 m boom width must be tested. The interval between tests must not exceed five years until 2025. A list of approved sprayer testers is available on the DAFM website.

Further Information

New and current information can be downloaded at the following web sites: Teagasc: http://www.teagasc.ie/health_safety/ and H.S.A.: http://www.hsa.ie/

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Agriculture and Food Development Authority

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