

# TEAGASC

## RESEARCH IMPACT HIGHLIGHTS IN 2024



# Foreword

**A**dvanced agriculture and food research is critical for ensuring sustainable farming practices and providing better food security. The development of new farming systems that can withstand the impact of climate change, while increasing animal and plant production, is a crucial aspect of advanced agriculture research. Equally important is research into sustainable farming practices that conserve soil, water, and other natural resources, reduce greenhouse gas emissions, and increase farm profitability. In 2024, Teagasc launched 'Better Farming for Water: 8-Actions for Change'. This national campaign aims to accelerate the adoption of actions on all farms to improve all water bodies, where agriculture is a significant pressure, to 'good' or 'high' ecological status using a multi-actor approach.

This publication contains 20 examples of our research impact from 2024, highlighting just some of the groundbreaking work from our four research programmes: Animal and Grassland Research and Innovation (AGRIP); Crops, Environment and Land Use (CELUP); Food (FOOD); and Rural Economy and Development (REDP).

To assess the impact of our research activities, Teagasc has developed a framework to guide the evaluation of research. This framework provides a structure to describe how Teagasc's activities contribute to impact in the agri-food sector through three interconnected impact pathways: Technology Development & Adoption, Capacity Building, and Policy Influencing. 'Modelling Irish agricultural GHG emissions' has influenced policy by informing the sectoral emissions ceilings allocated to the agriculture sector for the period 2031-2040 and future annual Climate Action Plans. 'Food digestion models' will increase capacity building by better understanding the relationship between food and health by monitoring the digestion and absorption of food in the human body. 'Forecasting grass growth for farmers' will increase technology development and adoption, resulting in increased grass utilisation and improved feed budgeting, reducing the need for bought-in feed on grassland farms.

Many of the other research impacts that will have similar impact pathways can be seen in this publication. Our research underpins our technical advice to farmers and the food industry, as well as supporting policy

formation. Innovation is very important for the food sector, and we outline the level of engagement the sector had with our innovation support facilities. Our staff could not do their work without the funding provided mainly by the Department of Agriculture, Food and the Marine, and funding agencies such as Taighde Éireann – Research Ireland, Enterprise Ireland, the Environmental Protection Agency and the Horizon Europe programme, as well as funding from farmers via the dairy and pig levies and industry funding. We thank them and thank our many partners, both Irish and international. And finally, I would like to thank our farmer and industry stakeholders for their support and loyalty, we greatly appreciate it.

Teagasc is extremely fortunate to have an outstanding

core of scientists, supported by top-class technical, farm, advisory, specialist and administration staff, whose work contributes to our collective research output. Additionally, I would like to acknowledge our collaborators in universities and other external bodies – including the farming community and agri-food companies – who are directly involved in many of our

research projects. I would also like to highlight our Walsh Scholars and post-doctoral fellows, whose contribution to our ongoing research activities is invaluable.

Finally, I want to acknowledge the dedication of my colleagues in Teagasc who were involved with, or supported, the research activities contained within this publication. I also want to commend the role of our extensive research teams across the organisation, whose work has also made a substantial impact but was not included in our 2024 publication.






Thanks to the combined effort of all Teagasc staff, I am confident that we can continue to safeguard our role as the leading organisation in the field of agricultural, environmental and agri-food research in Ireland.

**Pat Dillon,**  
Director of Research,  
Teagasc



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Pat Dillon, Kevin Heanue, Siobhán Jordan, Raymond Kelly and Declan Troy

**Acknowledgements:**

The editor acknowledges the input of the Research Heads of Department and Heads of Programme at Teagasc to the submission process.

Front cover image credits, clockwise from top: Teagasc; Georgijevic/istockphoto.com; Iain White/Maxwell Photography; Teagasc

A supplement of *TResearch* magazine.

All contributors listed are from Teagasc, unless otherwise specified.

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Please quote 'Teagasc Research Impact Highlights in 2024' when using direct quotes from items. Published June 2025.

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Published on behalf of Teagasc by Artful Dog  
artfuldogcreative.com

**Design:** Ross Behenna; Asami Matsufuji  
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AGRICULTURE AND FOOD DEVELOPMENT AUTHORITY

AGRIP

# Demonstrating efficient dairy calf-to-beef production

Padraig French, Nicky Byrne, Chloe Millar

In recent years, the use of beef bulls on dairy herds has significantly increased; now, over half of dairy calves are sired by beef breeds. Driven by increased use of sexed semen, this shift presents an opportunity to develop more profitable and environmentally sustainable pasture-based beef systems.

Realising this potential requires improvements in the beef genetics of calves, alongside better early-life nutrition and health and grassland management to support higher animal performance. To help development, the Tipperary Dairy Calf-to-Beef demonstration farm was established, leading to a progressive calf purchase agreement with dairy farms to support the seamless transfer of high-beef potential calves from dairy-to-beef farms. The agreement incentivises participating dairy farmers to use beef artificial insemination sires with higher Commercial Beef Value, promotes greater calf weight-for-age at three to four weeks, and ensures calves are vaccinated against pneumonia before transfer to beef farms.

The farm is a practical platform for applying and assessing research-based technologies in genetics, animal health and nutrition, and grassland management. It measures their impact on animal performance, labour efficiency, and farm profitability in a real-world context.

It also plays an important advisory and educational role. By hosting farm and student open days and discussions, and supporting Teagasc's DairyBeef500 course, the farm delivers key insights and communication to thousands of farmers and stakeholders, making it a valuable learning and demonstration hub for the industry.

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**Impact Pathway:** Technology Development & Adoption



CELUP

# Protected urea: reducing emissions while sustaining production

Mark Plunkett, Patrick Forrestral, John B. Murphy, David Wall, Dermot Forrestral, Francis Quigley, Brian McCarthy, Áine Murray

Using protected urea (PU) in place of calcium ammonium nitrate (CAN) is an important greenhouse gas emission reduction technology for the Irish agriculture sector. PU use has been steadily growing, from about 10% in 2021 to 26% in 2024, but this needs to increase significantly if agriculture is going to meet its climate carbon reduction targets by 2030.

Challenging weather conditions in 2024 led to questions from farmers and the agricultural sector regarding yield performance of PU. A long-term fertiliser nitrogen (N) field trial at Teagasc Johnstown Castle has been evaluating the use of PU fertilisers using NBPTurea, NBPT+NPPTurea and 2-NPTurea, compared to standard urea and CAN for over 10 years. The results showed similar yields were achieved using the tested protected urea products and for CAN – including in 2024. In addition, since 2019, field trials have been completed, evaluating PU in a grazing situation over a wide range of sites. Results from these trials show the

reliable performance of PU with consistent grass production compared to standard N

fertilisers. These results were widely communicated to the agricultural industry by Teagasc staff to give reassurance to farmers using PU products, including at the Teagasc Beef and Dairy National Conferences. PU alone has the capacity to reduce total farm carbon equivalent emissions by between 4 and 8% in conventional livestock farming enterprises.

PU use has increased to **26%** in 2024, up from 10% in 2021

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## REDP

## Underreporting injuries hampers farm safety

David Meredith, John McNamara, Diana van Doorn

Official statistics do not provide accurate measures of the level of farm injuries or their impacts on farmers, farm businesses or farm households, as these injuries are rarely reported in Ireland or across the EU.

As part of the EU-funded SafeHabitus project, Teagasc researchers completed research highlighting statistical limitations of currently available data and proposing farm safety variables for inclusion in the annual EU Farm Sustainability Data Network (FSDN) survey. The research team leveraged Teagasc's National Farm Survey's 20 years of experience collecting such data to demonstrate tangible benefits for policy development.

This involved strategic multi-level engagement: first with EU policymakers at the European Commission's Directorate-General for Employment, Social Affairs and Inclusion, and secondly with the Directorate-

General for Agriculture and Rural Development through formal workshops and informal meetings. This was followed by mobilising partners involved in the SafeHabitus project across 11 member states. Each partner liaised with their national FSDN coordinator to advocate for the inclusion of key variables summarising the number of work-related injuries on farms, whether a farm has a farm safety plan, and whether safety training was provided to workers and family members. This coordinated approach resulted in member states agreeing to incorporate the three key safety indicators in the FSDN survey, which will be implemented from 2025 onwards.

This initiative marks the creation of the first EU-wide standardised system for monitoring farm injuries among self-employed farmers. The project showcases how research-driven advocacy can bridge policy gaps, ultimately enhancing safety standards for agricultural workers across Europe.

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**Impact Pathway:** Policy Influencing

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## FOOD

## Supporting infant health

Catherine Stanton

The microbiome plays a crucial role in infant health and development, but until recently, the impact of C-section delivery has been relatively unknown.

The project 'Missing Microbes in Infants born by C-section' (MiMIC) began in 2017, recruiting 500 mother-infant pairs to investigate the effect of birth mode (C-section vs. vaginal birth) on infant gut microbiota over the first two years of life.

The study identified microbial populations that are missing in infants born by C-section, whose gut microbiota is often altered compared with natural birth.

In 2024, APC Microbiome Ireland and International Flavours and Fragrances announced a four-year extension of MiMIC to continue to study these children to age five. This follow-up study will provide insights into the long-lasting effects of

early-life microbiome disruptions, which could have profound implications for public health policy and clinical practices.

This critical phase will chart the relationship between early life microbiota, and specifically missing microorganisms because of C-section birth, on a range of health outcomes from atopic disease to neurocognitive development.

The research is committed to understanding the role the gut microbiota plays in long-term health outcomes, particularly in the context of birth mode, and to generating actionable insights and strategies to improve outcomes for future generations, ensuring every child has the best start in life.

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**Impact Pathways:** Technology Development & Adoption; Capacity Building; Policy Influencing

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CELUP

## Real-time forage quality for smarter breeding

Dan Milbourne, Stephen Byrne, Agnieszka Konkolewska, Rachel Keirse, Helena Hennessey

Improving forage digestibility is vital for enhancing animal performance in pasture-based livestock systems. However, traditional methods for assessing forage quality are labour-intensive and limit forage breeding progress. New tools are needed to enable rapid, cost-effective, and scalable measurement of nutritive value throughout multi-year breeding programmes.

Predictive models were developed to accurately estimate forage digestibility in real-time, using harvester-mounted Near-Infrared Reflectance Spectroscopy (NIRS) on fresh samples. This overcomes key limitations of conventional laboratory-based NIRS, which relies on dried, milled samples and is too labour-intensive for large-scale breeding trials. The new approach enables rapid, real-time analysis of dry matter digestibility across thousands of plots during routine harvesting. With good predictive accuracy, this system allows for high-throughput, season-long forage quality monitoring of the breeding programme, accelerating genetic improvement of forage cultivars.

The NIRS system and developed calibrations are now on the Teagasc forage breeding programme's harvester – enabling routine, high-throughput measurement of digestibility at scale, without additional labour. This enables the capture of more complete and detailed data across the growing season, supporting more informed selection decisions and accelerating genetic gain for forage quality. This enhances the capacity of breeders to develop high-performing, climate-resilient forage cultivars for Ireland's livestock farmers.

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**Impact Pathway:** Capacity Building



REDP

## Modelling Irish agricultural GHG emissions

Trevor Donnellan, Kevin Hanrahan, Gary Lanigan, Karl Richards

Under Ireland's Climate Law, the Climate Change Advisory Council (CCAC) has statutory responsibility for making carbon budget proposals to the government. In 2024, such a proposal was made covering the period 2031-2040.

Delivering the research and analysis to support these proposals is the Carbon Budgets Working Group (CBWG). Alongside Teagasc research economists, the CBWG includes researchers and academics from universities, the Economic and Social Research Institute, Sustainable Energy Authority of Ireland, the Central Bank of Ireland, and Met Éireann.

Teagasc's work involved extending the projection horizon of the Food and Agricultural Policy Research Institute (FAPRI)-Ireland model – using this model to provide projections to 2050 on agricultural activity, greenhouse gas (GHG) emissions, and sectoral output, input and income.

With colleagues from the Teagasc Climate Centre, the 2023 Teagasc Marginal Abatement Cost Curve (MACC) analysis was then reassessed over that extended projection horizon. Projections of GHG emissions from agriculture, under six alternative scenarios, were provided to the CCAC and CBWG. Along with projections of GHG emissions and mitigation possibilities in other economic sectors, these projections were used by the CCAC in developing the carbon budget proposal presented to the government in December 2024.

The Teagasc report was published on the CCAC website and formed a key pillar of the analysis provided by the CCAC to the government in support of its carbon budget recommendations. This Teagasc research will inform the sectoral emissions ceiling allocated to the agriculture sector for the period 2031-2040 and future annual climate action plans.

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**Impact Pathway:** Policy Influencing

**FOOD**

# Food products for patients with dysphagia

Shay Hannon, Ciara McDonagh

The team at the National Prepared Consumer Food Centre, Ashtown, played a pivotal role in supporting innovative start-up company Ocras through product development, ingredient and equipment sourcing, facility design for production and scaling.

They worked on the development of texture-modified foods for dysphagia (difficulty swallowing) that are safe, nutritionally adequate, and visually appealing.

Ocras and Teagasc have established a strong and collaborative relationship that ensured the successful commercialisation of a range of unique products addressing a critical dietary need for individuals with dysphagia.

The company has secured contracts with the Health Service Executive (Ireland) and care homes, and is in discussions with the National Health Service to expand its offerings into the UK market.

Ocras' innovative approach to food and packaging design has enhanced the quality of life for individuals with swallowing difficulties while promoting sustainability through waste reduction. This case study underscores the importance of collaboration between industry and research organisations like Teagasc in driving impactful innovations that respond to societal and market needs.

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**AGRIP**

# Forecasting grass growth for farmers

Elodie Ruelle, Michael O'Donovan, Klervi Le Floch, Richard Bateman, Ciaran Hearn

Weekly grass growth can be highly variable and, with climate change, is becoming increasingly unpredictable. The accurate prediction of the week ahead's grass growth will significantly improve grassland management on grassland farms. Decision-support tools must evolve to provide more forward-looking information to meet this growing challenge.

The Moorepark St Giles Grass Growth model (MoSt GG) was developed and calibrated using Irish weather and soil data to capture variability in grass growth across different conditions. Since 2019, it has been used to predict grass growth on commercial grassland farms and, since 2020, its forecasts have featured on national television via the RTÉ Farming Forecast. In 2024, a major step forward was taken with its integration into PastureBase Ireland, a national decision-support tool used by thousands of farmers to implement best grassland management practices. This ensures that predictive insights are delivered directly to end users, embedded in the tools they already use and trust.

With MoSt GG now live in PastureBase Ireland, farmers receive daily grass growth forecasts directly on their phones, helping them plan grazing and silage management more effectively. This leads to increased grass use and improved feed budgeting, reducing the need for bought-in feed. Importantly, the model's integration opens the door to future tools – such as precision fertiliser application or soil trafficability forecasts – which can help reduce nitrogen losses and adapt to extreme weather. As climate variability intensifies, access to forward-looking, data-driven decision support will be increasingly vital for building more resilient and sustainable pasture-based farming systems.

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**Impact Pathway:** Technology Development & Adoption

Ocras

Teagasc



CELUP

## Calculating farm nutrient balance

Jonathan Herron, Natasha Brown, Siobhán Jordan, Laurence Shalloo, Donal O'Brien



Teagasc

Last year Teagasc launched the Better Farm for Water Campaign with the objective of supporting farmers to improve water quality. The campaign consisted of '8-Actions for Change', one of which was to improve nutrient balance on farms in relation to nitrogen and phosphorus.

To support farmers to benchmark the status of the on-farm nutrient balance, additional functionality was added to AgNav – the digital sustainability tool developed through a collaborative partnership between Teagasc, Bord Bia, and the Irish Cattle Breeding Federation.

AgNav can be used to measure both farm-specific farm-gate nitrogen balance, along with a detailed breakdown of key sources. The availability of nutrient balance data will

**1,000**  
Over 1,000 farms have engaged in nutrient consultations using AgNav

strengthen the delivery of farm-specific advisory services focused on improving water quality through better agricultural nutrient management practices.

This approach is already delivering impact, as demonstrated by the Dairygold

Grassroots Programme, where over 1,000 farms have engaged in one-to-one nutrient balance consultations using AgNav. Adoption of AgNav is expected to achieve further growth through other water quality and sustainability programmes.

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**Impact Pathway:** Capacity Building

AGRIP

## Welfare of long-distance transportation of unweaned calves

Muireann Conneely, Luca van Dijk, Susanne Siegmann, Niamh Field, Katie Sugrue, Laurence Shalloo, Emer Kennedy

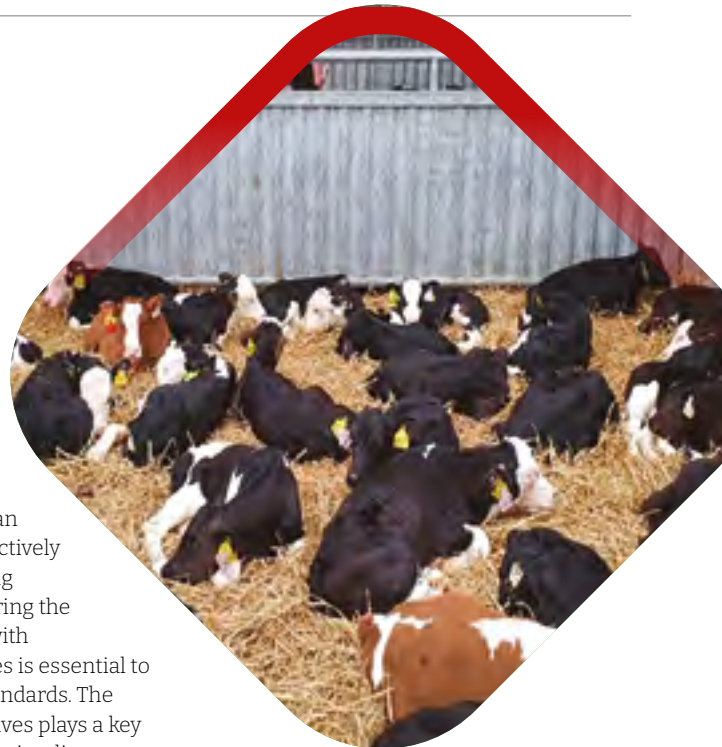
Improving the welfare of unweaned calves undergoing long-distance transportation from Ireland to mainland Europe is essential. This is based on both the requirement for the highest standards of calf welfare, and growing public concerns.

This project examined the welfare of unweaned calves during long-distance transport from Ireland to the Netherlands and explored strategies to improve it. It assessed welfare using physiological indicators such as energy balance, hydration status, body weight changes, and clinical signs of illness. Respiratory disease was evaluated using thoracic ultrasound, and behaviour during transport was monitored using pedometers and visual observation.

To improve calf energy balance, different feeding strategies were evaluated, including increasing milk volume fed before transport. Also trialled was a state-of-the-art feeding system that delivered milk replacer to calves

while on the ferry, aiming to support their nutritional needs in transit.

This research has demonstrated to the European Commission that Ireland is actively addressing calf welfare during transport. Accurately measuring the welfare impacts associated with transporting unweaned calves is essential to improving overall welfare standards. The inter-community trade of calves plays a key role in Ireland's ability to meet its climate targets, and our research supports this by ensuring that high welfare standards are upheld. Notably, the research has shifted the conversation – from calls to limit the transport of unweaned calves to the development of practical strategies for feeding calves during transit. As a result, the work has had a meaningful impact on European policy discussions.



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**Impact Pathway:** Policy Influencing

Teagasc

FOOD

# Improving milk powder production efficiency

Jonathan Magan, John Tobin, Eoin Murphy, Sophie Gaspard, Poonam Rani, Norah O'Shea

In the energy-intensive process of skim milk powder (SMP) production, concentrate viscosity is a critical rate-limiting factor, particularly when aiming for high total solids content prior to spray-drying. Increasing solids content in the evaporation step enhances energy efficiency and plant throughput, but this is particularly challenging during the late-lactation period due to naturally higher concentrate viscosities.

As part of initial laboratory-scale and pilot-scale trial work to assess mitigating strategies for seasonal issues in SMP production, Teagasc researchers observed promising temperature-dependent reductions in skim milk concentrate viscosity under specific conditions.

Following successful trials scaling this solution to the pilot plant and using the recently installed data capture platform, results were shared with industry partners via the Dairy Processing Technology Centre,

prompting an expression of interest from Kerry Group.

Subsequent collaboration led to the installation of an inline viscometer at Kerry's Charleville powder plant, allowing for direct

implementation and monitoring of the recommended process modifications during a full-scale commercial production run, attended onsite by the Teagasc researchers.

The observed viscosity reduction was achieved and proven at industrial scale, facilitating benefits

for Kerry Group including a rate increase (increased solids throughput) and reduced energy consumption, through reduced dryer temperature and steam usage, critically achieving an overall 6% reduction in kWh/tonne of SMP produced. Powder quality parameters were also maintained under the new conditions and benefits were communicated to the wider industry.

**6%**  
The process achieved an overall 6% reduction of kWh per tonne



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**Impact Pathway:** Technology Development & Adoption

REDP

# Mapping biodiversity and carbon storage

Stuart Green, Tom O'Dwyer, Eleni Kolintziki

Establishing a baseline of the nature value on the Teagasc Signpost Farms is essential to track improvements in biodiversity and above-ground carbon stored in hedgerows and trees.

Over two years, 92 farms were surveyed, under contract, using drone-mounted cameras and Light Detection and Ranging (LiDAR) scanners technology. The cameras provide very high-resolution images from which to map farm habitats, and LiDAR creates a 3-D model of the farm, from which it was possible to estimate biomass and thus carbon captured in trees, hedgerows and woodlands on each farm.

Each farm was mapped with a hybrid manual and machine-learning approach that fused all available datasets together. A geo-enabled PDF was created for each farm,

showing the extent of habitats, along with a report on the percentage cover of each habitat on the farm. The generation of carbon stocks reports is continuing and will be completed in 2025.

The baseline maps act as reference material for advisors and farmers to discuss nature and carbon-friendly farming options. The survey data is unique in Ireland; it forms the basis for exploring how best to exploit new sources of information to help inform farms of their options and, importantly, to provide evidence of improvements being made. These will be vital in the development of carbon farming markets and, going forward, will form the basis of mapping functionalities in AgNav, Teagasc's online climate action platform.



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**Impact Pathway:** Technology Development & Adoption

FOOD

# Biostimulants and packaging increase food shelf life

Lael Walsh, Shivani Pathania

**G**lobally, approximately 1.3 billion tonnes of food are wasted annually, with fruit and vegetables consistently the highest wasted foods by weight. The Leaf No Waste project was awarded €2M to develop novel solutions that tackle food waste – combining plant fortification with sustainable packaging to extend the shelf life of fresh produce.

Utilising a combination of commercially available silicon-biostimulants and tailored alternative plastic packaging, the project set about to develop longer product shelf life with alternative plastic packaging. Two interventions were tested across a series of horticulture crops of economic value including mushrooms, strawberries and herbs. The findings show that either intervention, or in combination, provides a means to extend the storage period for fresh food. Mushroom quality is improved by the double interaction effects of biostimulant plus packaging, the storage period of strawberries is lengthened with packaging reformulation, and the shelf life of herbs improves with biostimulants.

Results have led to novel patented technology to extend strawberry shelf life by 14 days from the current 10 days, which is being evaluated by industry. Several leading Irish horticulture companies worked alongside the researchers to maximise knowledge exchange. This has ensured rapid adoption of the potential of new technology to further enhance the industry in Ireland.

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through the Leaf No Waste project

**Impact Pathways:** Technology Development & Adoption; Policy Influencing



Teagasc

AGRIP

# New technologies to reduce antibiotic use on pig farms

Juan Manuel Ortiz Sanjuán, Fiona Crispie, Paul Cotter, Edgar Garcia Manzanilla

**P**iglet diarrhoea at weaning is the main reason for the use of antibiotics on pig farms worldwide. In the EU, the use of preventive antibiotic and therapeutic zinc oxide in piglet diets was banned in 2022. Understanding piglet diarrhoea in this new context is key to finding solutions.

The latest bacterial sequencing technologies were used in a series of field trials on commercial pig farms to show farmers and farm staff how bacteria changed in their farms when not using antibiotics and zinc oxide. The main pathogens, including *E. coli*, were clearly identified, the timeline of the changes was described, and solutions were suggested for each farm to prevent piglet diarrhoea. The solutions included strategies like piglet management, hygiene or biosecurity changes.

The focus of the solutions for diarrhoea in piglets when antibiotics and zinc oxide were available was mainly treating the piglet at weaning. This research shows the pathogens that needed to be targeted and that the focus should be in earlier piglet stages. These studies were carried out in eight commercial Irish pig farms (8% of the Irish sow population). All the farms have made significant progress towards total removal of antibiotics and the results are a good example for other farms to follow. Between 2022 and 2024 antimicrobial use on Irish pig farms has dropped by 35% and this reduction has been maintained despite the ban of preventive antibiotics and zinc oxide.

**35%**  
Antimicrobial use on Irish pig farms dropped by 35% between 2022 and 2024.

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**Impact Pathway:** Technology Development & Adoption



Iain White, Maxwell Photography

REDP

# National farm survey – small farms report

Emma Dillon, Trevor Donnellan,  
Brian Moran, John Lennon, Cathal Buckley

In 2022, through the National Farm Survey (NFS), a special survey was conducted of small farms – those with a standard output below €8,000 per annum. Information on farms of this scale – predominantly cattle and sheep farms – is not routinely collected. Small farms account for more than one-third of Irish farms (48,356) and occupy 15% of total farmland (630,000 ha), playing a key role in the continued viability of rural areas.

This project allowed for an assessment of the sustainability performance of small farms using nationally representative data. Data from the annual NFS sample on larger farms and from the small farms was then compared across economic, environmental and social dimensions.

Comparative analysis was also undertaken with NFS data on small farms collected in 2015. The 2022 survey had a particular focus on what motivated small farm operators and their expectations around the future in terms of land use and succession.

The report highlights the economic challenges faced by small farms in Ireland, their significant environmental contributions, and the social dynamics that influence their sustainability. It underscores the need for targeted policies and support to enhance the resilience and viability of small farms. The existence of a comprehensive dataset on farm-level sustainability is critical in meeting reporting requirements for Common Agricultural Policy monitoring and evaluation and the design of future agricultural policy.

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**Impact Pathway:** Policy Influencing



CELUP

## An IPM metric for Irish horticulture

Lael Walsh, Fiona Thorne, Jennifer Byrne

Adopting sustainable agriculture and promoting farm-level ecology incorporates Integrated Pest Management (IPM) by farmers.

The measurement and adoption of IPM has remained a challenge in the Irish horticulture sector because of diverse crops and systems of production. Over 2023 and 2024, the AgSustain project developed a horticulture IPM metric, using over 30 growers and advisors in three Delphi-method workshops for the top fruit, field, and protected crop systems in food horticulture. This metric was trialled and tested with 100 Irish growers to evaluate their IPM adoption.

This information was combined and analysed to develop and publish a unique IPM metric for food horticulture, the first of its kind, to measure and compare IPM across systems of production. Results of the survey show adoption is widespread among Irish growers with scores in the low- to mid-range (under 70, out of a maximum 100) with field crop growers performing best. This IPM metric has more recently been applied to a larger multi-country dataset of 480 farms to understand its application beyond Ireland, with a view to refining best practice. Cross-country comparison shows Ireland lags behind England in IPM adoption, with the policy landscape being highly influential on adoption at farm-level. The metric provides a method to benchmark IPM performance and chart cumulative progress on a national and cross-national basis, and highlights areas for improvement.

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**Impact Pathways:** Technology Development & Adoption; Policy Influencing



AGRIP

# Clover increases suckler cattle growth rates

Peter Doyle, Peter Bennett, Mark McGee, Paul Crosson, Michael O'Donovan, Nicky Byrne

International studies have shown that incorporating white and red clover into perennial ryegrass pastures has the potential to reduce fertiliser nitrogen requirements, increase animal performance and reduce greenhouse gas emissions. However, in Irish suckler beef systems there is a deficit of information on the benefits of incorporating clover into pastures.

Two studies were carried out at Teagasc Grange to fill this knowledge deficit. In the first study, yearling suckler steers and heifers grazing grass-white clover pastures over their 'second' grazing season (12 to 19.5 months of age) had a 24kg greater liveweight gain (LWG) of +0.1kg/day than those grazing grass-only pastures. This equated to a 14kg difference in carcass weight per animal.

The second study investigated the impact of a grass-only (150kg N/ha) or grass-clover (75kg N/ha – white clover for grazing and red clover for silage) pasture systems on lifetime cattle performance (from birth to finish).

The suckler progeny had a greater LWG from birth to weaning on the grass-white clover compared to the grass-only pasture, and a greater liveweight gain over the first winter on grass-red clover silage than grass-only silage, with no difference in liveweight gain over the 'second' grazing season. This equated to a 27kg greater final liveweight and 18kg greater carcass weight for the cattle on the grass-clover system.

Therefore, suckler beef farmers that incorporate red and white clover into grassland pastures can reduce their requirement for nitrogen fertiliser inputs and increase animal LWG in a suckler calf-to-beef system. This will improve their farm profitability, while also helping to meet sectoral climate targets.

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**Impact Pathway:** Technology Development & Adoption



**27kg**

**Cattle on the grass-clover system had a 27kg greater final liveweight than those on a grass-only system.**

Teagasc

CELUP

# Controlling fungicide resistance to late blight

Steven Kildea, Amanpreet Kaur, Deirdre Doyle, Ewen Mullins, Shay Phelan

In late autumn 2023, a single sample of *Phytophthora infestans* with resistance to the carboxylic acid amide group of fungicides was detected in Ireland. Currently the control of potato late blight caused by *P. infestans* is almost exclusively reliant on the application of fungicides. This highlights the immediate and significant threat the detection of this strain posed to the Irish potato industry.

To prevent such devastating impacts, it is essential to be able to rapidly detect this strain, devise control strategies to prevent its spread, and effectively communicate this to the industry.

A coordinated approach was taken between crops researchers and specialists to develop detection tools, and devise and disseminate field control strategies. To detect resistance, the team developed a digital droplet PCR capable of detecting *P. infestans* and associated fungicide resistance in a variety of matrices including potato leaves, FTA® preservation cards and spore samples. This allowed for the rapid and extremely sensitive detection of resistance.

In parallel, control strategies were devised which ensured both the mixing and alternation of fungicides at each application, guaranteeing field control whilst limiting potential selection for the resistant strain. These strategies were communicated to the industry throughout the season via dedicated workshops, crop walks, press articles and a trials tour. Whilst the strain was again detected in 2024, its impact on late blight control has been contained.

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**Impact Pathway:** Technology Development & Adoption



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## FOOD

## Food digestion models

Andre Brodkorb, Linda Giblin

Innovation in the food sector is leading to the continuous development of new foods and food ingredients. To better understand the relationship between food and health, scientists need to monitor the digestion and absorption of food in the human body.

However, animal or human studies on food digestion can be expensive and require invasive and sometimes unsuitable or unethical methods. It is now possible to simulate food digestion *in vitro*, i.e., the disintegration and breakdown of food into bioaccessible nutrients and their absorption across a simulated intestinal gut barrier.

Teagasc researchers, in collaboration with international scientists from academia and industry, have helped develop and validate *in vitro* digestion models across age groups – most notable being the INFOGEST method, published in 2019. This scientific paper has been the highest cited Teagasc publication for the last three years running, which is an

indicator for scientific excellence and worldwide acceptance of the digestion method.

Digestion of food ingredients and products are now offered as a service to food companies as part of Teagasc Moorepark's technical services to industry, SMEs, national and multinational companies alike. The INFOGEST method is currently being approved as an international IDF/ISO standard for the nutritional assessment of protein quality and digestibility (*in vitro* DIAAS method).

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**Impact Pathway:** Capacity Building

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## REDP

## Sustainable transition through generational renewal

Anne Kinsella

The 'Sustainable Transition of the Rural Economy Through Generational Renewal' project was completed in 2024. The project concluded that sustainable generational renewal programmes need a dual focus. Firstly, they require a framework of supports for adequate retirement income provisioning for retiring farmers (and their dependants) within a clear exit strategy from the farm. Secondly, a framework is required

to enable farm successors and new entrants a formal route to farm ownership through collaborative farming and alternative farm business structures.

In addition to desk-based research, the project team conducted case study interviews with farmers, advisors and other stakeholders. A final project report containing key policy recommendations was launched by Minister of State for Agriculture, Food, Fisheries and the Marine, Martin Heydon, TD. Subsequently, the research team were invited to discuss the key project findings and policy recommendations with the Common Agricultural Policy (CAP)

Entitlements Policy & Control Unit in the Department of Agriculture, Food and the Marine to inform

recommendations for the next round of CAP reform.

The research team also – by invitation – presented their policy recommendations to the Generational Renewal Commission, who were most interested in the research findings – particularly regarding the pension policy reforms aspects and their role in assisting farmers and their dependants to qualify for state pension support. Other high level policy impacts include presentation at the annual conference of the Irish Pensions Policy Research Group, European Committee of the Regions in Brussels, and the inclusion of project recommendations in an Irish Farmers' Association pre-budget submission report.

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**Impact Pathway:** Policy Influencing

Maxwell Photography



# Impact of Teagasc research publications

Emma Boughton, Teagasc Library and Information Services Officer

Teagasc uses two main approaches to identify the impact of its research: science excellence and societal impact. Science excellence focuses on peer-reviewed publications and their indicators of quality, while societal impact focuses on understanding the pathways through which such science is put into use and the changes it helps to bring about in society. Throughout this publication, we have focused on the impact pathways for each of the featured research impacts. In this article, we delve deeper into Teagasc's peer-reviewed publications.

## Peer-reviewed publications

Measuring the impact of research is a key activity for Teagasc. Here we consider one of the main indicators of science excellence – the performance of Teagasc articles in peer-reviewed journals – and compare it both to previous years and to the outputs of other relevant universities and Research Performing Organisations (RPOs). The inclusion criteria for this analysis are peer-reviewed articles published in the period 2019 to 2024, and having at least one Teagasc author.

Bibliometric analysis, which is based on citation counts, is one way to evaluate published research outputs. Citation counts and metrics from the Scopus database and the related SciVal research analytics tool were used in this analysis.

## How Teagasc compares

Comparing Teagasc with Irish universities and other RPOs for this period, Teagasc published the second highest number of articles and had the second highest overall citation count in the SciVal broad category of 'Agricultural & Biological Sciences'. For the narrower categories of 'Food Science' and 'Agronomy and Crop Science', Teagasc had the highest overall number of articles (see Figure 1).

Teagasc also performed well when compared to all European governmental organisations. For the category 'Agricultural & Biological Sciences', SciVal data places it 10th by total number of articles, and third by number of articles in the category of 'Food Science'.

The strong international and national reputation of Teagasc research is demonstrated by the fact that in the years 2019 to 2024, 59% of the Teagasc peer-reviewed articles indexed by SciVal listed international collaborators, with a further 36% listing national collaborators.

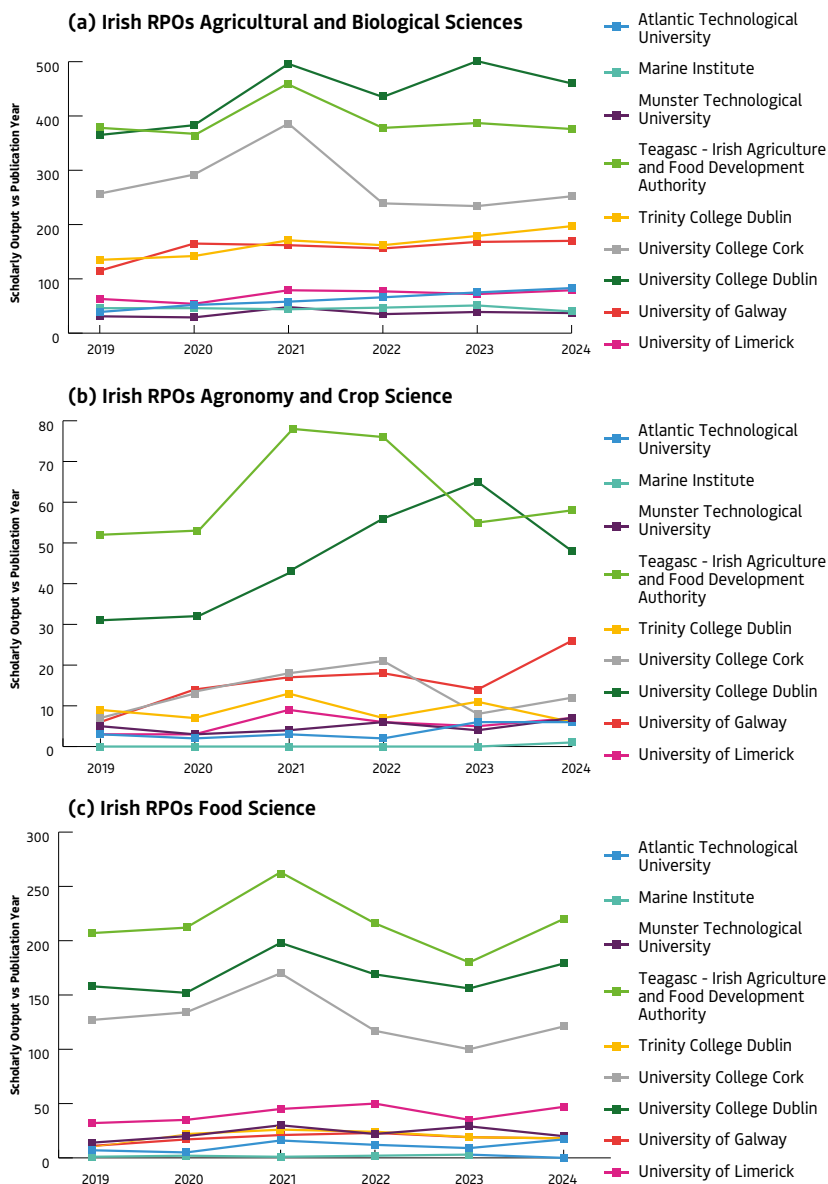


Figure 1: Number of papers by the top ten performing Research Performing Organisations in Ireland indexed in the SciVal in the category of (a) Agricultural & Biological Sciences; (b) Agronomy and Crop Science; and (c) Food Science.

### 2024 highlights

654

Articles published

68%

Open access

### Outputs in top percentiles in 2024

16

Publications in the top 10% most cited publications worldwide

54

Publications in the top 10% of journals by CiteScore

# Impacts from technology development and adoption by industry

Compiled by Siobhán Jordan, Head of Technology Transfer and Commercialisation, Teagasc



Teagasc’s research and innovation activities in 2024 have contributed to the development of practical solutions for the agriculture and food sectors. By working closely with agri-food companies and industry partners, Teagasc supported the development and adoption of research, technologies, and knowledge that help to address productivity, sustainability and regulatory challenges across the sector.

For example, in 2024, Teagasc strengthened its role as a key innovation catalyst for Ireland’s food sector, delivering over €2M worth of high-impact technical and innovation services to 198 clients through the organisation’s Food Programme. A significant share of these services was delivered across the meat, dairy, and prepared consumer foods sectors – cornerstones of Ireland’s agri-food economy.

Engage@Teagasc, the organisation’s dedicated Technology Transfer Office, continues to enable and support industry collaboration, entrepreneurship, and commercialisation. In 2024, the team supported 27 invention disclosures from across the Research programmes and filed three new patents. A total of 49 Licences, Options, and Assignments (LOAs) were signed, underlining the high level of commercial interest in Teagasc technologies.

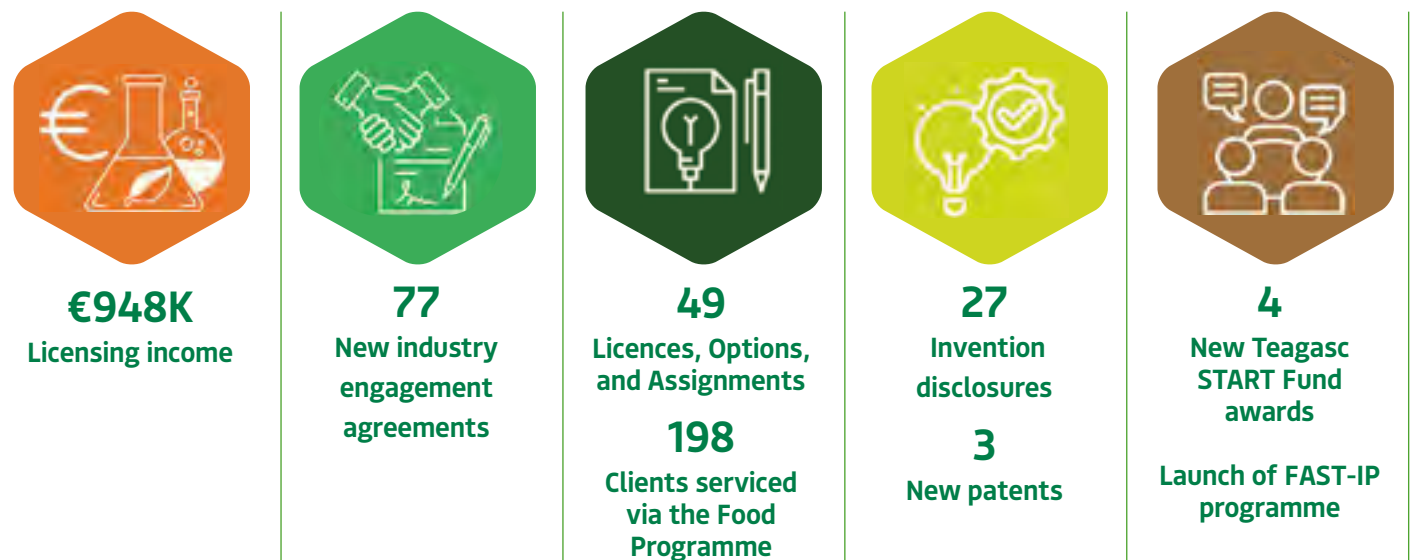
Profitable partnerships with companies through funding support from Enterprise Ireland, including Innovation Vouchers and Innovation Partnerships, are essential for collaboration and knowledge exchange.



Highlights also included the launch of the FAST-IP entrepreneurship programme with UCD, and the support of four new Teagasc START Fund awards to further develop high value commercial opportunities.

With the rollout of a revised Intellectual Property policy, 2024 has seen Teagasc strengthen its internal systems to support sustainable impact from research. These foundations ensure that future innovations are developed, protected, and translated to benefit Ireland’s farmers, food producers, and rural communities.

## 2024 activities and impacts delivered by Engage@Teagasc facilitating the delivery of end-user ready solutions





## Shedding some light

The ContinuFOR site Fossy Hill underwent a light thinning to transform the Sitka spruce stands to continuous cover forestry (CCF). Thinning provides timber, while also increasing the growing space and light levels for the remaining trees. Another name for CCF is low impact management, and it is an alternative management option to clearfell forestry. Sites like Fossy Hill demonstrate alternatives to clearfell rotation forestry, and help with our research on the productivity and benefits of CCF systems.

**Photo and description by:**

Grace Jones

**Teagasc Project:**

ContinuFOR

**Funding:**

Department of Agriculture,  
Food and the Marine