



# TEAGASC

## RESEARCH IMPACT HIGHLIGHTS IN 2018



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The annual expenditure on research in Teagasc is approximately €65 million, which comes from a variety of sources. These include the core grant-in-aid funding allocated by the Department of Agriculture, Food and the Marine (DAFM), and competitive funding awarded nationally – principally, the Food Institutional Research Measure (FIRM), the Research Stimulus Fund and Competitive Forestry Research for Development (CoFoRD) programmes of the DAFM. Other important national sources are Science Foundation Ireland, Enterprise Ireland, the Environmental Protection Agency, and the Irish Research Council, and in recent years our researchers have been very active in winning funding from international programmes such as EU Horizon 2020. Farmer levy contributions, industry-funded research, and earnings from services offered and farming activities also provide funding.

In total, this is a very significant investment and, given the Teagasc mission to support science-based innovation in the agri-food sector and the wider bioeconomy, it is very important to demonstrate the impact of this investment. In any given year, the impact of Teagasc research is a combination of the continuing impact of past research, and the new impact of recent research. This publication highlights some of these new impacts achieved in 2018. The examples selected are from across our programme and range from research conducted on issues in soils and the environment, animal production, crop production, food processing, food and health, to economics and social science. They are not an exhaustive account of the impact of Teagasc's research but they do demonstrate the breadth of research carried out by Teagasc. The impacts are made in a range of areas including livestock and crop (including

horticulture) production, and the food industry, and they demonstrate an impact on shaping policy.

Of course researchers are not solely responsible for achieving these impacts. They also depend on the work of others, such as our advisers and specialists, experts in other organisations and industry, and farmers, food companies and policy makers, who ultimately make the changes in what they do based at least in part on our research.

I wish to commend my colleagues in Teagasc who carried out the research reported here or supported it in some way, and other researchers whose work also had impact but is not included in these 20 examples. I would also like to acknowledge the many collaborators we have in universities, institutes of technology and other external bodies, as well as the farming community and agri-food companies, which were directly involved in many of the research projects leading to these impacts. We greatly value those contributions, which are highlighted in the individual reports.

Finally, I would like to thank the funders of the research, which are listed above. I believe it is wise investment and will pay rich dividends across the agri-food industry, the wider economy, and Irish society over the coming years.



**Frank O'Mara**  
Director of Research, Teagasc

## Teagasc National Farm Survey Fertiliser Use Survey 2005-2015

Emma Dillon, Cathal Buckley, Brian Moran,  
John Lennon, David Wall

### Beefing up dairy-beef cattle

Donagh Berry

**Industry impact:** The expanding dairy herd, coupled with improving reproductive performance, will necessitate that a greater proportion of slaughtered cattle in Ireland will originate from dairy herds. However, the genetic antagonism in cattle between carcass merit and the extent of assistance required at calving demands an index that combines the desired genetic attributes from the perspective of the dairy producer (i.e., easy calving, short gestation) with those of the beef producer and industry as a whole (i.e., efficiency of growth of valuable meat). A profit-based breeding index with eight traits was developed, and subsequently deployed by the Irish Cattle Breeding Federation, to improve the carcass merit of the delivered calf with minimal consequences on the dairy cow. The suites of traits included reflect calving performance (65% of emphasis), carcass merit (26% of emphasis), feed intake (8% of emphasis) and management traits (1% of emphasis). The breeding index will be used by dairy farmers for selecting suitable beef bulls for use on their dairy females, but will also be used by beef bull breeders to breed the next generation of beef bulls demanded by dairy producers.

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**Other contributors and collaborators:**  
Irish Cattle Breeding Federation and AbacusBio.

**Funding:** VistaMilk SFI Research Centre.

**Industry impact:** This publication reports the quantities of macronutrients, nitrogen (N), phosphorus (P), potassium (K) and lime applied on Irish farms over the period 2005 to 2015. These data were collected through the Teagasc National Farm Survey (NFS), which contains information on the types of fertiliser used on both grassland and arable farms in Ireland on an annual basis. Trends for chemical fertiliser use are presented by nitrates zone, land use class, farm system, stocking rate band and agri-environmental scheme participation. Factors external to the farm gate such as prices, weather or regulatory changes can influence fertiliser application rates. The data indicates that higher application rates of N, P and K on grassland were generally associated with farms in nitrates zone A, farms of wide land use potential, dairy farms and those with higher stocking rates. Application rates were on average one-third lower for agri-environmental scheme participants. The report covers an important period during which the EU Nitrates Directive came into operation, bringing with it significant changes to chemical fertiliser management both at farm and field level. The report received widespread coverage in the farming press, in particular highlighting the underutilisation of lime on Irish farms. The data has subsequently been used by the Department of Agriculture, Food and the Marine in documenting the benefits of lime use on acidic soils.

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**Funding:** Teagasc grant-in-aid.

## What is Irish grass-fed milk?

Donal O'Brien, Brian Moran, Laurence Shalloo

**Industry impact:** Sustained market interest in grass-based milk is leading to more consumer requests for information on the quantities of grass in a dairy cow's diet. To meet this new demand, we developed a model that can provide robust numbers around the levels of pasture consumed by dairy cows. Our model was published in an internationally peer-reviewed journal and deployed via the Teagasc National Farm Survey's 320 dairy farms to generate a nationally representative Irish grass-fed number, i.e., the percentage of grass as fed in the diet of dairy cows. The analysis showed that the average grass-fed number for Irish dairy farms is 95% of the diet on an as-fed basis. Currently, the model is being applied within the Sustainable Dairy Assurance Scheme to generate a grass-fed number for every Irish dairy farmer. The model's approach will be used to develop a grass-fed standard, which will provide certainty for customers and counteract claims that may be false.

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**Funding:** Teagasc grant-in-aid.

## AranLIFE

Daire Ó hUallacháin, Louise Duignan, John Finn (all Teagasc), James Moran (GMIT)

**Industry impact:** The collaborative AranLIFE project saw the effective implementation of a results-based approach that pays farmers for the quality of the species-rich grassland that they deliver, resulting in increased biodiversity value of over 1,000ha of priority Natura 2000 habitat (EU-protected areas). The project developed a targeted grazing plan to support stock and maintain the quality of priority grassland. The project also identified seasonal limitations with forage quality and developed customised diet supplements for livestock to improve their health, welfare and value while grazing on the species-rich vegetation. This project is impactful because of increased commitment in the EU to results-based approaches in Pillar 1 and 2 of the Common Agricultural Policy (CAP). The effectiveness of the project was recognised through securing funding (€1.45 million) for a follow-up European Innovation Partnership (EIP) project, Caomhnú Árann.

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### Contribution of non-research stakeholders:

The project would not have been possible without the involvement of the 68 AranLIFE farmers and the wider farming community of the Aran Islands.

### Other contributors and collaborators:

AranLIFE was a collaborative project, with the Department of Culture, Heritage and the Gaeltacht as the Co-ordinating Beneficiary, Teagasc as the Associated Beneficiary and the Department of Agriculture, Food and the Marine, Fáilte Ireland, the Heritage Council and Galway County Council involved as co-financiers. James Moran (Galway-Mayo Institute of Technology) also collaborated on the project.

**Funding:** Funding was secured through national (see collaborator list) and EU funding (EU LIFE+ Nature Funding).





## INFOGEST 2.0

André Brodtkorb

**Industry impact:** Simulated gastrointestinal digestion is widely employed in many fields of food and nutritional sciences, as conducting human trials are often costly, resource intensive and ethically disputable. As a consequence, *in vitro* laboratory-based alternatives that determine endpoints such as the bioaccessibility of nutrients or the digestibility of macronutrients are used for screening and building new hypotheses. Teagasc researchers have been involved in a large-scale EU-funded network to improve and standardise the scientific protocol for simulating food digestion. The protocol is a result of a long-term collaboration between more than 27 academic institutes from 18 different countries. INFOGEST 2.0 is a standardised step-by-step *in vitro* protocol for the study of gastrointestinal digestion of food. It is based on an international consensus developed by an EU-funded COST Action INFOGEST (2011-2015) and includes digestive enzyme assays, spreadsheets, videos and links to online tools and a YouTube channel. The method is now the academic and industry standard to simulate the digestion of food using standard laboratory equipment. It has been validated in several *in vivo* trials and is a particularly good approximation of the gastrointestinal digestion of dairy products. It is a static digestion method that uses constant ratios of meal to digestive fluids and a constant pH for each step of digestion.

The method is designed to be used with standard laboratory equipment and requires limited experience to encourage a wide range of researchers to adopt it.

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**Other contributors and collaborators:** Collaborators from Europe, North America, Australia and New Zealand.

**Funding:** European Cooperation in Science and Technology (COST) Action FA1005, Dairy Research Ireland, Department of Agriculture, Food and the Marine Food Institutional Research Measure (FIRM).

## Salad potato production in Ireland

Michael Hennessy, Shay Phelan,  
Denis Griffin, John Pettit



**Industry impact:** Salad potatoes or 'baby' potatoes are a growing consumer segment (growing approximately 7-10% year on year). In 2014, salad potato production in Ireland accounted for approximately 15% of production, with imports filling the gap. A joint industry plan involving Teagasc as the lead, the Irish Farmers' Association and Bord Bia (Irish Food Board) set about increasing Irish production (with a target of 50%), thereby achieving import substitution. The programme addressed technical production problems by farmers and also market access issues. Slaney Farms provided a hub for meetings and co-designing solutions to technical issues encountered by growers. This farm and others provided a vital link to demonstrating best practice and acceptability of the concept to other farmers. After the three-year programme, production is estimated to have increased by over 200% from approximately 3,000 tonnes/per year to over 7,000 tonnes in 2018.

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### Contribution of non-research stakeholders:

Teagasc specialists and advisors and John Stafford, Slaney Farms, Wexford.

### Other contributors and collaborators:

Irish Farmers' Association, Bord Bia, Scotland's Rural College (SRUC) and Stuart Wale, Potato Specialist.

**Funding:** Teagasc grant-in-aid and Bord Bia.

## Quantification of lipid oxidation in dairy powders

Kieran Kilcawley, David Mannion, Holly Clarke

**Industry impact:** Lipid oxidation is a major contributor to the deterioration of food quality, resulting in the formation of undesirable compounds, odours and flavours in dairy powders, which can limit shelf life and product quality. The sensory perception and composition of milk powders is heavily dependent on the milk from which it was derived; and on processing parameters such as temperature, drying time, packaging material and storage conditions. Traditional methods to evaluate lipid oxidation in dairy powders can both under- and overestimate the problem. Identification and quantification of the key volatile compounds arising from lipid oxidation known to influence the sensory perception of dairy products is a significant step forward. A new method was developed and validated using headspace solid phase extraction gas chromatography mass spectrometry to quantify 13 critical lipid oxidation volatile aromatic compounds below their sensory perception thresholds. This method is already being used by producers of dairy powders to monitor quality and potentially predict shelf life.

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**Funding:** Teagasc funding project 0044 (Profiling Milk from Grass).

## Financial impact of risk management tools

Jason Loughrey, Trevor Donnellan, Fiona Thorne

**Industry impact:** Economists from Teagasc, Cork Institute of Technology and University College Cork launched a report called 'An evaluation of suitable tools to manage price/income volatility at dairy farm level in Ireland' in September 2018. The report contains an assessment of currently available risk management tools, including the income averaging system. The research highlighted the strict eligibility rules relating to participation in the income averaging system, which meant that over half of all specialist dairy farms were automatically excluded from participation in the system. As a result, in Budget 2019, the scheme eligibility rules relating to off-farm employment were removed, thereby permitting a much greater number of farms to avail of the income averaging system.

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**Contribution of non-research stakeholders:** Dairy Research Ireland and the Irish Co-operative Organisation Society (ICOS) provided organisation and administrative support during the project. Farmers participating in the National Farm Survey, Teagasc farm recording staff and Brian Moran (Teagasc).

**Other contributors and collaborators:** Farm Development Co-op (FDC) and UBS. Micheál O'Leary of Teagasc supplied data and ICOS. Dennis Bergmann, Declan O'Connor (CIT) and Thia Hennessy (UCC) also contributed to this research.

**Funding:** The Dairy Research Trust.



## First Irish red clover variety

Patrick Conaghan

**Industry impact:** The first ever Irish red clover (*Trifolium pratense*) variety, named FEARGA, has been bred by Teagasc at Oak Park, Carlow, as part of the Animal & Grassland Research and Innovation Programme. Red clover is a nitrogen (N)-fixating legume with the capacity to fix 150-200kg N/ha/year. It is relatively drought tolerant due to its deep tap root, offering superior production to white clover in dry summers. It is primarily used for silage production, offering high yields of high-quality forage with greater animal intakes and performance than grass silage. It is an ideal break crop to improve soil structure and fertility and to supply organic matter. FEARGA was bred from the variety Merviot by one cycle of phenotypic recurrent selection for high yield, persistency and longevity. There are no official red clover trials in Ireland. However, FEARGA has completed the UK official trials across Northern Ireland, Scotland, England and Wales – where it excelled. FEARGA was found to be the highest yielding variety in the UK, yielding 22% and 31% more than the control variety Merviot in the second and third harvest years, respectively. FEARGA also offered significant improvements in persistency, with 54% higher autumn ground cover than Merviot in the third harvest year. FEARGA is officially recommended for use by farmers across the UK. FEARGA is the foremost red clover variety for Ireland and is expected to dominate the market for years to come.

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**Contribution of non-research stakeholders:** FEARGA is currently being commercialised under licence by Goldcrop Ltd., an Irish seeds and inputs company, which will market and distribute seed to farmers across Europe, including Ireland and the UK.

**Funding:** Variety licence and royalty fees from the seed industry and Teagasc grant-in-aid (RMIS 6378).

## National spotted wing Drosophila monitoring programme

Michael Gaffney, David Brogan



**Industry impact:** The Irish soft fruit sector is one of the most valuable in Irish horticulture. Since 2015 Teagasc, in collaboration with UCD, the Irish soft fruit industry and Bord Bia, have been conducting on-farm monitoring for the invasive fruit fly *Drosophila suzukii*, or spotted wing Drosophila. *D. suzukii*, originally from southeast Asia, has become the major pest of soft and stone fruit worldwide in the last decade. *D. suzukii* damages fruit during the ripening and ripe stages, in contrast with other Drosophila species that damage only over-ripe fruit. In 2018, 17 commercial farms were submitting weekly samples to Teagasc. The information collected has been essential in providing both a national overview on the spread of this commercially important invasive pest; and also providing growers with specific information on their farm. The data generated has been essential to support changes in crop management to reduce the impact of this pest, as well as the temporary registration of new control options. Significant research efforts are ongoing to address spotted wing Drosophila globally. The monitoring programme has allowed us to fully participate in and map international best practice to Irish conditions and allow mitigation measures to be evaluated more quickly.

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**Contribution of non-research stakeholders:** Eamonn Kehoe, Teagasc Soft Fruit Advisor and the Irish Soft Fruit Growers' Association.

**Other contributors and collaborators:** Jan Robert Baars (UCD).

**Funding:** Co-funded by participating Irish soft fruit growers, Bord Bia and Teagasc grant-in-aid.



## Future levels of Irish agricultural greenhouse gas and ammonia emissions

Trevor Donnellan, Kevin Hanrahan, Gary Lanigan

**Industry impact:** The future level of agricultural activity in Ireland is subject to considerable uncertainty for several reasons. These would include: the outcome of Brexit; potential EU trade agreements with third countries; the future size of the EU budget (2021 to 2027); and, the next Common Agricultural Policy (CAP) reform. To take account of such uncertainty, six different scenarios were developed to scope out the size of the Irish agricultural sector in the future. This largely involved making differing assumptions about how the dairy and beef sector would evolve in the period to 2030, as these sectors are the principal source of Irish agricultural greenhouse gas (GHG) emissions. This then allowed projections to be made about how Irish agricultural GHG and ammonia emissions might evolve to 2030. These emissions could then be compared with potential emission reduction targets to see how much of a gap would need to be filled through actions designed to mitigate GHG and ammonia emissions from the sector.

Using research from a separate study, which developed marginal abatement cost curves for agricultural GHG and ammonia emissions, it was then possible to determine the likely level of future emissions that could result under the various scenarios and the implications this would have for Ireland's compliance with GHG and ammonia mitigation targets.

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**Funding:** Teagasc grant-in-aid.

## Food Works – producing the next generation of food entrepreneurs

Ciara McDonagh, Eddie O'Neill, Carol Griffin

**Industry impact:** Food Works is a Government-supported accelerator programme that helps to develop the next generation of scaleable and export-driven Irish food businesses. It is run by three Government agencies: Teagasc; Bord Bia; and, Enterprise Ireland. Teagasc offers technical support to the companies on the programme, particularly expertise in terms of product and process development. Following a rigorous selection process, nine ambitious Irish food and drink companies were selected to take part in Food Works 2018, and a number of success stories have resulted. Shane Ryan from Limerick City founded Fiid and has launched a range of meals designed to eliminate mindless snacking by keeping you fuller for longer. Fiid's four-minute plant-based meal pots are currently available in retailers across Ireland including Supervalu and Dunnes Stores, with the company donating a meal to a child in the developing world for every pot sold.

Wellnice Foods was founded by nutritionist BJ Broderick and engineer Trín O'Brien from Limerick City. Their first product, Wellnice Pops, developed under the Food Works Programme, is a range of healthy ice pops made exclusively from cold-pressed vegetable and fruit juice. Wellnice Pops are now stocked in a number of independent health food shops and specialty stores across the country.

Juspy, a functional foods company focusing on the nutritional needs of women at different life stages, was founded by Leonie Lynch. 2018 saw the launch of the company's first product, Juspy Natural Nourishment, which was developed and is currently being produced at Teagasc Moorepark. Juspy now employs three people and is available online and in a range of cafés and health food shops.

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**Contribution of non-research stakeholders:** Enterprise Ireland and Bord Bia work in collaboration with Teagasc to deliver the Food Works Programme.

**Funding:** Teagasc, Bord Bia and Enterprise Ireland.





## Improving soil fertility on heavy soils farms

David Corbett, David Wall, Ger Courtney, James O'Loughlin, John Maher, Bridget Lynch, Pat Tuohy

**Industry impact:** Increased nutrient efficiency is a key requirement on farms in order to meet environmental sustainability and production growth targets. Heavy soils with high proportions of fine soil particles tend to offer particular challenges in terms of nutrient-use efficiency and achieving good soil fertility status. Over the past number of years, we have generated a dataset from the Heavy Soils Programme (HSP), which allows for analysis of soil nutrient dynamics across these soil types. An intense regime of data collection at a paddock scale in terms of nutrient inputs (chemical/organic fertiliser, concentrates) and off-takes (milk, meat, silage, grass) allows for an in-depth understanding of changes in soil nutrient levels when compared with annual soil tests over an extended period (five years). Data on the response rates of these soils, being gathered both through real farm data and controlled studies on HSP farms, is allowing for soil-specific nutrient management recommendations for the 10 heavy soils farms. Targeted nutrient improvement measures across the HSP farms have seen them move from a position where only 2% of paddocks sampled in 2013 were optimum for pH, phosphorus (P) and potassium (K), to the current position where 30% of paddocks achieve this status. Recommendations from the Programme are benefitting farmers working on similar soils through the Knowledge Transfer programme.

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**Other contributors and collaborators:** University College Dublin.

**Funding:** Kerry Agribusiness.

## Identifying pest risks to Sitka spruce

Melanie Tuffen, Helen Grogan



*Image: Chris Malumphy, Fera Science Ltd., UK.*

**Industry impact:** Sitka spruce is the predominant tree species used in Irish forestry and it is currently relatively free of damaging pests and diseases. An in-depth study identified over 1,000 pests and potential pests of Sitka spruce. A new pest risk analysis (PRA) scheme for Ireland was developed and high-risk species have been identified and subjected to PRA. Spruce bud scale, hemlock looper and nun moth are listed as 'high-risk' pests with potential to cause significant damage should they be introduced to Ireland. Measures to reduce the risk of introductions are being considered by the Department of Agriculture, Food and the Marine (DAFM). The PRA scheme was presented to external stakeholders at a meeting held by the DAFM on their plant health strategy. The pest list will be utilised by other European countries, including by an alliance of Nordic countries, investigating threats to their coniferous forestry.

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**Contribution of non-research stakeholders:** Private and State forestry inspectors and personnel provided knowledge and expertise at stakeholder meetings.

**Other contributors and collaborators:** DAFM Plant Health Laboratory, Maynooth University, DAFM Forest Service.

**Funding:** DAFM CoFoRD.

## Can a cheese snack make you feel 'fuller for longer'?

Linda Giblin, Tom Beresford, Alina Kondrashina

**Industry impact:** In an effort to control weight gain, Teagasc research has focussed on foods that increase the feeling of fullness. A study of Irish Cheddar cheese demonstrated that most resulted in increased production of the satiety hormone GLP-1 in an *in vitro* assay. A commercial Cheddar, which contained a non-fat component that increased GLP-1 production 10 fold, was selected and, in collaboration with the Food for Health Ireland consortium and industry partners, a human trial was undertaken. Blood levels of GLP-1 were significantly higher 90 minutes after cheese consumption compared to consumption of an egg or scone-based snack, suggesting that Cheddar may be a viable alternative snack that increases the feeling of fullness and thus offers the industry a new marketing strategy for cheese in the snack food sector.

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**Contribution of non-research stakeholders:**  
Food for Health Ireland industry partners.

**Other contributors and collaborators:**  
Food for Health Ireland.

**Funding:** Enterprise Ireland, Food for Health Ireland TC201 30001.

## Institutional drivers of land mobility

Anne Kinsella, Cathal Geoghegan\*, Cathal O'Donoghue\*\*

**Industry impact:** During 2018, the OECD Working Party on Agricultural Policies and Markets (APM) became most interested in research methodology employed in relation to the institutional drivers of land mobility. Research was presented to the OECD, with reference to the impact of taxes on farm transfers and structural adjustment. It was highlighted as a unique research methodology applied at the farm level, with no comparable research applications found in literature internationally. The research, through micro-simulation modelling, focused on policy and taxation drivers. Long-term leasing income taxation incentives were applied to various farm scenarios. An OECD report on taxation in agriculture from the Trade and Agriculture Directorate, Committee for Agriculture (Ref:TAD/CA/APM/WP(2019)1) is forthcoming and references this research. The OECD is to explore future work in this area in collaboration with other network participants. In 2017, following publication of the research, direct correspondence was received from the Cabinet of Commissioner Phil Hogan referring to this research area and related research papers, with findings further discussed/circulated within DG-AGRI.

Research was instrumental in providing more focused pre-budget submissions to the Agri-Taxation Review Working Group. Income stabilisation and taxation measures, including further incentives for longer-term leasing to improve land access for aspiring and expanding farmers were implemented, thus giving farmers more certainty in planning the long-term strategy for their business.

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**Contribution of non-research stakeholders:**  
Knowledge transfer specialists have facilitated dissemination of the research. Teagasc Agri-Taxation Submission Working Group (Fintan Phelan, Kevin Connolly, Thomas Curran, James McDonnell and Anne Kinsella).

**Funding:** Funding provided by Teagasc Walsh Fellowship scheme and Brendan Kearney and Associates, Economic Consultants.

\*Former Teagasc Walsh Fellow/currently NUIG. \*\*NUIG.



## Teagasc Pig Production Model

Julia Adriana Calderón Díaz, Laurence Shalloo, Michael McKeon, Ger McCutcheon, Alan Bohan, Edgar Garcia Manzanilla

**Industry impact:** Teagasc has already developed stochastic simulation economic models for dairy, beef and sheep. With the development of the Teagasc Pig Production Model (TPPM), Teagasc has economic models for all the main livestock industries available. These models produce very reliable economic predictions of the studied scenarios and help in the prioritisation of actions. In addition to the model, user-friendly decision tools have been developed for the farmers. The TPPM has been built with data from more than 60 commercial pig farms in close collaboration with farmers and advisors. It has already been used for cost-benefit analysis of the main options considered by farmers under the Targeted Agricultural Modernisation Scheme (TAMS), to quantify the effects of different pathologies commonly found in Irish pig farms (Porcine reproductive and respiratory syndrome (PRRS), flu, enzootic pneumonia and pleuropneumonia), and is now being used to optimise diet formulation and feeding practices. The TPPM was developed in collaboration with members of the ProHealth FP7 project (EU funded).

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**Contribution of non-research stakeholders:** More than 50% of farmers included in the Teagasc eProfit Monitor have donated their data; and private veterinary practitioners, nutritionists, abattoirs and all pig advisors have contributed with different information required.

**Other contributors and collaborators:** Jarkko Niemi (LUKE, Finland) and Ilias Kyriazakis (Newcastle University, UK).

**Funding:** Department of Agriculture, Food and the Marine project PathSurvPigs 14/S/832 and Teagasc grant-in-aid project TPPM ref 0057.

## IPM strategies for septoria tritici blotch

Steven Kildea, Hilda Dooley, Deirdre Doyle, Fiona Hutton



**Industry impact:** Septoria tritici blotch (STB) caused by *Zymoseptoria tritici* continues to be the most economically destructive disease of Irish winter wheat crops. As a wet weather disease, Irish crops are at considerable risk and, as such, Irish farmers must apply fungicides to protect potential yields. Unfortunately, this combination has meant that the Irish *Zymoseptoria tritici* population has developed resistance to the main fungicides used for its control. In light of these changes, and continued regulatory pressures on the availability of multisite fungicides, Teagasc research is ongoing to determine the best means to ensure that Irish winter wheat crops are protected, but equally to discover how best to manage resistance to current and future fungicide chemistries. To achieve these goals Teagasc combines detailed sensitivity monitoring with an extensive programme of field trials throughout the main wheat growing regions in Ireland. These have resulted in an increased awareness of the need to maximise the concept of integrated pest management in cereal disease control programmes, with increased emphasis being placed on both varietal choice and agronomic practices used by growers. Resulting control strategies are recommended by Teagasc tillage specialists and advisors and published in national and international press.

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**Contribution of non-research stakeholders:** Septoria-infected leaf samples were supplied by Teagasc Advisory staff. Control strategies are developed in consultation with the Teagasc tillage specialists.

**Funding:** Funding for this research was provided under the Teagasc Walsh Fellowship scheme and the Department of Agriculture, Food and the Marine Research Stimulus Fund (11S113 & 13S503).

## Novel procedure to generate transparent, edible and insoluble haemoglobin films

Carlos Álvarez, Anne Maria Mullen

**Industry impact:** The food and packaging industries are keen on adapting novel biomaterials to reduce the current dependency on petrol-based materials. Also, the EU is demanding a reduction in the generation of food waste, encouraging its recovery, reutilisation and revalorisation. A novel method to generate transparent, food-grade and insoluble bioplastics from pork haemoglobin has been developed; it faces both issues by generating a novel biodegradable and sustainable material to partially replace petroleum-based materials, while blood from meat processors is revalorised.

Such technology has the potential to be transferred to other protein-based films, the high solubility of which restricts the range of applications. It also unlocks the potential of using wasted proteins as a renewable source for many applications, such as food packaging, bioactive carriers or even biomedicine.

Two companies operating at global level, and another at national level, were contacted and are deeply interested in furthering collaboration on this project, aiming to transfer this technology to the industrial scale.

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**Other contributors and collaborators:** University of Oviedo (Spain) and DIT (Dublin, Ireland).

**Funding:** ReValueProtein Research Project (Grant Award No. 11/F/043) supported by the Department of Agriculture, Food and the Marine (DAFM) under the National Development Plan 2007–2013 funded by the Irish Government.

## Chlorine-free cleaning

David Gleeson

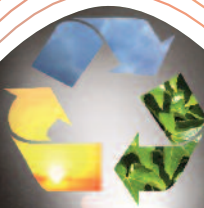
**Industry impact:** It is becoming increasingly difficult to achieve dairy product specifications, when chlorine-based products are incorporated in milking equipment cleaning routines on farm. Residues such as trichloromethane and chlorate in milk are directly linked to the use of chlorine-based cleaning detergents. An alternative to the difficult task of policing proper use of chlorine-based detergents on farm is to remove chlorine as an ingredient from the detergent. To address the needs of industry, new non chlorine-based cleaning protocols have been developed and evaluated on research farms. The implications of removing chlorine at farm level on microbiological and residue levels are being investigated on commercial farms. Guidelines on best practice plant cleaning (in the absence of chlorine) have been compiled (Moorepark Dairy Levy Research Update, Series 37). These booklets have been distributed to 10,000 milk suppliers through the relevant milk processors.

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**Contribution of non-research stakeholders:** Detergent manufacturers.

**Other contributors and collaborators:** Milk quality advisors and milk processors have facilitated the dissemination of this research.

**Funding:** Teagasc grant-in-aid (RMIS 6643) and Dairy Research Ireland.



## Impact of Teagasc research publications

Máire Caffrey

As a research-performing organisation, Teagasc needs to evaluate research outputs to justify investment, guide decisions on the direction of future research and understand how performance compares to similar organisations. Funding bodies require data to show return on investment and researchers like to know how their peers rate their outputs.

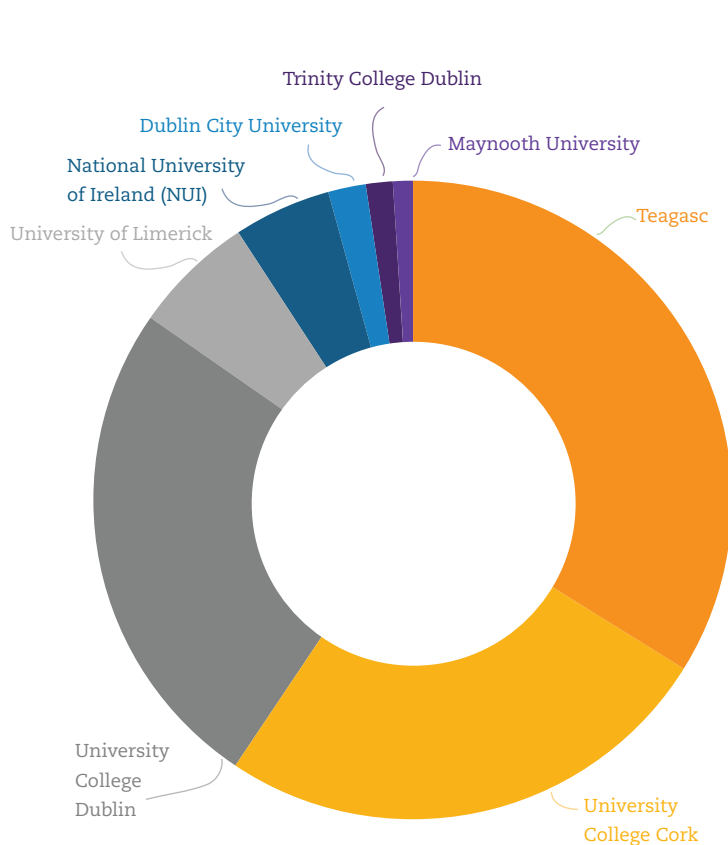


Figure 1. Number of papers by Teagasc and Irish universities that are indexed in the Web of Science category Food Science and Technology (2014-2018).

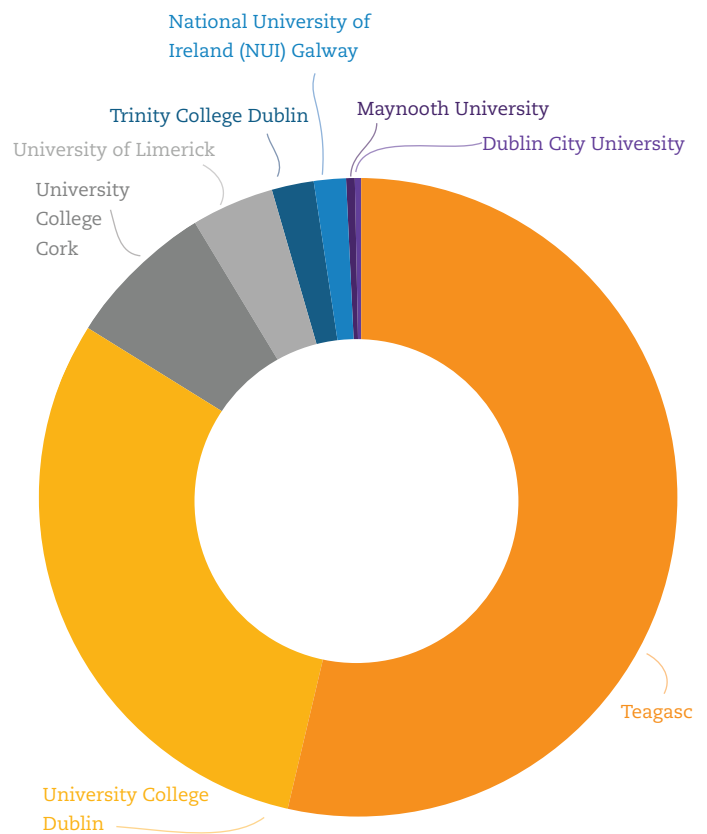


Figure 2. Number of papers by Teagasc and Irish universities that are indexed in the Web of Science category Agriculture, Dairy and Animal Sciences (2014-2018).

Teagasc monitors its research impact in various ways. Counting citations of a researcher's articles, by other scientific articles, is one metric that can be used (bibliometric analysis). There are a number of resources available providing both these citation counts and other metrics. Teagasc uses Web of Science, and its accompanying research evaluation tool InCites. Web of Science is an online subscription-based citation indexing service, which enables exploration of the scientific literature, as well as counting citations to each indexed article. InCites is a research evaluation tool that allows an organisation to analyse institutional productivity and benchmark outputs.

When using citation-based metrics, comparisons within subject categories are the most meaningful. To place our performance in a national context, we can compare Teagasc's performance with that

of the eight Irish universities, within two relevant subject categories: (a) Food Science and Technology; and, (b) Agriculture, Dairy and Animal Sciences.

Considering articles published in the period 2014 to 2018 and indexed in Web of Science, we can make the following comparisons:

- within category (a) Food Science and Technology, Teagasc ranks first by number of publications (742) and also first by number of citations (6,561 – as of March 2019); and,
- Within category (b) Agriculture, Dairy and Animal Sciences, Teagasc ranks first by number of publications (414) and also first by number of citations (2,075 – as of March 2019).

Of course, all bibliometric analysis must be placed in context and the impact of our research must be evaluated in a variety of other ways in order to give the full picture.



## Teagasc Research Programmes

Teagasc's mission is to support science-based innovation in the agri-food sector and wider bio-economy that will underpin profitability, competitiveness and sustainability.

This is achieved through the close coupling of research and knowledge transfer in four programme areas:

- Animal & Grassland Research and Innovation;
- Crops, Environment and Land Use;
- Food; and,
- Rural Economy and Development.

### Animal & Grassland Research and Innovation Programme Departments

- Animal & Bioscience Research
- Grassland Science Research
- Livestock Systems Research
- Pig Development
- Dairy Knowledge Transfer
- Drystock Knowledge Transfer

**Locations:**

- Athenry, Co Galway
- Grange, Dunsany, Co Meath
- Moorepark, Fermoy, Co Cork

### Crops Environment and Land Use Programme Departments

- Crops Research
- Environment, Soils and Land Use Research
- Forestry Development
- Horticulture Development
- Agricultural Catchments
- Crops Knowledge Transfer
- Environment Knowledge Transfer

**Locations:**

- Johnstown Castle, Co Wexford
- Oak Park, Co Carlow
- Ashtown, Dublin 15

Each of these programmes is composed of research, development and knowledge transfer/industry development departments, as outlined below. Research is conducted at six dedicated locations, while knowledge transfer professionals are located throughout the country (see map on back cover).

Our annual research portfolio comprises some 350 research projects carried out by 800 scientific technical and other support staff and Walsh Fellow graduate students in our research centres throughout Ireland.

In order to maximise the impact of our research, Teagasc actively collaborates with research organisations across the world. This collaboration stretches from individual projects and publications right up to formal alliances and partnerships.

### Food Programme Departments

- Food Biosciences Research
- Food Safety Research
- Food Chemistry & Technology Research
- Food Industry Development
- Food Quality & Sensory Science Research

**Locations:**








- Ashtown, Dublin 15
- Moorepark, Fermoy, Co Cork

### Rural Economy and Development Programme Departments

- Agricultural Economics and Farm Surveys Research
- Spatial Analysis, Food Marketing and Agri-Innovation Research
- Farm Management and Rural Development
- Knowledge Transfer

**Locations:**

- Ashtown, Dublin 15
- Athenry, Co Galway

-  Head Office, Research Centre and Advisory
-  Research Centre and Advisory
-  Advisory Centre
-  Research Station
-  Teagasc College and Advisory
-  Private College
-  Planned Closure



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