TResearch
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'SUPER' BERRY
A new strawberry taking Ireland by storm

TEAM SPOTLIGHT
The benefits of white clover can't be ignored

FARMER HEALTH
The case for making healthier choices

Irish horticulture: The big picture p.11

Food for thought

The horticulture sector has a key role to play in delivering food security and nutrition to Ireland's people

teagasc
Agriculture and Food Development Authority

Welcome

Welcome to the Autumn/Winter 2021 issue of *TResearch* magazine. With a new issue comes a new look – we were inspired to make changes to the magazine after the disruptiveness of the global pandemic showed us just how important impactful communications is.

By charting the success and progress of Irish agriculture and food, we aim to improve awareness and understanding of trends, challenges and solutions. But we can only do this if our magazine remains engaging.

We've put the people who carry out our cutting-edge research front and centre. This issue, researchers you'll meet include our Grassland Research team – who discuss the latest findings in clover research (p16) – and Stephen Butler, whose Q&A on sexed semen practices explores the innovative work happening in the field (p22).

Since 2021 is the International Year of Fruits and Vegetables, we've lined up a series of connected articles. Dermot Callaghan looks at the impact a food system policy would have on Irish horticulture (p6), while Lael Walsh evaluates the sector's progress in adopting sustainable practices (p8).

We aim to keep improving *TResearch* so that it remains an essential resource for anyone interested in Irish agri-food research. The changes we make are for our readers, so we want to hear from you. If you have ideas on how we can improve the magazine, topics you would like to see featured, or if you would like to give us feedback on the content, please contact me.

I hope you enjoy this issue.

Catriona Boyle
Editor, *TResearch* magazine, Teagasc

Fáilte chuig eagrán an fhómhair/an gheimhridh 2021 den iris *TResearch*. Tagann cuma nua le heagrán nua - thaispeáin cur isteach na paindéime domhanda cé chomh tábhachtach agus atá cumarsáid a mbíonn tionchar aici ar chúrsaí agus ba é seo a spreag muid chun athruithe a dhéanamh ar an iris.

Trí rath agus dul chun cinn talmhaíochta agus bia na hÉireann a leagan amach, tá sé mar aidhm againn feasacht agus tuiscint ar threochtaí, dúshláin agus réitigh a fheabhsú. Ní féidir linn é seo a dhéanamh ach má fhanann ár n-iris suimiúil.

Tá na daoine a dhéanann ár dtaighde ceannródaíoch curtha chun tosaigh againn. San eagrán seo, tiocfaidh tú ar thaighdeoirí, ina measc: ár bhFoireann Taighde an Talaimh Féaraigh - a bpléann na torthaí is déanaí maidir le taighde seimre (lth16) - agus Stephen Butler, a bhfiosraíonn a C&F, atá bunaithe ar chleachtais seamhain miangasach, an obair nuálach atá ag tarlú sa réimse sin. (lth22).

Os rud é go bhfuil 2021 ina Bhliain Idirnáisiúnta na dTorthaí agus na nGlasraí, tá sraith alt atá ceangailte socraithe againn. Breathnaíonn Dermot Callaghan ar an tionchar a bheadh ag polasaí córais bia ar ghairneoireacht na hÉireann (lth6), fad is a mheasann Lael Walsh dul chun cinn na hearnála maidir le cleachtais inbhuanaithe a ghlacadh (lth8).

Tá sé mar aidhm againn *TResearch* a fheabhsú ionas go bhfanann sé mar acmhainn riachtanach d'aon duine a bhfuil suim acu i dtaighde agraibhia na hÉireann. Is dár léitheoirí iad na hathruithe a dhéanaimid, mar sin táimid ag iarraidh cloisteáil uait. Má tá smaointe agat ar aon chaoi is féidir linn an iris a fheabhsú, ábhair ar mhaith leat a fheiceáil, nó má tá tú ag iarraidh aiseolais a thabhairt dúinn ar ábhar na hirise, téigh i dteagmháil liom le do thoil.

Tá súil agam go mbaineann tú taitneamh as an eagrán seo.

Catriona Boyle
Eagarthóir, iris *TResearch*, Teagasc

TResearch is an official science publication of Teagasc. It aims to disseminate the results of the organisation's research to a broad audience. The opinions expressed in the magazine are, however, those of the authors and cannot be construed as reflecting Teagasc's views. The Editor reserves the right to edit all copy submitted to the publication.

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Science Week: Festival of Farming and Food

To celebrate Science Week 2021 (7 to 14 November), Teagasc ran 'The Festival of Farming and Food', hosting over 20,000 people at both in-person and online events. In-person events included nature walks highlighting the importance of forestry, and a visit from local school Clarin College to Teagasc Athenry. Teagasc researchers also visited Holy Family School for the Deaf in Cabra, Dublin. Online, broadcaster Jonathan McCrea emceed a series of live events, discussing everything from fruit and vegetables and sustainability, to the science of dairy. The festival was sponsored by Science Foundation Ireland. You can watch the events for each day of the week here: **www.teagasc.ie/corporate-events/science-week**

Teagasc Senior Research Officer Kaye Burgess speaks to students of the Holy Family School for the Deaf about where bacteria is found, as part of Teagasc's 'Meet a Scientist' event in Cabra, Co. Dublin

Castlemorris Woods, Co. Kilkenny, in its full autumn glory. The woods formed the backdrop for the 'Trails and Tales' event with Teagasc Forestry Advisor Michael Somers. Michael kept everyone enthralled with the science and history of forestry

Home truths

Many of the fruit and vegetables that Ireland imports can be grown locally. While the challenges of doing so are not to be overlooked – growing and selling produce requires land, capital, marketing and competitive pricing – there's an opportunity for Irish growers to replace imports with home-grown produce.

Here, we take a look at how much of the fruit and vegetables we enjoy are supplied from overseas.

Teagasc researchers recognised as highly influential in global list

Four researchers from Teagasc have been named in the 2021 Highly Cited Researchers list, paying tribute to their exceptional influence in their fields. The list, compiled yearly by analytics company Clarivate, uses papers that rank in the top 1% by citations globally in the Web of Science™ citation index to determine the outcome. Worldwide, Teagasc has the joint fourth highest number of researchers on the list in the field of agricultural sciences, while also having the third most highly cited researchers across organisations in Ireland. The researchers featured are:

Paul Cotter

Paul's whose research focuses on the microbiology and microbiomes of food (particularly fermented and other dairy foods), food processing and production environments and the gastrointestinal tract, with a view to establishing and maintaining a healthy gut microbiota through dietary interventions.

Catherine Stanton

Catherine's research includes nutritional aspects of dairy and functional foods, probiotic cultures, bioactive metabolite production, infant gut microbiota and healthy proteins and fats that are produced by gut bacteria. Catherine is also very interested in the microbiome during pregnancy and in infancy.

Brijesh Tiwari

Brijesh's research includes the application of novel food processing, extraction and preservation technologies, with a strong focus on the investigation of biochemical aspects of food and food products. A particular focus of Brijesh's current research relates to the investigation of green and sustainable solutions to food industry challenges.

Paul Allen

Paul's a retired researcher whose interests covered a range of cutting-edge approaches to important meat research challenges.

News in brief

€9 million

The Department of Agriculture Food and the Marine are funding Teagasc €9 million to build a new National Agricultural Sustainability Research and Innovation Centre in Johnstown Castle. Among other things, the centre will provide solutions for farmers and other stakeholders to improve soil health and restore and protect biodiversity.

Input costs have increased in 2021 between 10.5% and 17.7% **across various enterprises in horticulture**. Sharp increases have been seen in the cost of labour, packaging materials, fertiliser, energy and a myriad of other inputs that are key components of production.

54,000

Over 54,000 dairy and beef farmers can see the carbon footprint of their farm through Bord Bia's Sustainable Assurance Farmer Feedback Report. The figure has been calculated using Teagasc prediction models and the farmers' own data.

A patentable method has been developed at **Teagasc to utilise animal blood (haemoglobin) as a raw material for the generation of bioplastics.** These have the potential to be used as packaging materials for a variety of applications, reducing our reliance on petroleum-based plastics and contributing to the circular bioeconomy.

Unearthing the value of Irish fruit and vegetables

Policies reflecting the link between food and health present opportunities for the Irish horticulture sector to generate both economic and societal benefits.

The newly launched Food Vision 2030 report has brought much attention to the term 'food system'. This is because the strategy's central vision is that "Ireland should become an international leader in sustainable food systems over the next decade".

Sustainable food systems bring economic, environmental and social benefits, and these dimensions are at the heart of the vision. But what are the possible implications for the horticulture sector in Ireland in terms of fitting into a food system policy?

A boost to public health

One prime implication for the horticulture sector would be that research undertaken would need to consider the relationship between production and consumption, and its impact on human health and the environment.

The benefits of eating fruit and vegetables are well reported, ranging from improved immunity and support to children's growth and development, to lower diabetes risk and longer life. Thousands of research papers are published every year across a spectrum of journals praising the virtues of fruit and vegetables in the diet. It's therefore no surprise that they occupy the base foundation of every food pyramid across the developed world.

According to the World Health Organization, noncommunicable diseases (NCDs) such as heart disease, stroke and cancer are collectively responsible for 70% of all deaths worldwide. An unhealthy diet is recognised as being one of four major risk factors driving up NCDs, so a central pillar of any food system should be to mitigate such diets.

The homegrown deficit

Irish horticulture has an output value ranked fourth behind dairy, beef and pig meat, but it's ahead of the sheep and cereals sectors. It was valued at €477 million (farm gate value) in 2019 by the Department of Agriculture, Food and the Marine, with food horticulture representing €400 million of this total figure.

The food sector chiefly supplies the domestic market. State agency Bord Bia estimated the retail market to be valued at €1.7 billion in 2020, with fruit accounting for €841 million, vegetables €610 million and potatoes €242 million.

Pre-Covid, the food service market for fresh produce had been valued at €400 million annually, highlighting a large trade deficit in fresh produce compared to imported produce. International trade is important to guarantee food supply, and different regions of the world have climates and soils better suited for certain types of production. However, an increase in Irish production oriented towards nutrition security is warranted in light of the food system model approach.

5 to 7

World Health Organization guidance recommends eating five to seven portions of fruit and vegetables per day.

What is a food system?

Food systems encompass all the actors and interactions that make up the food value chain – covering, among other things, the production of crops, transportation, consumption and disposal. At their best, they support nutrition, health and safety.

Sustainable food systems deliver food security and nutrition to all people in a way that doesn't compromise economic, social and environmental bases for future generations.

Society's influence on healthy eating

The theme of International Year of Fruits and Vegetables (IYFV) 2021 is 'Fruits and vegetables – your dietary essentials'. To support this, we have developed an infographic (seen on page 11) to depict the interconnections between human health and the food we consume, specifically fresh horticultural produce.

FatCamera/iStockphoto.com

The benefits of fruit and vegetables include improved immunity and support to children's growth and development

In this graphic, we have presented the economic farm gate value of the horticulture sector side-by-side with the health benefits of eating fruit and vegetables, and some of the costs associated with treating NCDs caused by poor diets. These factors may appear unrelated, but we need to reframe how we think about food systems, which give equal or at least increased emphasis to positive societal impacts – in this case human health.

If we are to develop a food system that is aware of social dimensions, research will need to demonstrate the true value of fruit and vegetables to society and provide an evidence base.

Consumer-related research will also need to support consumers in taking some responsibility. Less than 30% of people eat the recommended daily intake of fruit and vegetables, meaning a re-evaluation of fresh produce in this broader context of food for health is needed. We also need to waste less and be more discerning about the origins of our food in the context of its environmental footprint.

"International trade is important to guarantee food supply, but an increase in Irish production is warranted."

A focus on Irish fresh produce

If the food system model is to be the future, we will need to change the research frame of reference in terms of why Irish horticulture production is important and consider reorienting the arguments for building more capacity into Irish production of fresh produce.

In the context of horticultural development, technologies exist to mitigate soil type and climate and bring production closer to consumption, underpinning our supply of this high-value produce. Research, however, will need to quantify the economic and health benefits of alternative policies, which aim to increase production and consumption.

By reimagining our food system and re-evaluating fresh horticultural produce in terms of the role that it plays in human health, we can create a more viable and sustainable Irish horticulture sector that promotes consumer health.

In this way, fruit and vegetables could improve the health of our society while also improving the economic value of the sector. T

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Going green

Addressing challenges to sustainability in Irish horticulture

sanjeri /iStockphoto.com

As we recognise 2021 as the International Year of Fruits and Vegetables and Teagasc centres its focus on sustainability, it's important we evaluate the horticulture sector's progress in sustainability adoption.

Horticulture in Ireland supports healthy lifestyles and diets and is a significant contributor to the economy. Forces such as Brexit, Covid-19 and climate change, however, have placed increased pressure on food systems worldwide.

Supply disruptions have led to food shortages and price volatility in certain places, and these pressures present a risk to countries like Ireland that import more food than they export.

Certain imported crops (such as bananas) cannot be grown locally, and there are times when home-grown produce is unavailable. There are also other social, economic and environmental barriers that may be stopping local food production.

Meanwhile horticulture, like other sectors of agriculture, is facing pressure to adopt sustainable business practices. And with plant-based foods making up one-third of the population's dietary intake in Ireland, there is an urgency to identify areas of opportunity and address challenges.

Grower sustainability

The Horticulture Development Department in Teagasc carried out qualitative research to understand how sustainability is presently understood and adopted in Ireland. To do this, they conducted semi-structured interviews with horticulture growers across Ireland, in both organic and non-organic systems and across different business sizes (firm types), maturity levels, founder demographics (age, gender and location) and production types.

Lael Walsh, Research Officer in the Horticulture Development Department, says: "Our research aimed to identify challenges currently faced by the sector, determine knowledge and resource support needed to develop sustainable horticulture enterprises, and understand the enabling environment needed to support the sector to grow sustainably."

Data were then analysed using a literature review and interview transcripts to identify connections between sustainability pillars (economic, environmental and social), challenges and the impacts identified in the literature. The results are summarised in the boxout on page 10.

Understanding sustainability challenges

"Our research shows that awareness of sustainability is high among Irish growers based on their knowledge of sustainability frameworks and engagement with certification and auditing schemes," says Lael. "Notably, greater attention and importance is placed on economic and environmental sustainability.

"Despite signs in the literature that sustainability pillars are positively related to firm performance, however, knowledge of how environmental, social and economic sustainability integrate is low. This presents an opportunity to strengthen the sector."

60%

Ireland imports over 60% of fruit and vegetables, resulting in a significant trade deficit.

Economic sustainability issues were focused around high costs and low product prices, as well as limited opportunities for diversification. The result of this is a slow ▶

Dónall Flanagan

Farmers are facing pressure to reduce the use of non-renewable resources like peat

adoption of sustainable practices and low levels of investment, innovation, wages and growth.

A similar study in New Zealand found sustainability adoption was perceived to be costly, and growers did not expect to benefit financially from implementing better environmental practices. Furthermore, levels of knowledge and skills in sustainability were inadequate, and there was a poor understanding or realisation of benefits from sustainability adoption.

18,000

A labour force survey carried out by Teagasc indicates that over 18,000 people are employed directly and indirectly in Irish horticulture.

Environmental pressure to reduce pesticides, greenhouse gas emissions and the use of non-renewable resources (e.g. peat), alongside a low concern for biosecurity, were highlighted. Pressures to reduce pesticides are perceived to increase risks of crop loss and increase production costs beyond a point where horticulture enterprises remain economically viable, unless the market accepts a lower level of aesthetic quality.

Social issues, meanwhile, were more diverse. Consumer perception was highlighted as a strong driver of product quality and industry standards, yet high skill was needed to reach this. With wages recognisably low, new entrants aren't being attracted into the sector and prestige for the profession is decreasing.

Sustainability challenges faced by Irish horticulture enterprises

Economic

- High cost of operating sustainably
- Low prices
- High start-up capital requirements
- Competition from imports
- Lack of opportunities for product differentiation
- Poor availability of finance
- Difficulty of remaining profitable
- The need to develop new marketing channels
- Limited opportunities for diversification/lack of capacity to exploit opportunities

Environmental

- Pressure to reduce pesticide use
- Protection of nature and biodiversity
- Reduction in greenhouse gas emissions and carbon footprint
- Stringent packaging requirements
- Low concern for biosecurity

Social

- High amount of knowledge required for reliable, high quality yields
- Low prestige for the profession
- Consumer perception that quality means clean, blemish-free, consistently sized products
- Low wages
- Outdated training
- Supply chain sustainability (low number of local plant raisers and seed suppliers)

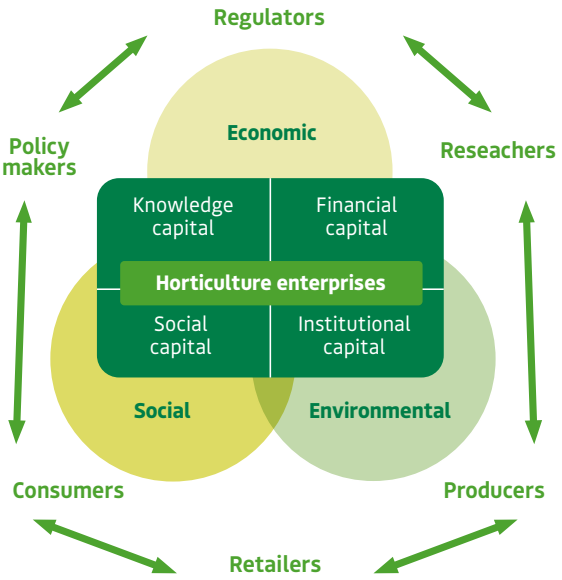

Figure 1: A value network model for Irish horticulture developed by Lael Walsh

A new horticulture model

The current operating environment – centred on a linear value chain model and offering low levels of integration – may be hindering sustainability adoption. As such, Lael has created and is proposing a new 'value network' model for Irish horticulture (Figure 1), in order to move away from the concentration of power given to retailers and consumers.

"In this new model, the value network would recognise an inherent interdependence between actors and elements in systems," explains Lael. "In this way, shared responsibility and alliances would be championed in order to achieve a sustainable and vibrant horticulture sector." T

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FRUITS AND VEGETABLES – DIETARY ESSENTIALS

INTERNATIONAL YEAR OF FRUITS AND VEGETABLES 2021

SUPPORT LOCALLY GROWN, SUSTAINABLY PRODUCED, IN-SEASON FOOD

EAT 7 DIFFERENT TYPES OF FRUIT AND VEGETABLES DAILY *(HSE GUIDELINES)*

EATING PLANT FOODS LOWERS THE RISK OF CERTAIN DISEASES:

- CANCER
- HEART DISEASES
- TYPE 2 DIABETES
- INFLAMMATORY DISEASES

FRUITS AND VEGETABLES IMPROVE GUT HEALTH AND PROVIDE DIETARY ESSENTIALS SUCH AS VITAMINS, MINERALS, FIBRE, PHYTOCHEMICALS, AND ANTIOXIDANTS.

THE IRISH HORTICULTURE SECTOR

MUSHROOMS	POTATOES	FIELD VEGETABLES	PROTECTED FRUIT	PROTECTED VEGETABLES	OUTDOOR FRUIT	HONEY
€119m	€111m	€78m	€43m	€34m	€11m	€4m

IRELAND'S FOURTH LARGEST AGRICULTURE SECTOR

'FARM-GATE' VALUE: €477M

90% OF HEALTHCARE COSTS ARE SPENT ON **30%** OF THE POPULATION WITH CHRONIC DISEASES *(THE ROYAL COLLEGE OF PHYSICIANS OF IRELAND)*

ONLY 37% OF ADULTS ARE A HEALTHY WEIGHT ADULT OBESITY COSTS **€1.13 BILLION** PER ANNUM *(HEALTHY IRELAND SURVEY & SAFEFOOD IRELAND)*

Teagasc Agriculture and Food Development Authority

PRODUCED BY TEAGASC HORTICULTURE DEVELOPMENT DEPARTMENT

10%
Protected fresh strawberry production has increased by at least 10% per year.
Source: Eamonn Kehoe

The new 'super' berry

Work carried out on the new and popular 'Malling Centenary' strawberry variety has allowed Teagasc researchers to gain a better insight into the fruit's promising potential.

For decades, strawberries have been the main soft fruit crop grown in Ireland. In the 1970s and 1980s, this crop consisted mostly of processing strawberries, but in recent times this has been offset by a huge increase in protected fresh strawberry production.

At present, we produce at least 8,500 tonnes of fresh strawberries per year, worth an estimated €45 million. For over 40 years, the Dutch cultivar 'Elsanta' was the most popular cultivar grown and the mainstay of Irish production. A few years ago, however, it was replaced by a new variety: Malling Centenary.

A cause for celebration

Malling Centenary was bred and released for the Centenary celebration of the East Malling Research (EMR) centre in Kent. The centre – founded in 1913 by an association of over 600 fruit growers – is most famous for its work on apple rootstocks.

Malling Centenary is classed as an early-midseason cultivar making it suitable for early and extended season production. Its main benefit is the very high percentage of Class 1 (good quality) fruit produced each yield. In fact, it's normal for over 90% of the produce to be considered Class 1.

The yield so far is a little lower than 'Elsanta', but the increase in operational efficiency – for example picking and packhouse speeds – easily makes up for any shortfall in respective yield. The fruit shape, size and quality, including shelf life, are all excellent.

Digging deeper

Initially, there was very little known about this new strawberry variety, so Teagasc undertook research that primarily focused on establishing a growing system for the crop using a heated glasshouse unit.

The first trial was focused on developing the optimal nutrition regime for this new variety, and the main goal was to achieve

Strawberries are the main soft fruit crop grown in Ireland

Malling Centenary is suitable for early and extended season production

successful crop production with lower fertiliser inputs. Lower fertiliser inputs save money for the grower and have considerable benefits for the environment, making it a major win when achieved.

We grew one crop of Malling Centenary over two growing seasons, planting them in early 2018 in a heated glasshouse unit. The crop was fed with both a low and a standard feed and was overwintered in the glasshouse, protecting the strawberries from freezing cold temperatures.

Once growth began in early 2019, night-break lighting using special LED lights was used to break the crop dormancy. Without the use of these lights, crop yields and strawberry quality can be much lower.

Uncovering remarkable potential

In the first season, the fruit harvest took place between late April and late July 2019. This long growing season is a phenomenon when growing Malling Centenary using heated glass. The variety contains an 'ever bearing' (long-day) variety in its breeding line, which may be contributing to this very long season extension.

The yields in the first season were 675g and 635g per plant using the low and high feed respectively. There was no difference in the Class 1 fruit between the feed levels, and the quality was very high, with scores of 88% and 89% respectively. This very high Class 1 quality demonstrates how you can increase the productivity and fruit quality on the farm by growing this variety.

FACT FILE

On the day of the EMR Centenary celebrations, a bowl of Malling Centenary strawberries was presented to HRH Princess Royal when she opened the celebrations, meaning they're strawberries bred for royalty!

The main benefit of the Malling Centenary is the high percentage of Class 1 fruit produced in each yield

In the second season of production, fruit harvesting took place between late April and late July 2020. The crop produced 463g and 454g of fruit per plant from the low and high feed treatments respectively. Once again there was no difference between Class 1 quality, with a score of over 80% for both the low and high fertiliser treatments.

Promising outlook for strawberry production

In total, over the two growing seasons, both the low- and high-fed crops gave a yield of 1.13kg and 1.08kg of fruit respectively. This outstanding result demonstrates that you can achieve an excellent yield whilst reducing the nutrient input into the crop, without a detrimental effect on crop yield or fruit quality.

Furthermore, this means less fertiliser and water is needed for successful production, offering opportunities for impressive economic and environmental benefits. T

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Soil management matters

Benefits for pest and disease control

As public demand for fruit and vegetables increases and European legislation tightens around fertiliser and plant protection use, more information is needed on the differences between organic and conventional soils.

Agronomic practices – practices that farmers use to improve areas like soil quality and water usage – can alter soil macrobiology and microbiology. How these factors may affect a soil's ability to impact on the survival of crop pests is of interest, particularly if it can help inform and enhance integrated pest management (IPM) strategies.

Research shows that agricultural soils are habitats for many naturally occurring beneficial species that can kill insect pests, and soil management may play a key part in improving pest suppression. To find out more, Teagasc researchers explored these processes in controlled long-term agronomic experiments.

Multiple soil frameworks were assessed during the study, and a model insect (*Galleria melonella*) was used to work out how effective each soil type was at suppressing insects.

Pest and predator occurrence

To assess the impact of organic and standard agronomic management systems on pest numbers, cabbage root fly (CRF) eggs were monitored over two years at sites in Kinsealy, Dublin (2014-2015) and Nafferton, Newcastle (2015-2016).

Celine Delabre, a Teagasc Walsh Scholar who conducted this research for her thesis, says: "Egg numbers were 29% (Kinsealy) and 52% (Nafferton) lower in organic plots compared to standard plots.

"At Kinsealy, there was no difference in observed above-ground predators. However, when plant root zones were examined, there was a 30% increase in Carabid and Staphylinid predator beetles in the organic plots."

Table 1. Site comparison

	Crops	Rotation	Organic nitrogen source	Plot size	Soil type	Established
Kinsealy, Dublin	Two varieties of broccoli	Field vegetable only (Ley - carrot, allium, brassica). Lettuce as a cover crop when required	Pelletted chicken manure and calcified seaweed	18.7m²	Loam to clay loam	2009
Nafferton, Newcastle	One variety of cabbage	Cereals and potatoes included, with hort brassicas	Farmyard manure	288m²	Sandy loam	2001

CRF pupal numbers were also significantly reduced in organic plots, with the presence of root zone predator beetles positively aligned to the number of pupae recovered, independent of the agronomic approach.

Similar results and predator groups were observed at Nafferton, with medium-sized (6-9mm) Staphylinid beetles being the dominant predator found.

While the agronomic approaches and plot size at each site differed (Table 1), there was some consistency in the effect of soil management practices on pest and predator occurrence. When soils from the field were placed in containers at a constant temperature and a *Galleria melonella* was added to the soils, a significantly higher rate of mortality was seen in the organic soils from Kinsealy than from the standard soil.

> **Agronomic management may be tailored towards positive impacts on soil microbial activity.**

Similarly, when CRF eggs were added to the soils with brassica vegetables growing in pots, the root systems from the standard soils were 15% lower in biomass than plants grown in the organic soils. However, when the Nafferton soils were tested contradictory results were found. There was higher mortality of the *Galleria* in the conventionally managed soils, and the sterilised soils had the largest below-ground biomass.

Widening the scope of research across soil types

"While the results from the controlled experiments were contradictory," says Celine, "these findings applied to only two sets of experimental soils at Kinsealy and Nafferton.

Staphylinid beetles were the dominant predator found at Nafferton

"To get a broader picture across more soil types and agronomic approaches, the same techniques were applied to 36 paired horticultural fields (organic and standard) across Great Britain and Ireland."

Initial analysis of the soils sampled indicated observable differences by agronomic approach in microbial activity, mineralisable ammonium, earthworm counts and the presence of free living nematodes (small non-segmented worms).

When baiting with *Galleria*, the mortality ratio from the 36 soils showed a significantly higher mortality in organic soils after 10 days' exposure. After 19 days, however, the gap closed and the significance was reduced.

Potential for natural regulation

Individual analysis of data from paired fields indicated that four pairs of fields showed no difference between organic and standard soils. Meanwhile 10 pairs showed higher mortality in the organic soils, and four pairs showed higher mortality in the standard soils.

Of the five Irish pairs, four showed significantly higher mortality in the organic soils. All soils indicated the presence of entomopathogenic nematodes (a group of nematodes that cause death to insects) and there was no significant effect of agronomic approach in their occurrence.

"This study indicates that agronomic management may potentially be tailored towards positive impacts on soil microbial activity, as measured by community physiological profile," says Celine. "It can also lead to pest suppression at plot level, while improving the presence of natural enemies.

"The presence of natural enemies co-occurring in all pest samples and the related positive correlation of pests and predators suggests the potential for natural regulation occurring in some instances. And while results showed some variability, overall the study does highlight the need to include naturally occurring beneficial species in future crop protection studies." T

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The clover effect

In 2011 Teagasc researchers began studying the important role white clover plays in sustainable Irish pasture-based dairy and beef farms.

Here, we speak to Head of Grassland Research Michael O'Donovan and his team to find out more about this work and the benefits it will have for Irish farmers. Joining him are Senior Research Officer Deirdre Hennessy, Grassland Technologist Fergal Coughlan and Grassland PhD student Aine Murray.

Photography: Fergal O'Gorman

Clover research is central to Teagasc's grassland programme, which looks at ways to utilise grass to improve the profitability and sustainability of Ireland's milk and meat production.

One of the key areas of focus is the use of white clover on pastures, as agriculture in Ireland is facing increasing pressure to reduce the use of nitrogen fertiliser and greenhouse gas emissions.

What is the link between white clover and nitrogen fertiliser?

Michael O'Donovan: Nitrogen fertiliser helps crops to grow faster and attain higher dry matter yields. But with the new Farm to Fork Strategy (designed to accelerate our transition to a sustainable food system approach), nitrogen fertiliser use will have to reduce on farms. White clover is a plant that, with the help of bacteria living on it, stores extra nitrogen from the atmosphere and then releases it into the soil once it dies. This process is known as nitrogen fixing, and it's important because it makes nitrogen digestible for other plants.

> **Herbage production and quality can be greater on grass-clover swards compared to grass-only swards.**

Michael O'Donovan (second to right) and colleagues from the Grassland Department measuring the quantity of herbage in grass-white clover swards

Where is white clover found?

Aine Murray: It's found in grassland that is grazed by livestock. Its stolons grow along and above the ground surface, establishing plant roots formed from any non-root tissue and producing leaves at different points. This special growth pattern is what enables it to survive when grazed.

Why should farmers consider introducing white clover onto farms?

Fergal Coughlan: As Michael already mentioned, white clover can "fix" nitrogen – and a lot of it – which means the use of nitrogen fertiliser can be reduced in swards where clover is present. The less chemical fertiliser used, the more work clover does, helping the ecosystem.

Aine: White clover can also benefit animal and sward performance. It has higher nutritional value for livestock – including high quality protein and other nutrients. Herbage production and quality can also be greater on grass-clover swards compared to grass-only swards, especially where the use of nitrogen is lower.

Fergal: That's a good point – clover actually thrives in soil with lower nitrogen levels, so extra chemical fertiliser isn't needed for clover to grow.

What experiments have you been doing to test the effects of white clover use?

Deirdre Hennessy: We've been using grazing plot experiments to assess issues like the comparison of cultivars and nitrogen fertiliser application rate and strategy. We're also undertaking studies to increase our knowledge in areas such as the nutritional value of white clover and the effects of nitrogen fertiliser on growth and persistence.

Michael: We've also expanded our research to include farm systems experiments – an approach that is similar to how commercial farms are run, which allows us to make closer commercial farm comparisons.

What have the results of your experiments shown so far?

Deirdre: They've been encouraging. We've seen first-hand some of the benefits that Aine and Fergal mentioned earlier, like increases to the productivity and profitability of Irish grazing systems thanks to higher herbage quantities and quality.

Michael: It's also shown that white clover is more compatible with intensive grazing regimes (eight to 10 grazings each year).

Michael O'Donovan and colleagues separating field samples into grass and white clover to estimate sward clover content

This helps reduce the amount of chemical fertiliser required, and increase the efficiency of nitrogen use, milk solids produced per cow and farm profit.

Deirdre: In March 2021 we launched a national farm study across 30 farms to give us a launchpad to see how clover can work on commercial farms.

What does this national study involve?

Fergal: Farms have been set the target of establishing grass-white clover swards with 20-25% clover content in the next three years. White clover is being established on those farms using both reseeding and over-sowing methods. The establishment and persistence of clover and the factors influencing it will also be examined over the next 10 years.

Why is white clover not already being used more widely on farms?

Aine: Something that is generally taken for granted and remains a big challenge is that good grazing management is required at farm level in order to maintain white clover. Improved methods and management of sowing are required to establish sufficient amounts.

Outside of the benefits white clover has, why should farmers be interested in this research?

Michael: EU policy initiatives have targets to reduce fertiliser use by up to 20%, so farmers will need to find ways to cut back. Furthermore, clover is pivotal to our grassland system, so we need it working on all grassland farms. T

In good company

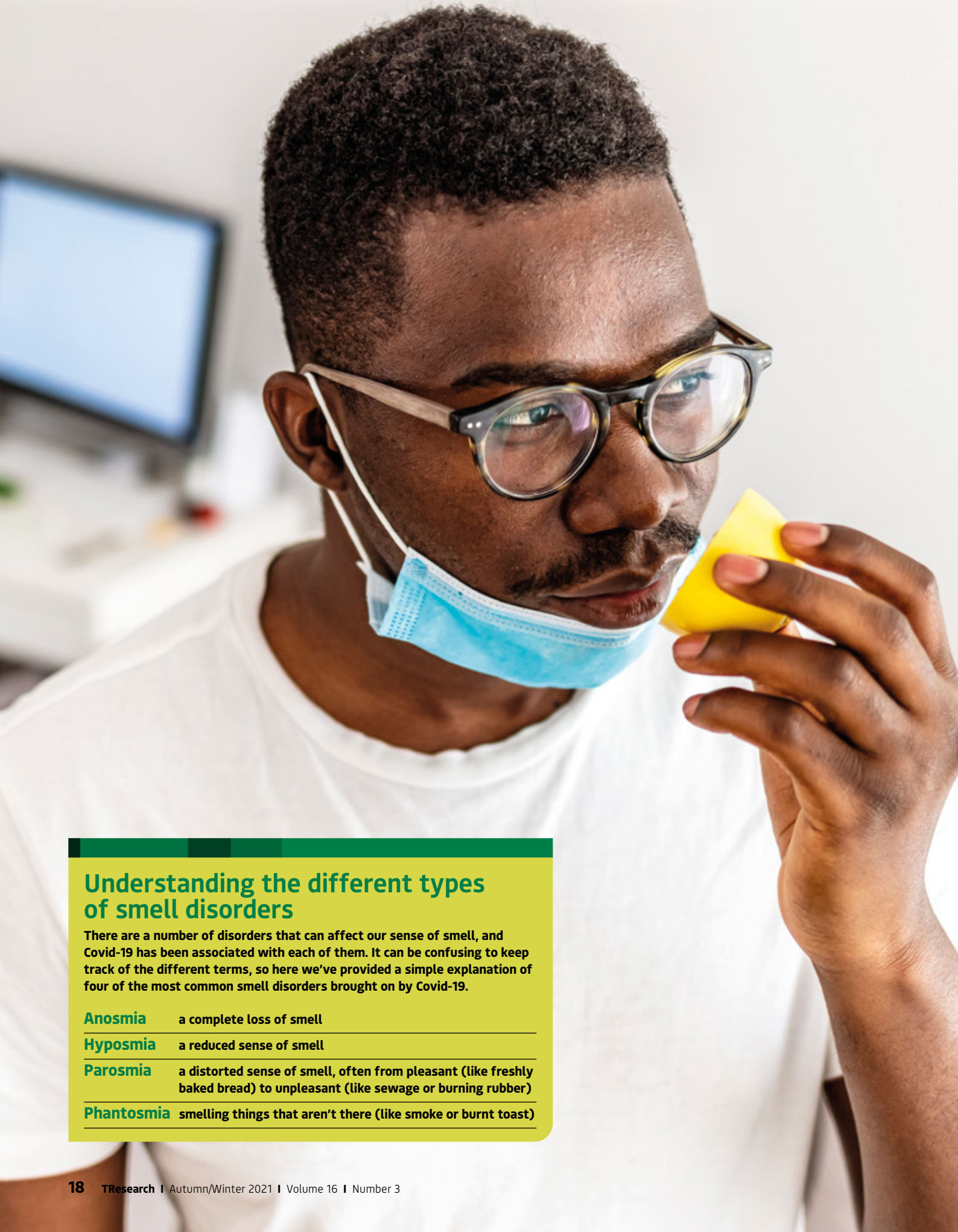
Combined, you have over three decades of experience in clover research. What is it about this area of study that you find so interesting?

Michael: I like that clover provides a challenge in that we have to shift the previously held view that it doesn't last on farms. Our paddocks in Teagasc Moorepark are nine years in production and still have 20% clover content – being able to prove clover's durability is great.

Deirdre: For me, it's increasing our understanding of the role of white clover, which goes with what Michael said about misconceptions. By providing farms with information on the performance of white clover in grassland over time, we can give them the confidence to utilise clover in their pasture-based systems.

Fergal: I also like experimenting with previously set boundaries when it comes to farm systems and then sharing our findings with the industry. We get to explain the do's and don'ts with first-hand experience to support our guidance.

Aine: I chose to carry out my PhD in clover research as it is one of the main ways Irish farmers can reduce greenhouse gas emissions. Clover is very topical, and I'm constantly questioned by farmers and advisors on how they can improve their knowledge in the area, which is promising.



Understanding the different types of smell disorders

There are a number of disorders that can affect our sense of smell, and Covid-19 has been associated with each of them. It can be confusing to keep track of the different terms, so here we've provided a simple explanation of four of the most common smell disorders brought on by Covid-19.

Anosmia	**a complete loss of smell**
Hyposmia	**a reduced sense of smell**
Parosmia	**a distorted sense of smell, often from pleasant (like freshly baked bread) to unpleasant (like sewage or burning rubber)**
Phantosmia	**smelling things that aren't there (like smoke or burnt toast)**

Wake up and smell the pandemic

Around the world people with Covid-19 have been struggling with a change in sense of smell, leading researchers at Teagasc and University College Dublin to investigate how these symptoms have been affecting people in Ireland.

The smell of freshly baked bread, the sweetness of chocolate and the cooling of mint are all examples of sensory sensations we experience while eating food. The enjoyment we get from this is mainly driven by the interaction between our senses of smell and taste, which together create our perception of flavour.

Because we have more smell receptors in our nose than taste receptors on our tongue, our sense of smell plays a key role in detecting flavour in food. That's why when we lose our ability to smell, it can considerably impact our enjoyment of food and drink.

During the early stages of the Covid-19 pandemic, anecdotal evidence from across the world suggested that people infected with the virus were losing their ability to smell. And while it is well known that viruses that lead to the flu or common cold can often affect sense of smell, reports were growing worldwide of people experiencing a sudden loss of smell in the absence of any other Covid-19-related symptoms.

One year on from these reports, it was clear that a loss of smell is one of the most common symptoms of Covid-19 infection. While most people get back their ability to smell within a few weeks, a sizeable proportion still have not recovered and are experiencing long-term loss of smell. For these people, the impact on mental health and quality of life can be substantial.

1/4

A quarter of respondents taking part in the STEVIE survey reported a complete loss of smell.

Sniffing out the truth

At the beginning of the Covid-19 outbreak, very little information was available about how people's perception of smell was being affected in Ireland.

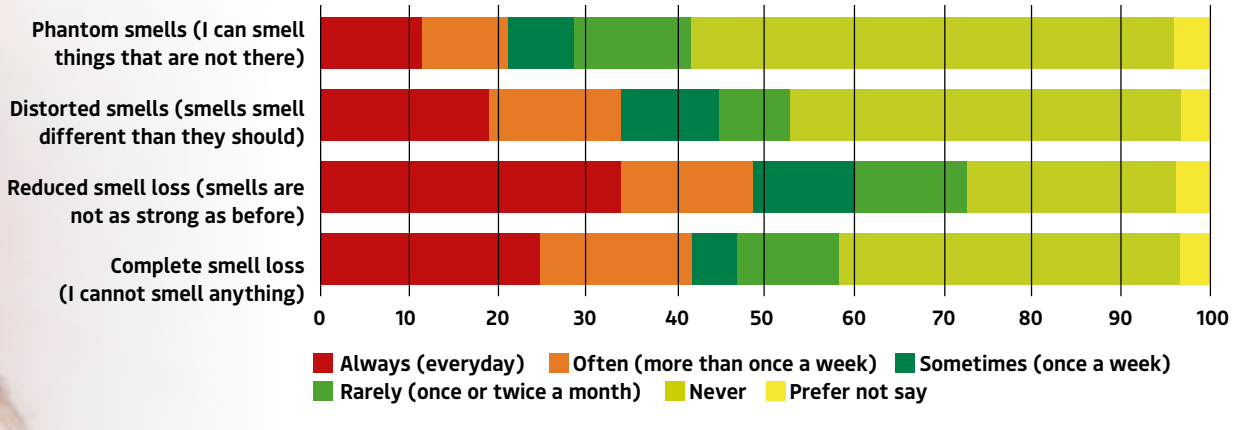
To address this, researchers at Teagasc and University College Dublin (UCD) collaborated with sensory scientists across the Republic of Ireland and Northern Ireland to launch the Smell and Taste Evaluation in Ireland (STEVIE) survey.

The survey had three aims: to determine what proportion of people had lost their sense of smell, how much of it was attributed to Covid-19 and how significant these changes have been.

Of the 282 people that took part in the survey, 62% reported a change in their sense of smell. Within this group, 86% also noticed a change in their sense of taste.

Among those reporting a change in smell, 53% had not ▶

Figure 1. Type and frequency of smell loss experienced by STEVIE survey respondents



jjubaphoto/iStockphoto.com

A loss in smell can make food seem bland or unpalatable

NataBene/iStockphoto.com

been previously tested for Covid-19, while almost 27% had tested positive and 18% had tested negative.

The type and frequency of smell loss experienced by respondents is presented in Figure 1 on page 19.

A quarter of people who lost their sense of smell couldn't smell anything at all, while a third said their sense of smell was reduced, meaning smells weren't as strong as before.

Almost 53% of people reported a daily distortion in their sense of smell, while 11% of respondents reported smelling something that was not there.

In terms of impact on eating behaviour, 50% of those who experienced a change in smell noted a decrease in their interest in and enjoyment of food, while 45% reported a reduction in appetite.

When asked how smell loss had impacted their quality of life, one-fifth of people responded that it was 'affected greatly'. Meanwhile, two-fifths noted that it was 'somewhat affected'. The majority of people surveyed had not spoken to a GP or physician about the changes to their smell or taste.

A persistent problem

The STEVIE study provides a snapshot of how Covid-19 has impacted a cohort of the Irish population in terms of smell loss. And the findings suggest these symptoms may negatively impact quality of life for some people in Ireland.

For a period of time following this survey, Ireland experienced the highest rate of Covid-19 infection in the world. Given this, it's likely that persistent smell dysfunction is affecting a proportion of those recovering from Covid-19 in Ireland.

Supporting this idea is the fact that an Irish Facebook group called Tasteless Cuisine was set up recently to support those suffering from smell and taste loss as a result of Covid-19. Support is also available through charities advocating on behalf of those impacted by smell and taste loss, such as AbScent and Fifth Sense.

In order to help those affected, further research is needed to ascertain the full extent of smell and taste dysfunction in Ireland, and the most promising interventions and treatments need to be identified. T

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Less is more

The United Nations' Food and Agriculture Organization (FAO) has been helping Lebanese potato farmers decrease their use of chemical fertilisers and pesticides.

Words by: Food and Agriculture Organization of the United Nations

Fix it with chemicals. That was the old belief.

Traditionally, farmers in Lebanon depended on chemical fertilisers and pesticides to manage plant nutrition or plant pests and diseases. Most farmers believed that increasing the quantity of chemical fertilisers would increase the yields of their crops.

But now, the rapidly deteriorating economic and financial crisis in Lebanon has made people rethink the situation. Most agricultural inputs (such as agrochemicals, seeds and vaccines) are imported and, with the devaluation of the Lebanese currency, they can no longer afford to rely on these increasingly expensive inputs.

This situation combined with the downsides of chemicals has farmers more convinced than ever of using fewer fertilisers and pesticides, and finding better ways to manage their land, improve yields and preserve water.

Using integrated crop management practices to reduce agrochemicals

One FAO project is helping farmers reduce their reliance on pesticides and fertilisers, while also addressing the agrochemical pollution of Lebanon's Upper Litani River Basin. The project promotes integrated crop management (ICM), a technique that balances farming requirements with environmental responsibility.

FAO/Elie Harika

FAO/Rima Seifeddine

FAO/Elie Harika

FAO's project trained 42 potato farmers in integrated crop management (ICM)

Mostapha Kheireddine, a young potato farmer from Majdaloun-Baalbek in the eastern part of Lebanon, was farming with practices passed down in his family when he heard about this project from his neighbour. He attended a project field day during the late potato season in December 2020. He was then selected to join the project.

Through this project, Mostapha and 41 other potato farmers were trained in ICM practices.

This project established numerous potato pilot plots in Baalbek to compare the farmers' traditional practices with ICM practices. In every plot, two fields were planted side by side, one by a project facilitator using validated ICM practices.

Throughout the potato-growing season, the plot facilitator followed the crop development and made the necessary changes in the levels of irrigation, pest management and crop nutrition. The facilitator kept a record of all interventions made in both farmer and ICM plots, including quantities and types of pesticides and fertilisers used. At the end of the growing season, the yield of each field (farmer and ICM) was calculated and comparisons were drawn.

Proof that reducing agrochemicals won't harm food security

The results proved that it is feasible to reduce the use of chemical fertilisers by an average of 50% and pesticide sprays by at least 60%, while maintaining or improving productivity. Farmers could see the results directly in the field and were convinced.

Mostapha reduced his application of fertilizers by 100kg per 0.1 hectare and is confident in his work: "With the support of FAO and other teams, we now know how much water to add to the crops and how to test the soil. We are now more experienced.

"This year I only used chemical pesticides once. I used to spray my land twice per year. Next year I am not spraying chemical pesticides at all!" T

FURTHER READING • Read the full story at ***www.fao.org/fao-stories/article/en/c/1445963/***

Nothing but the best

Reproductive Physiologist Stephen Butler is leading dairy cattle reproduction research at Teagasc to increase female calf births and improve the value and sustainability of dairy and beef farms.

Photography: Fergal O'Gorman

Dairy farming is Ireland's most profitable agricultural enterprise. Research plays an essential role in improving its productivity and sustainability, and much of Teagasc's work is done to help support farmers and their success.

The breeding and genetics of cattle is one such area of interest. In most dairy herds, 70% of calves born are destined for beef production. But due to genetics, half of these calves will be male dairy calves. Males that have dairy traits are of low economic value for beef farming, and any animal that has low economic value is a potential welfare concern.

Back in 2013 a project was launched at Teagasc Moorepark to reduce the number of male dairy calves born into Irish dairy herds. This ongoing project looks at how sexed semen (specially processed semen that removes 'Y' chromosome sperm cells which lead to the birth of a male) could resolve the issue. It has made some exciting developments over the years and sexed semen has gained increasing popularity in Ireland as a result.

The project is led by Teagasc Reproductive Physiologist Stephen Butler. Stephen started his journey with Teagasc over two decades ago, when he completed research for his Masters in Animal Nutrition at Teagasc Moorepark. A subsequent opportunity to study at Cornell University via the Teagasc Walsh Scholarship programme saw Stephen swap Ireland for New York where he completed his PhD in Physiology of Reproduction. He returned to Teagasc in 2004 and has been here ever since.

Stephen, why is sexed semen of interest to dairy farmers?

The genetics of cattle semen mean that the chances of a male or female calf being born

With a local lab, it'll be easier to get sexed semen straws produced from as many first-choice bulls as required

Sexed semen technology has improved over the years

are roughly equal. Sexed semen increases the percentage of sperm cells containing the desired sex to around 90%. This means that in dairy breeding, 90% of pregnancies that take place after insemination with sexed semen will be female calves.

How has your research on sexed semen developed over the years?

In total, we have conducted three large-scale field trials in collaboration with the Irish Cattle Breeding Federation (ICBF), University College Dublin (UCD), Irish artificial insemination (AI) companies and Sexing Technologies – a leader in sexed semen production.

The first was in 2013, when Sexing Technologies set up a temporary lab in Teagasc Moorepark to run a field trial to evaluate their sexed semen product. In the years since, improvements to the technology used have been made – most notably, sperm cell numbers have increased from two million to four million per straw (a device semen is stored in). Because of this improvement we did extra trials on the product, including testing AI after observed oestrus (when the cow expresses sexual receptiveness behaviours) and fixed-time AI (when the timing of ovulation is controlled). These trials have allowed us to identify some guidelines for the most effective use of sexed semen.

Sexing Technologies has recently re-established a sexed semen lab at Teagasc Moorepark. This lab opened in November 2021, and provides a semen sorting service for the Irish AI industry.

What are the benefits of having this lab in Ireland?

It's a major cause for celebration because it will kick-start greater usage of sexed semen and, importantly, the number and quality of bulls available sexed will increase.

Before this, Irish AI companies sent bulls overseas for the process, usually to the UK or the Netherlands. But biosecurity and quarantine requirements meant they didn't send a large number of bulls or the best bulls. Now, with a local lab, it'll be easier to get sexed semen straws produced from as many first-choice bulls as required, because they don't have to travel abroad.

What benefits does sexed semen have for farmers?

Sexed semen has many advantages for farmers, including the potential for increased genetic gain by inseminating only the best females with sexed semen.

Sexed semen use would typically be limited to the first two to three weeks of the breeding season. This is an advantage because it streamlines replacement heifer management and gives them the maximum amount of time to grow before they become lactating cows.

The cows (and heifers) that are not suitable for producing replacements can receive beef semen. The calves born are more attractive to beef farmers and can help to displace suckler beef production – an emissions-intensive system – and improve the sustainability of beef production.

What are the challenges of using sexed semen?

The sexing process is damaging to sperm cells. Pregnancy rates are lower, so it needs to be used carefully to achieve good fertility outcomes.

Another challenge is the cost. Sexed semen is more than twice the price of a conventional semen straw. Whilst the initial cost is higher, however, it's repaid once the calves are born thanks to their value.

It's also likely that the technologies and procedures used will continue to improve as investment into this area increases, resulting in improved pregnancy rates and lower costs of production.

What's the focus for your research over the next 12 months?

We have an exciting project planned to examine the use of sexed semen to generate IVF embryos in order to accelerate genetic gain in both dairy and beef breeds. Sexed semen is a very useful tool in that process as it allows breeders to decide in advance the preferred sex of the embryo. T

Up close and personal

What's your favourite animal?
It has to be man's best friend – a dog. They're always happy to see you!

If you hadn't ended up in agriculture, what other job would you have wanted to give a go?
Centre back for Manchester United and Ireland, playing alongside Roy Keane and Denis Irwin during the glory years!

What are you most proud of professionally?
I'm about to complete my final year as Senior Editor for the physiology section of a leading journal in my area of work. It was a real honour to get the invitation and it's been a very rewarding experience.

Discovering a new whey to reduce fat

Teagasc researchers have found a way to reduce weight gain from foods rich in fat, potentially minimising the harmful effects of dietary fat. Here, we map the development of their research and their findings over the years.

2011

Teagasc researchers decided to look for food ingredients that, when included in fatty foods, can reduce capacity to cause weight gain and the development of obesity and associated diseases like diabetes.

Teagasc's Kanishka Nilaweera says: "Bovine (cattle) milk is a rich source of nutrients providing many health benefits, so we looked closely at key components in milk that can be used as food ingredients. We focused our attention on whey – a high-quality protein found in cows' milk."

2013

Initial research conducted on mice showed that whey protein isolate (WPI) – the protein-rich form of whey – reduced body fat mass and weight gain when consumed as part of a high-fat diet.

2014

"This was an exciting year as we provided the first insight into the potential mechanism for the previously mentioned WPI effects by showing that the proteins caused shrinkage of the gut," says Kanishka.

2016

To further explore the bioactivity in WPI, work was undertaken using two proteins present in WPI, namely bovine serum albumin (BSA) and lactoferrin (Lf). "We found that BSA reduced body fat and weight gain from a high-fat diet, while the Lf had no direct impact on weight gain," explains Kanishka.

"However, Lf did affect a stress-related parameter that is also linked to weight management. These data suggested that individual whey proteins act on different components affecting weight gain in the host, possibly via the gut as the key route of action."

Bovine (cattle) milk is a rich source of nutrients providing many health benefits

ACKNOWLEDGEMENTS

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Studies have found that whey protein isolate can reduce weight gain

2017

Re-visiting the impact on the gut, the researchers presented their next set of data showing that WPI also affected gut associated microbes (tiny living organisms in the human body).

2019

"Having established a tentative link for the mode of anti-obesity action of WPI, we temporarily set our sights elsewhere to highlight a host mechanism that tries to counteract interventions, such as dieting, that reduce body fat and weight gain," says Kanishka.

"The host mechanism, which involves an increase in gut size with the loss of body fat, was found to have evolved to allow more food to be ingested and accommodated in the enlarged gut, so that it can then be used to replenish the lost body fat.

"The fact that WPI reduced gut size provided the incentive to push our work forward."

2021

Expanding their previous work, the researchers assessed the impact of varied quantities of dietary fat and proteins as well as protein quality (casein which is slow-digesting and WPI which is fast), on the sizes of over 20 different body tissues that together determine body weight.

"By looking at over 20,000 data points, we concluded that the intake of high quantities of dietary fat with casein cause an unhealthy expansion of many tissues – including the gut – which together increase weight gain and inflammation," explains Kanishka.

"By swapping casein with WPI, we reduced tissue expansion – including gut size – as well as weight gain and inflammation."

The effects were accompanied by altered gut microbes in WPI-fed animals. The researchers further found that microbes are the activity of WPI that reduce weight gain. Further analysis revealed that the dietary fat consumed by the animals had been modified by WPI-sensitive microbes. This work has significant appeal because if people find it hard to change their preference for high energy fat-rich foods, the solution may be to find a way to change them inside the body with the help of gut microbes, so that the harmful effects of dietary fat can be minimised.

The researchers published their findings in May 2021. T

FURTHER READING

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The big pension problem for farmers in Ireland

Researchers at Teagasc and Maynooth University have been investigating the effect proposed changes to the State pension system will have on farmers in Ireland.

Under the current Irish State pension system, low-income farmers might not qualify for the contributory or non-contributory State pension. This leaves them at risk of working long into their retirement years or becoming financially dependent on family members in their old age.

The Government's Roadmap for Pensions Reform 2018-2023 aims to modernise Ireland's pension system, but it fails to fix the ongoing issue for farmers who don't qualify for any State pension.

Through a study, Teagasc and Maynooth University researchers have illustrated this stark reality and recommended a model that will give farmers undisputed entitlement to a contributory State pension.

Private pension coverage in Irish agriculture

Ireland has an ageing farming population, and private pension coverage for Irish farmers is relatively low. According to IFAC, an expert team of accountants and financial advisors, as of 2019 62% of Irish farmers aged over 65 had no private pension. For Irish farmers aged between 40 and 65 years old, 52% either had no private pension or had a private pension that only covered one spouse.

Michael Hayden, Assistant Professor of Accounting at Maynooth University, says: "Average annual farm income is low, and a lack of affordability for private pensions is a major contributing factor to low coverage.

"To receive an adequate income in their old age, farmers face working into their later years, liquidating farm assets or relying on the State pension."

The impact of assets on State pension entitlement

The researchers designed hypothetical farm case studies to include farmers with no private pension and variable pay-related

> **Many farmers and their partners who have worked most of their adult lives on the family farm may not have sufficient PRSI contributions to qualify for full SPC.**

kali9, SolStock /istockphoto.com

Introducing a framework where farmers can rely on the security of the SPC will make decisions about farm transfers to younger generations less financially pressurised

social insurance (PRSI) contribution histories when assessing their entitlement to the State Pension Contributory (SPC) and/or the State Pension Non-Contributory (SPNC) payments.

They found that farmers who do not have sufficient PRSI contributions to qualify for the SPC are unlikely to qualify for the SPNC, unless they get rid of the majority of their farm assets.

Teagasc Senior Research Officer and Economist Anne Kinsella says: "For a single farmer to qualify for full SPNC, they cannot have capital assets exceeding €50,000.

"For capital assets between €50,000 and €100,000, they would receive a reduced pension only. Capital assets over €100,000 would result in no entitlement.

"We also found that many farmers and their partners who have worked most of their adult lives on the family farm may not have sufficient PRSI contributions to qualify for full SPC.

"To be entitled to SPNC, a farmer who on retirement wishes to transfer the family business to a designated successor, cannot retain anything other than a few acres of land. This means a perfectly understandable wish to retain assets could potentially leave them with no entitlement to a state pension."

A sustainable solution for the farming community

The most recent reforms of the State pension system do little to reduce the lack of coordination between succession planning, retirement income planning, old age income security and generational renewal.

"This issue could threaten the sustainability of farming in Ireland and further add to the problems surrounding generational renewal, leading to far-reaching negative societal impacts," says Michael.

Bridget McNally, Associate Professor of Accounting at Maynooth University adds: "Objectively, a compulsory PRSI contribution system that gives farmers and farm successors realistic access to the SPC would be a positive development for the farming community."

This system would require a number of changes to the current and proposed new contribution system. In particular it would require mandatory PRSI contributions for farm successors and partners working on farms who are not currently in the PRSI system, with a flat rate amount for those with income below a specified limit.

"There needs to be a framework where farmers paying their way can rely on the security of the SPC," says Bridget. "This way decisions about farm transfers to the younger generation can be less financially pressurised and less driven by fear of income vulnerability in old age." T

Understanding Ireland's State pension system

A person who has reached state pension age may qualify for a State Pension Contributory (SPC) and/or a State Pension Non-Contributory (SPNC) payment. The SPC is not means-tested and entitlement levels are based on pay-related social insurance (PRSI) contributions.

Before March 2018, entitlement was based on a 'yearly average' approach. However, the Roadmap for Pensions Reform plans to replace this with a 'total contributions approach' (TCA). Under the TCA, the level of SPC a person is entitled to is proportionate to the number of social insurance contributions made over their working life.

A full SPC is available to all persons with a full record of 40 years of social insurance contributions. Those with less than this receive a proportionate amount.

For the means-tested SPNC, calculations of an individual's means can be complicated and may change between assets. Cash income is calculated with imputed income (benefits not part of a salary or wage) from the individual's property and investments. The only exception to this is the individual's home, which is exempt from the calculation.

Asset-rich but cash-poor claimants and their partners are vulnerable to having income imputed which places them above the threshold for entitlement to the SPNC.

Further information

You can find the full research article at **https://doi.org/10.1016/j.jrurstud.2021.05.032**

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Health and wellness on farms

Teagasc researchers have applied the Total Worker Health model to new research to support the health and wellbeing of farmers. By looking at how diet and exercise impact health and safety, they hope to alert farmers in Ireland to the health issues directly impacting them.

Being overweight or obese is now a major public health issue worldwide and a recognised risk factor for non-communicable diseases (NCDs) such as cardiovascular disease (CVD) and certain cancers. More recently, it has been a risk factor for experiencing Covid-19 more severely.

At the same time, national data from the Central Statistics Office (CSO) shows that, within the age range 17-64, death from CVD is five times higher among farmers than occupational groups with the lowest rate. Irish farmers also face death from cancer at three times a higher rate in the same comparison.

Diana van Doorn, Teagasc Walsh Scholar, says: "Irish and Australian studies have shown that a mixture of risk factors for CVD, particularly being overweight or obese, is high among farmers.

"Farming is also widely recognised as a dangerous occupation because of the common occurrence of work injuries and fatalities, and being overweight has been highlighted as a risk factor for occupational injury.

"On top of this, being overweight puts people at higher risk of other physical and mental disorders, like musculoskeletal disorders (MSDs) and depression."

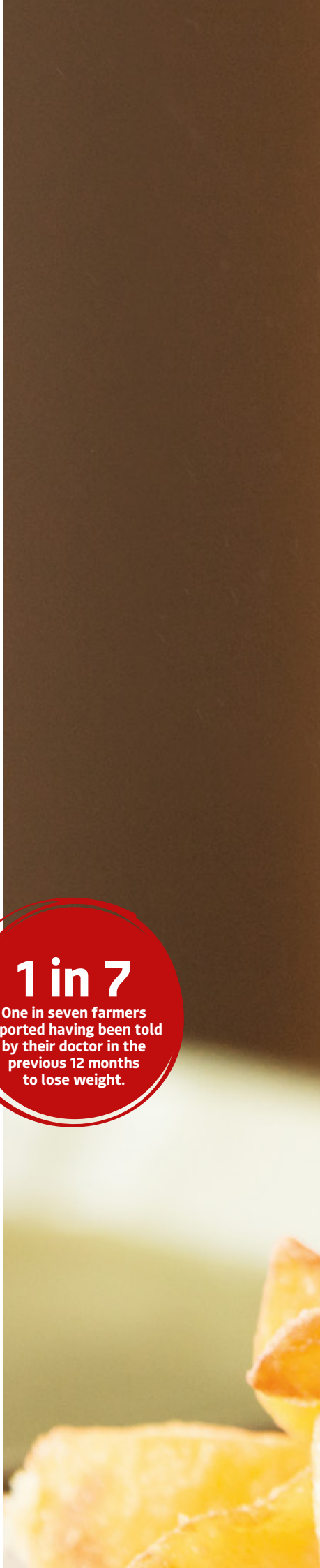
From a Total Worker Health perspective, a look into farmers' dietary habits is needed to reduce the risk of dying or having a disease associated with being overweight. While the causes leading to someone being overweight can be complicated, it's well known that unhealthy diets are an important factor. Especially problematic is an increased consumption of energy-dense food high in fat and sugars.

Total Worker Health

The Total Worker Health model uses policies, programmes and practices to look after workers' health, safety and wellbeing. It aims to protect workers from work-related health and safety dangers and prevent injury and illness.

1 in 7

One in seven farmers reported having been told by their doctor in the previous 12 months to lose weight.



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Salt
Salt
Salt
Salt
Salt
Salt

Reducing how much unhealthy fat, sugar and salt people eat and drink each day and increasing how much fruit and vegetables they eat and drink are key targets in Ireland's National Health Policy.

Exploring causes for farmers' excess risk of death

Teagasc researchers have done research to find possible causes for this excess risk of death and to assess the impact of diet and exercise on farmer health.

"We surveyed male farmers aged over 18 for our study," says Diana. "The average age of participants was just over 41, which is lower than the national average age for farmers which is around 57."

Almost two-thirds (64%) of participants reported having a farm size of over 40.5 hectares (well above average), and farmers from all the main farming enterprises took part in the study.

Weight and weight loss behaviours

When using BMI classifications, almost two-thirds (62%) of participants were found to be overweight or obese. 65% reported being 'about the right weight', while 25% reported being 'too heavy'. This meant that half of the farmers who reported being 'about the right weight' were actually classified as overweight or obese.

1/3

One-third of participants (31%) reported having actively tried to lose weight in the past 12 months.

Eating and cooking habits

Findings in relation to eating and cooking habits showed that 60% of farmers reported consuming fried food more than once per week. Over 70% reported consuming full fat milk instead of low fat milk.

More than one in three reported that salt was added during cooking (35%) and/or to food at meal-times (36%). Interestingly, those who reported adding salt during cooking were significantly more likely to add salt at meal-times.

Almost half of farmers (46%) reported consuming red meat most days of the week whilst one in six farmers (17%) reported consuming processed meats most days of the week.

"Younger farmers (those aged under 45) were significantly more likely to report eating processed meats and poultry on most days of the week," says Diana. "But no significant associations were found between age and the daily recommended servings of vegetables, carbohydrates, dairy or fats, nor in the amount of red meat and fish eaten."

The exercise that farmers get doesn't include enough of the kind that provides CVD protection

The limitations of exercise

Several Irish studies have indicated that farmers get more than the internationally recommended 10,000 steps per day, but such studies are limited as they don't cover year-long sampling.

"In our study the majority (93%) of participants reported being moderately/highly physically active," says Diana.

Research by Loughman et al, however, has indicated that farmers have a high sitting time of around 8.26 hours a day.

Dietary habits compared to national guidelines

The researchers did a study review of the reported daily intake of food groups by participants and compared it to Food Pyramid guidelines. They found the following:

94%
The vast majority of farmers (94%) reported eating less than the recommended five portions of fruit and/or vegetables per day.

67%
Two-thirds (67%) consumed less than the recommended three servings of dairy products per day.

1 in 4
One in four (24%) farmers consumed more than the recommended two servings of protein per day.

1 in 10
One in 10 (11%) farmers reported consuming more than two servings of fats per day.

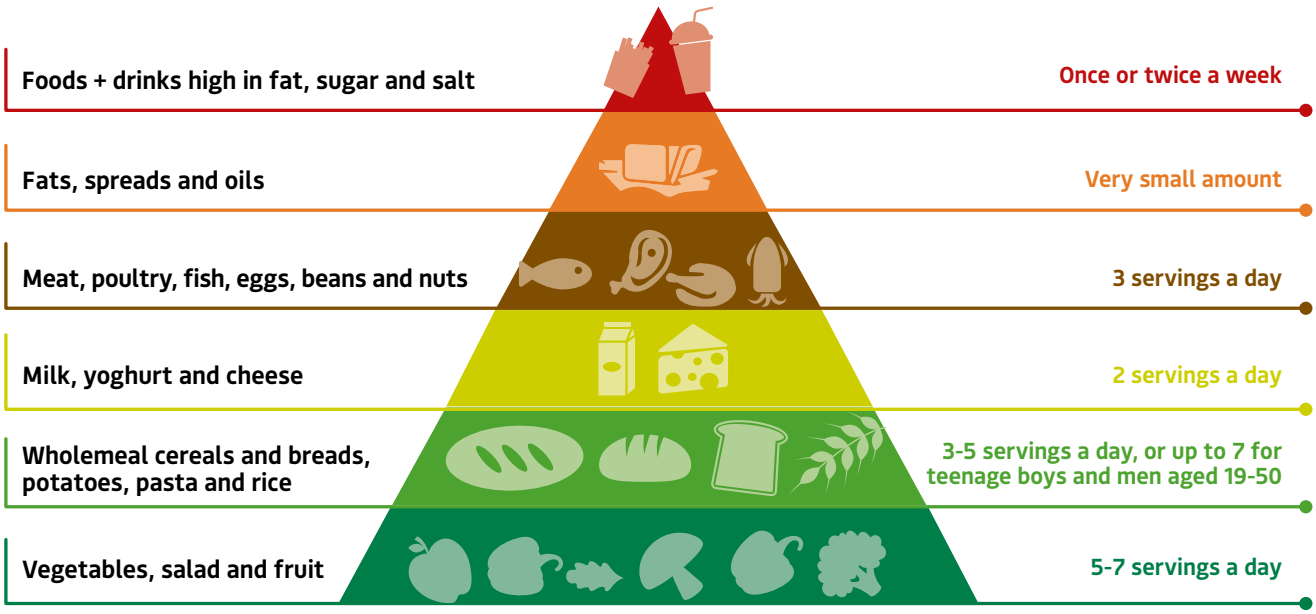
60%
60% of farmers reported eating sugary and/or salty snacks between meals the previous day. Of these, the majority (72%) reported eating two or more sugary and/or salty snacks.

35%
In comparison, just 35% of participants (non-industry specific) from national survey data reported consuming one or more sugary and/or salty snacks per day.

ManuWe/iStockphoto.com

HSE Food Pyramid

Ireland's Health Service Executive (HSE) recommends using the Food Pyramid model as a guide for what you eat and how much you eat each day.



Visit www2.hse.ie/wellbeing/how-to-eat-well.html for more information.

Furthermore, the exercise they do get doesn't include enough moderate- to vigorous-intensity physical activity (MVPA) – the kind of exercise that provides CVD protection.

Making healthier choices

"The findings from our study provide a greater understanding of how dietary habits might potentially contribute to poorer health outcomes among farmers," says Diana. "This helps to underline the importance and urgency of developing effective and tailored health promotion interventions for farmers, including healthy eating campaigns as part of Total Worker Health interventions."

Irish farmers are recognised for producing quality food with numerous health benefits, yet they eat a low proportion of the food they produce directly. Instead, they consume food bought in shops. This food is often produced and processed in an international system, and the ingredients in – and processing of – such foods can lead to health impacts.

"Our advice for farmers is to check the Health Service Executive (HSE) Food Pyramid for guidance on healthy food consumption," says Diana. "Farmers should also undertake a health check regularly and consult their GP before making significant health-related lifestyle changes.

"While food choice and consumption is largely a personal behavioural issue, support is needed – and available – to assist farmers in making healthy choices." T

Further information

This article is based on the following paper: van Doorn, D., Richardson, N., Storey, A., Osborne, A., Cunningham, C., Blake, C., McNamara, J. (2021) 'Investigating the Dietary Habits of Male Irish Farmers to Prevent Mortality and Morbidity'. *Safety*, 7: 54. <doi.org/10.3390/safety7030054>.

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ACKNOWLEDGEMENTS

The participation of farmers in this study is greatly acknowledged, as is the input of all authors to the original paper.

FURTHER READING

- Loughman, T.A., Flaherty, J.T., Houlihan, A, and Dunne, D. (2021) 'A Cross-Sectional Analysis of Physical Activity Patterns, Aerobic Capacity and Perceptions About Exercise Among Male Farmers in the Mid-West Region of Ireland', *Journal of Agromedicine*. https://doi.org/10.1080/1059924X.2021.1879699.
- Smyth, B., Evans, D.S., Kelly, A., Cullen, L., and O'Donovan, D. (2013) 'The farming population in Ireland: Mortality trends during the 'Celtic Tiger' years', *European J. Public Health 2013*, 23, pp. 50–55, https://doi.org/10.1093/eurpub/cks017.

FUNDING

- This research was funded through the Teagasc Walsh Scholarships Programme.

Whatever the weather

The impact of changing weather patterns on water quality

Teagasc's Agricultural Catchments Programme has investigated the impact of changing weather patterns on water quality in three river catchments over a 10-year period.

Between 2010 and 2019, Teagasc and Ulster University researchers studied water quality, water quantity and weather data in three contrasting agricultural catchments: Ballycanew and Castledockrell in County Wexford, and Timoleague in County Cork. Their aim was to find out how changing weather patterns affected the quality of water.

The summer effect

Over the 10-year period, soil temperature in both Ballycanew and Castledockrell increased between June and September. In Ballycanew, the number of times that soil temperature exceeded 17°C three days in a row also steadily increased.

Edward Burgess, Agricultural Catchment Specialist, says: "Soil nitrogen mineralisation (the conversion of organic nitrogen into inorganic nitrogen) is closely linked to soil temperature. If warmer summers are followed by more rain in the winter, soil nitrogen is more vulnerable to leaching (the loss of nutrients) into rivers."

Ballycanew is not generally considered vulnerable to nitrate loss as the soil has a high clay content with poor drainage. This results in anaerobic conditions that favour denitrification (a process that converts nitrate to nitrogen gas).

River nitrate levels are typically around 2.6mg per litre, but following the summer drought in 2018, daily average concentrations reached 13.6mg per litre when the rain arrived in September.

An extra 6.5kg per hectare of nitrate above average for the month of November was recorded leaving the catchment. This added over half the average yearly load of nitrate in one month.

Rainfall intensity

The researchers found that the amount of yearly rainfall didn't change over the 10-year period, but there was an increase in the number of days with heavy rain and high air temperatures. Both of these things significantly influence the mobilisation of nutrients – like nitrogen and phosphorus – into rivers.

"All three catchments were more likely to experience large amounts of rain – exceeding 25mm per day – in the October to December period," says Edward. "And the number of these rainfall events increased in the Wexford catchments for the month of December.

"Long-term data from Ireland's national meteorological service Met Éireann have also shown a gradual increase in the likelihood of large rainfall days."

Such large winter rain events – during which soil is more likely to be full of moisture – will cause surface runoff (water that flows over the land). This then dissolves and leads to the loss of phosphorus from the soil.

"Even well-drained soils, such as in Castledockrell, can become full of moisture in winter months," says Edward. "Heavy rain then leads to more surface runoff and soil erosion, in particular from river banks and exposed soil."

Source impact

Drier summers result in rivers with lower flows, and pollutants from identifiable sources become more obvious because of less dilution.

The researchers found a small regular source in one of the catchments during the 2018 summer drought, where the levels

of phosphorus spiked every day to a level almost 10 times the ecological quality standard.

Cases like this are more likely to occur in small streams during summer droughts, and will have a significant impact on aquatic ecology. It's unlikely this would have been identified without river nutrient and flow data being collected by the Agricultural Catchments Programme every 10 minutes.

Implications for policy

Since 2009 national agricultural goods production has increased on average by over €300 million each year. This is closely linked to the expansion of the national dairy herd following the removal of milk quotas.

Over the same period the Environmental Protection Agency has reported a decline in water quality, with agriculture being identified as a major source of nutrients. The coinciding nature of increased agricultural production and declining water quality understandably suggests that both are linked.

"Actions and regulations to improve water quality could focus only on limiting the source of nutrients," says Edward, "but recent weather events – like major storms and the hot, dry summer of 2018 – also influence the release and transport of nutrients to our watercourses.

"The differing soil textures and chemistries between the three catchments we studied have resulted in a contrasting response to changing weather patterns. This means that, if agri-environmental measures are to be effective, they must include an awareness of changing and extreme weather patterns influencing the link between land use and water quality." T

ACKNOWLEDGEMENTS

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Getting to know

Michael Gaffney

Michael Gaffney works in Teagasc's Horticultural Development Department in Dublin. Here, we find out more about Michael and his interests inside and outside of work.

Hi Michael. Tell us a bit about yourself.

Hello! I'm a Senior Research Officer at Teagasc and an Adjunct Assistant Professor at the School of Agriculture and Food at University College Dublin (UCD). I'm also a father of five!

What is your educational background?

I graduated from Maynooth University (BSc) with a degree in Biology and completed a PhD at UCD. My PhD was funded through the Teagasc Walsh Scholarship Programme, with collaboration from Bord na Móna.

What does your career path within Teagasc look like?

In 2002 I started an 18-month MSc research project with Teagasc and UCD, developing fungi to control insect pests that could be incorporated into growing media. This evolved into a PhD as the project progressed. In 2007 I briefly moved to the University of Wales for a project before returning to Teagasc as a Specialised Horticultural Advisor within the newly formed Horticultural Development Unit. In 2013 I became a Research Officer with responsibility for Horticultural Agronomy and Entomology.

What does your current work include?

The development and testing of integrated pest management solutions, including the creation of electronic decision support and advanced crop monitoring tools. I am also involved in cross-departmental research on food safety in horticultural produce.

What's a professional achievement you're proud of?

One of the great aspects of working with an organisation like Teagasc is working closely with growers and seeing research being conducted and applied on commercial farms. We have conducted monitoring for an invasive insect on commercial farms and assisted growers in changing their practices to help manage this pest. Doing that has been very rewarding.

What are you passionate about outside of work?

With a young family spare time can be hard to come by, but I am a keen rugby supporter and still referee in the Leinster Senior Leagues occasionally. T

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Success in the Southwest

The economics of farming

The viability of farms in the Southwest region of Ireland is good when compared to other regions, but volatility in farm income and operating surplus show there are still challenges to address.

Agriculture is a major part of the economy in Ireland's Southwest region of County Cork and County Kerry, and the region performs well in farm viability when compared to other regions in Ireland. A farm business is defined as being 'economically viable' – when the economic benefits exceed its economic costs – if the family farm income (FFI) is enough to pay family labour at the minimum wage and provides a 5% return on the capital invested in non-land assets, i.e. buildings, machinery and livestock.

But there's still volatility in farm operations, so here we've taken a closer look at the economics of farming and the challenges farmers are facing.

Farm income and viability

Figure 1 (page 35) shows the level of average FFI and farm viability over time, with farm income represented on the left vertical axis and farm viability on the right vertical axis.

In recent years the proportion of farms classified as viable in this region has consistently surpassed 40%, with a high of 55% in 2017.

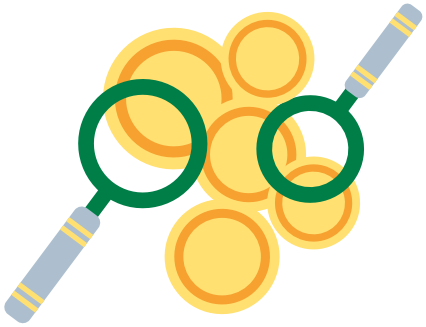
Average farm income, however, appears volatile. At its peak, the average FFI exceeded €40,000 in 2017, but fell by almost €10,000 the next year.

Economic value of agriculture

Figure 2 (page 35) shows the difference between income and what is being spent – otherwise known as operating surplus (OS) – over the last decade, including the extra benefits earned by both farmers and agricultural contractors. This measure is different from the normal definition of farm income as it excludes deductions for interest payments on borrowed capital and the deduction for land rental payments.

In 2010 the OS for the region was €461.5 million, but reached €851 million in 2017, overall showing huge volatility over time. The OS increased greatly between 2016 and 2017, with higher milk prices and production levels. This was followed by significant decline in 2018 as a result of reduced milk prices and a summer drought.

Lower beef prices influenced the small scale of recovery in 2019. Specialist beef farms account for about 45% of farm holdings in this region. Major changes to beef prices and support payments for cattle farmers can therefore play an important role in influencing the economic surplus of agriculture.



Livestock population

Figure 3 (page 35) shows the trends in the cattle population by age. Overall, it is clear that dairy cow numbers have increased greatly over time between 2010 and 2019.

There are three main milk processors in the region: Carbery Group, Dairygold and Kerry. These account for over 3 billion litres of milk volume annually and close to 40% of total product nationally.

Significant declines in the non-dairy cow population are evident from 2010. T

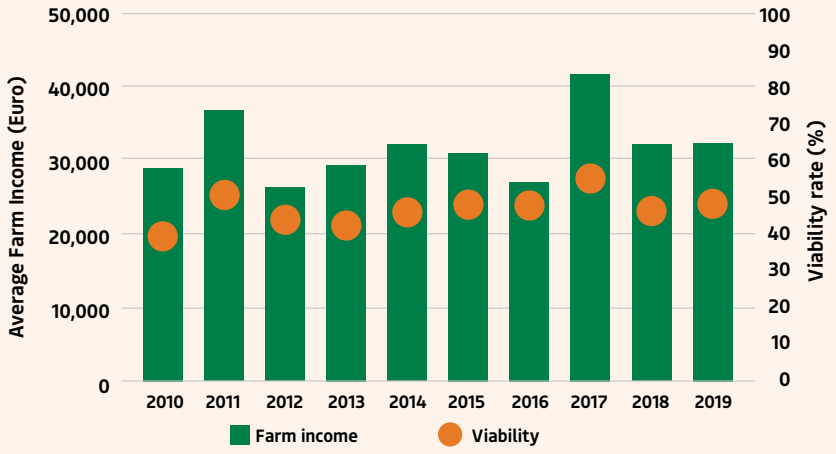
The generational sustainability challenge

The 2016 Farm Structures Survey suggests that ageing in the farming population is less problematic for the Southwest. However, challenges concerning farm succession for farms with less productive land remain. Young farmers are also struggling to gain access to land.

The next generation of farmers are likely to face growing challenges around environmental sustainability. To address biodiversity, farmers will need to take on major actions to mitigate greenhouse gases, and there will need to be more adoption of measures. Teagasc's greenhouse gas Marginal Abatement Cost Curve (MACC) suggests changes to fertiliser used and the way in which slurry is applied to the land. A significant increase in afforestation (including agroforestry) is also required.

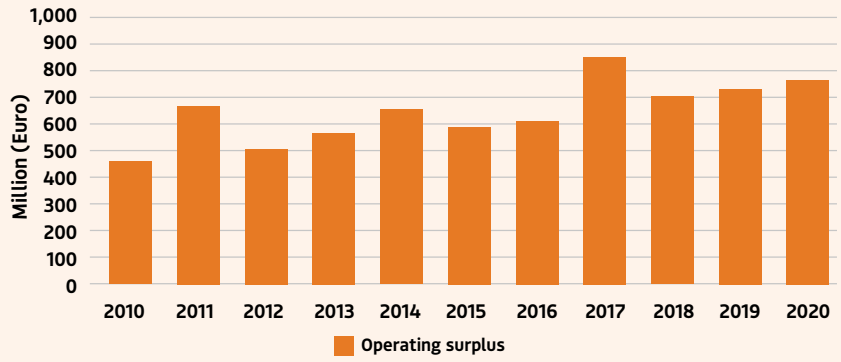
The sooner these actions are put into place, the sooner farmers in this region can become more environmentally sustainable whilst improving economic viability.

Figure 1. Average farm income and farm viability in the Southwest region 2010-2019



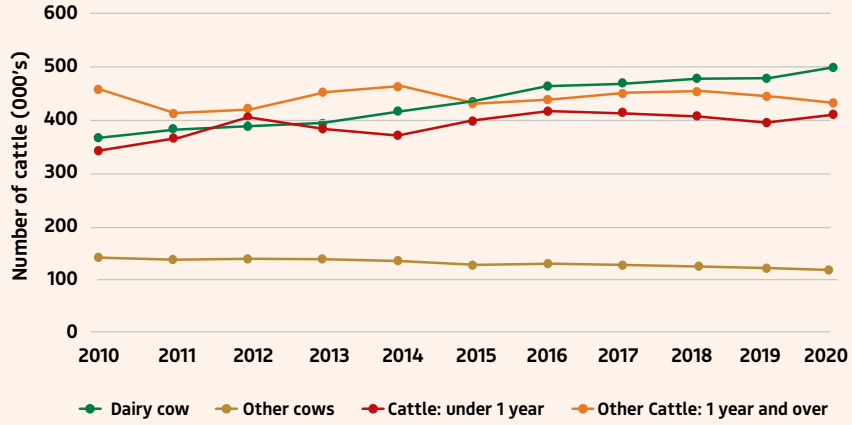
Source: Author's calculations using Teagasc National Farm Survey data

Figure 2. Total operating surplus of agriculture in the Southwest region 2010-2020



Source: Central Statistics Office 2020

Figure 3. Cattle population in the Southwest region 2010-2020



Source: Central Statistics Office June Surveys 2010-2020

Farm income in the Southwest region of Ireland

€760 million

In 2017 total farm income in the Southwest region was approximately €760 million.*

60%

In recent years farm income has accounted for 60% of the pre-tax farm household income in the Southwest. This proportion is much higher than other regions.*

€107 million

In addition to the economic surplus earned by farmers and contractors, the surplus earned by farm employees has risen steadily in recent years, reaching €107 million in 2020. This indicates the importance of primary agriculture in delivering direct employment for people living in this region.

Source: Central Statistics Office 2021

2,000

Approximately 2,000 people in the Southwest are employed in the dairy industry.**

1,400

Approximately 1,400 people in the Southwest are employed in the meat and meat products industry**

**Stats have been taken from the Annual Revenue Farm Income Report 2019*

***Stats have been taken from the 2016 Census of Population.*

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SeaHealth

The benefits of seaweed for our gut

Researchers are studying seaweed to find out if its unique properties are beneficial for gut and metabolic health.

Hypertension, type 2 diabetes and obesity are chronic diseases in middle- to high-income countries worldwide. They are all classed as metabolic disorders, which means they stop the body from converting food into energy in the usual way and can increase our risk of getting high blood pressure. These disorders can be made worse by an imbalance of beneficial versus harmful bacteria in the gut – a condition called dysbiosis – which causes digestive problems that affect overall health.

Evidence shows, however, that these disorders may be improved by keeping our gut healthy through diet.

Teagasc is collaborating with the Commonwealth Scientific and Industrial Research Organisation (CSIRO) in Australia and CyberColloids in Ireland to screen Irish and Australian seaweeds for bioactives (chemicals that have a biological effect on our bodies) that may positively impact the human gut and metabolic health.

Studying seaweed

This project, titled SeaHealth, aims to produce new knowledge for industry experts and the scientific community on the potential functional food-use of certain seaweeds. It also aims to generate new technical know-how for the seaweed processing sector to develop high-value functional ingredients from raw seaweed. Seaweeds are a sustainable source of bioactives and include some unique properties that don't occur in plants that grow on land.

In the SeaHealth study, chemical compounds will be taken from red, brown and green seaweeds using food-safe methods. They will then be studied for their ability to act as prebiotics (food ingredients for gut bacteria) and decrease the activity of enzymes (proteins in the body that increase the rate of chemical reactions).

The seaweed extracts that are found to have useful properties will be added to food products to improve health benefits. The researchers will be careful not to negatively impact the sensory elements of food – like taste and texture – during this process.

The seaweed extracts will then be assessed for use as functional ingredients, and also possibly as traditional protein-replacement products. The extracts will also be compared to existing pharmaceutical products that decrease enzyme activity and support gut health.

Sustainable research

When looking for potential functional food ingredients, researchers will use sustainable seaweed resources to minimise any environmental impact. This could help to generate growth, access new markets and increase value-added output for the seaweed processing and ingredients sectors.

Knowledge from the project could improve standard operating procedures for the isolation, extraction and stabilisation of high-value ingredients found within it.

Consumer demand for natural and organic food products is driving major growth in the seaweed extracts market

At present there is major growth in the seaweed extracts market, and consumer demand for natural and organic food products is the main factor driving this. This could be boosted further by the development of new products that are beneficial to health. It could also provide different plant-based ingredients for growing market sectors, like veganism and vegetarianism, that are nutritionally balanced and may benefit the gut.

The project results will provide technical know-how and understanding of consumer attitudes to assist in further utilisation and development of functional food ingredients from raw seaweed. In addition, results could lead to further scientific and industrial research in this area on national and international levels.

8.5%

From 2020-2027, the global seaweed extracts market is predicted to increase by 8.5%, of which the food industry will comprise the largest market segment.

Source: Data Bridge Market Research, 2021

Seaweeds are a source of bioactive compounds

FUNDING

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"Peat-based growing media faces a tough future"

Dermot Callaghan, Head of the Horticultural Development Department, explains why Teagasc is renewing research emphasis on finding alternatives to peat-based growing media in horticulture.

Peat is a universal ingredient used for most plant species in almost all production systems in Ireland and around the world. Its physical and biological attributes, combined with its low nutrient status and predictable interaction with chemical fertilisers, is what sets it apart for professional production. The batch-to-batch consistency it offers is the key factor contributing to successful large-scale plant, crop and mushroom production.

The design of plant production systems, production protocols – including nutrition regiments – and integrated pest management approaches are developed with peat-based media at their centre. Due to its excellent biological, chemical and physical properties, peat is a main component of substrates. It maintains a stable physical structure and is comparatively lightweight, allowing it – and the products grown in it – to be transported. It also interacts well with existing nursery equipment and machinery.

Moving from soil to soil-less culture systems has had very significant advantages in the modern era of horticultural production in Ireland. Some of this upside has been in environmental terms. The opportunity to combine growing media technology and greenhouse growing has led to input reduction and output recovery with significantly improved yield and quality. This has improved the opportunity for import substitution of key horticulture food and plants.

Environmental concerns about peat

The extraction of peat for any purpose, however, even as a highly valued ingredient in a plant and food-producing sector like horticulture, has come under increasing scrutiny. Extraction is currently challenging from a legal, environmental and regulatory point of view: the dual consent system needs compliance with planning permission and Integrated Pollution Control (IPC) license requirements. Additionally, consumers are increasingly interested in the sustainability credentials of products.

There is a renewed emphasis on finding alternatives to peat-based growing media in Teagasc. This research area has attracted significant attention nationally and internationally in recent decades, but it is destined to become a central pillar of horticultural research across Europe and further afield in the coming decade.

Designing a peat-free approach

Alternatives to growing media will need to achieve equitable yields and product quality compared to standard peat products. The batch-to-batch consistency required by large-scale professional producers will pose a significant research challenge and require very detailed risk assessment and performance evaluation in crop specific production systems.

In the future, there will be a requirement to develop manufacturing processes and novel technologies to design new growing media using new approaches. There will also be a requirement to optimise material processing through composting and refinement of pyrolysis and hydrothermal-carbonisation technologies. T

Alice Rodnova/Shutterstock.com

2022

JANUARY

INFOGEST: webinar series on food digestion

Date 5 January and then the first Wednesday of each month until April 2022

Time 2PM

INFOGEST is an international research network of scientists from academia and industry in over 45 countries, who aim to improve the scientific knowledge of food digestion. Through a webinar series hosted by Teagasc's André Brodkorb, each month speakers from across the network present their latest research on the topic of digestion.

The series is being held in the run up to the 7th International Conference on Food Digestion in Cork in May 2022.

- **Contact:** **andre.brodkorb@teagasc.ie or muireann.egan@teagasc.ie**
- **More information:** **www.teagasc.ie/food/research-and-innovation/webinars/infogest-webinar-series/**

btyoungscientist.com

BT Young Scientist and Technology Exhibition 2022

Date 12 to 14 January

Location Dublin

Teagasc is hosting a virtual stand in the 'World of Science and Technology' at the BT Young Scientist and Technology Exhibition (BTYSTE) 2022. The BTYSTE is the final stage of a competition in which students from across Ireland submit science projects to be judged. This year the exhibition will feature 550 student projects shortlisted from 219 schools spanning 29 counties.

Teagasc will award a prize to the student project that best demonstrates a thorough understanding of the science of agricultural or food production or the use of science to improve technologies available to agricultural or food production.

- **Contact:** **catriona.boyle@teagasc.ie**
- **More information:** **btyoungscientist.com**

MAY

International Conference on Food Digestion 2022

Date 3 to 5 May

Location Cork

The International Conference on Food Digestion is a major event in the field of food, nutrition and health. It is organised by the INFOGEST research network, whose objective is to improve the health properties of food by sharing knowledge on the digestive process. 2022 will mark the 7th conference since it was first established, covering six themes corresponding to six INFOGEST working groups: *In vitro* digestion models; Food interaction and meal digestion; Absorption models; Lipid digestion; Starch digestion; *In silico* models. The deadline for abstract submissions is 21 January 2022.

- **Contact:** **icfd2022@abbey.ie**
- **More information:** **https://www.icfd2022.com**

World Potato Congress 2022: The changing world of the potato

Date 30 May to 2 June

Location Herbert Park Hotel, Dublin

World Potato Congress Inc. is a non-profit organisation that creates a value chain network to lead sustainable growth and development of the potato, to meet increased global use and demand. 2022 will mark the 11th edition of this congress. Themes covered during this event will include potato business (e.g., value chain developments and added value products) and sustainability (e.g., water management and irrigation and integrated pest management).

- **More information:** **https://wpc2022ireland.com**

SEPTEMBER

Teagasc open day: Technologies for improving farm sustainability

Date TBC

Location Teagasc Environment Research Centre, Johnstown Castle, Co. Wexford.

This open day will look at strategies to increase environmental efficiency and profitability on farms and management of grass-clover and multi-species swards under dairy and dairy calf to beef systems, and to enhance biodiversity in grassland farming systems.

You will also learn about the latest fertiliser and slurry technologies for increased nutrient efficiency, and technologies for enhancing carbon sequestration.

- **Contact:** **david.wall@teagasc.ie**

The Pest of Johnstown Castle

"Not a day goes by working in Teagasc Johnstown Castle – Ireland's leading research centre for soils and the rural environment – without the presence of peacocks. While pretty to look at, staff and students alike have run afoul of these rambunctious colourful fowl. Whether it's an obnoxious "caw" to give you cardiac arrest while you work intensely, or a ravenous attack on your freshly seeded plots – beware, the pest of Johnstown Castle!"

Photo and description by: Kerry Ryan, Teagasc Walsh Scholar