


Annual Report 2020
& Financial Statements


Teagasc
Agriculture and Food Development Authority

Introduction

The 2020 Annual Report is built around the goals outlined in the Teagasc Statement of Strategy. Examples of key achievements and developments for the Research, Knowledge Transfer and Operations directorates are described in the context of these goals.

CONTENTS

Mission

To support science-based innovation in the agri-food sector and wider bioeconomy so as to underpin profitability, competitiveness and sustainability.

Vision

Teagasc wishes to be nationally and internationally recognised as the knowledge provider of choice for Ireland's agri-food sector.

Teagasc is registered as a charity, under Section 40 of the Charities Act 2009. Registered Charity Number: 20022754.

CHAIRMAN'S STATEMENT

The year 2020 will live long in the memory. The first quarter of the year began with some very positive developments such as the 'sod-turning' for the National Food Industry Hub at Teagasc Moorepark in January and a visit by the United Kingdom's Duke and Duchess of Cambridge, to Teagasc Grange in early March. Soon after the COVID-19 pandemic altered all our lives and work routines. But the sliver lining in the cloud was the response of Teagasc staff who embraced the challenge of delivering entire programmes in advisory and education through online platforms. A special tribute is also due to our farm staff and those that work in our labs who had to attend their place of work throughout the entire period.

Each year the Teagasc National Farm Survey (NFS) collects detailed data from a representative sample of Irish farms. In 2020 and 2021 the public health measures required to combat the COVID-19 virus disrupted the normal data collection processes used by the Teagasc NFS. With the cooperation of the hundreds of farmers who participate in the NFS, our farm recorders have been collecting farm data in ways that ensure compliance with all public health guidelines.

These processes and the public health policy restrictions on movement have however led to delays in the finalisation of the 2020 Teagasc NFS report. This year, as last year, I'm drawing on the estimates of the sector's performance in 2020 published by Dr. Kevin Hanrahan and the economists from Teagasc's Agricultural Economics and Farm Survey Department in their Outlook 2021 report.

Weather conditions in 2020 were favourable for Irish agriculture's grassland systems but made for a difficult year for many Irish cereal producers. The average family farm income in 2020 was estimated to be €24,700, up about €1,300 on the 2019 level. This positive outcome for the "average" farmer however masks contrasting fortunes across the principal farm types that characterise Irish agriculture.

On dairy and drystock farms, total production costs decreased in 2020 due to lower feed, fertiliser and fuel prices, while input use was relatively stable. Stability in milk prices and increases in both lamb and cattle prices led to a growth in incomes on dairy, cattle rearing and sheep farms. Incomes on 'cattle other' farms – despite lower prices in spring 2020 due to the COVID-19 disruption of European meat markets – remained stable. Due to the below average cereal crop yields in 2020, average tillage farm incomes declined significantly.

Overall in 2020 Irish dairy farmers are estimated to have seen a decrease in their key pasture and forage costs. With average farm level milk production continuing to grow in 2020 and stability in the average milk price received, average incomes on Irish dairy farms in 2020 are estimated to have increased by 5% to €69,000.

In 2020, prices for prime finished cattle were on average similar to the levels reported in 2019. In 2020, prices for younger cattle were higher relative to those earned in 2019, leading to an increase in market output value on single suckling enterprises. The market output value on the average cattle finishing enterprise declined in 2020 as a result of higher prices paid for purchased cattle. Small decreases in feed usage and lower feed prices contributed towards lower feed expenditures on cattle enterprises in 2020.

The introduction of the Beef Environmental Efficiency Programme – Sucklers (BEEP-S) scheme contributed positively to the value of gross output on single suckling farms while the Beef Finisher Payment (BFP) scheme contributed to gross output on cattle finishing enterprises. In 2020, the average family farm income on cattle rearing farms is estimated to have increased by 17% to €10,600. The average family farm income earned on 'cattle other' farms is estimated to have remained unchanged in 2020 at €13,800.

The value of Irish sheep meat exports to the EU in 2020 was up 12% on those in 2019, driven by higher European lamb prices and an increase in the volume of meat shipped from Ireland. Total direct costs of production for Irish midseason lowland lamb enterprises are estimated to have increased marginally in 2020. With overhead costs of production decreasing by 2% in 2020, family farm income earned from sheep production is estimated to have increased substantially in 2020. Teagasc estimates that the family farm income on specialised sheep farms in 2020 increased by 30% to €19,200.

While international cereal prices at harvest in 2020 were higher than in 2019 due to lower production in some regions and relatively low stocks levels,

difficult growing and harvest conditions in Ireland were reflected in significantly lower average yields. Spring barley and winter wheat yields were both down by over 10% relative to 2019. Lower production volumes were partially offset by some reduction in costs. In 2020 Teagasc estimates that the average tillage family farm income declined by 11% to €29,000 per farm.

The conclusion of the Trade and Cooperation Agreement (TCA) between the EU and the UK on Christmas Eve 2020 removed the threat of a "No Deal" Brexit and as a consequence the economic outlook for the Irish agriculture and food industries is more optimistic and less uncertain than it was for most of 2020.

At least for the short to medium term, the TCA maintains Ireland's preferential market access to the UK market. The deal agreed allows for continued tariff-free trade between the UK and EU for qualifying goods, but it does mean that new impediments to bilateral EU-UK trade have emerged, in the form of customs, product certification and rules of origin checks. Despite the additional frictions and costs of trading introduced by Brexit, the general market prospects for 2021 are positive for the Irish agri-food sector.

The year 2020 provided many challenges and none more so than upskilling farmers on sustainability issues. Ireland has 6,500 farmers who apply yearly for a derogation to farm above 170 kg NpH up to 250 kg NpH. This cohort of farmers must attend a training course to meet the terms and conditions of being in derogation.

This modular training consists of Nutrient Use Efficiency, Farming Sustainably in derogation (Water Quality, Gaseous Emissions and Biodiversity), and Grassland Management. Teagasc knowledge transfer specialists and advisors delivered interactive modular training to 3,000 of these farmers in 2020, involving over 100 courses, through the online platform Zoom.

The establishment of a National Agricultural Soil Carbon Observatory (NASCO) was funded by DAFM in 2020. This platform will consist of a series of carbon dioxide flux monitoring towers which are being established at long-term monitoring benchmark sites in order to assess the carbon sequestration capacity of grassland and cropland; assess the impact of management on Carbon sequestration; and quantify the impact of drainage and re-wetting on peat soils.

Several NASCO sites will integrate into both the SignPost Farm and Agricultural Catchments Programmes led by Teagasc. The platform will establish living laboratories that will evaluate the impact of rewetting of peatlands on GHGs, biodiversity, water quality and flooding. These data from NASCO will be used to validate soil carbon models and incorporate sustainability management practices into national greenhouse gas inventories.

In 2020 Teagasc launched a series of webinars and virtual training courses, specifically developed for the Irish food industry, in anticipation of continuing COVID-19 restrictions throughout 2020. The webinars covered a range of applied topics such as food product development, packaging and sensory science through to more novel subjects such as insects as an emerging source of protein and using imaging as a tool to study food structure. This was accompanied by the development and delivery of new and existing food industry training courses in an on-line format. Teagasc Food Innovation Gateways, a key biannual event in the industry's calendar, was also delivered virtually.

In accordance with the Code of Practice for the Governance of State Bodies 2016, I wish to confirm that Teagasc is adhering to the relevant aspects of the Public Spending Code.

I would like to offer my congratulations to Elizabeth Reynolds and Brian Rushe on their appointment to the Teagasc Authority and to also congratulate Liam Woulfe on his reappointment. I also offer sincere thanks to Cliona Murphy for her great service to the Authority.

In conclusion, I would like to thank Teagasc Director Professor Gerry Boyle and all his Teagasc colleagues for their dedication and contribution to the organisation during the very difficult circumstances which prevailed in 2020.

Teagasc chairman, Liam Herlihy (centre) introduces Prince William to Prof. Gerry Boyle, Teagasc Director during the visit of the Duke and Duchess of Cambridge to Teagasc Grange.

REPORT OF THE DIRECTOR

The impact of the COVID-19 pandemic in Ireland and across the world in 2020 was dramatic. The flexibility and resilience of Teagasc staff has been impressive and the body of work they have delivered to support stakeholders, customers and clients is remarkable.

Teagasc maintained its education programme delivery in 2020 despite COVID-19. The organisation adapted to a hybrid delivery model combining face to face and remote delivery within the national guidance parameters set out for education institutions under the Level 1 to 5 COVID-19 measures. Ensuring the safety of learners and staff was the primary focus.

A Teagasc COVID-19 management plan was put in place across all Teagasc delivery locations. Teagasc maintained completion and QQI certification schedules for its 2019/2020 full-time programmes. Programmes for the 2020/ 2021 year commenced on schedule in September 2020. Likewise, Teagasc maintained delivery for its adult education part-time and distance Green Cert education programmes with courses continuing to commence and be completed on a rolling basis.

Through the calendar year 2020 Teagasc held 201 Zoom Webinars, 6,682 Zoom meetings, through 250 Zoom accounts supporting farmer clients and other stakeholders.

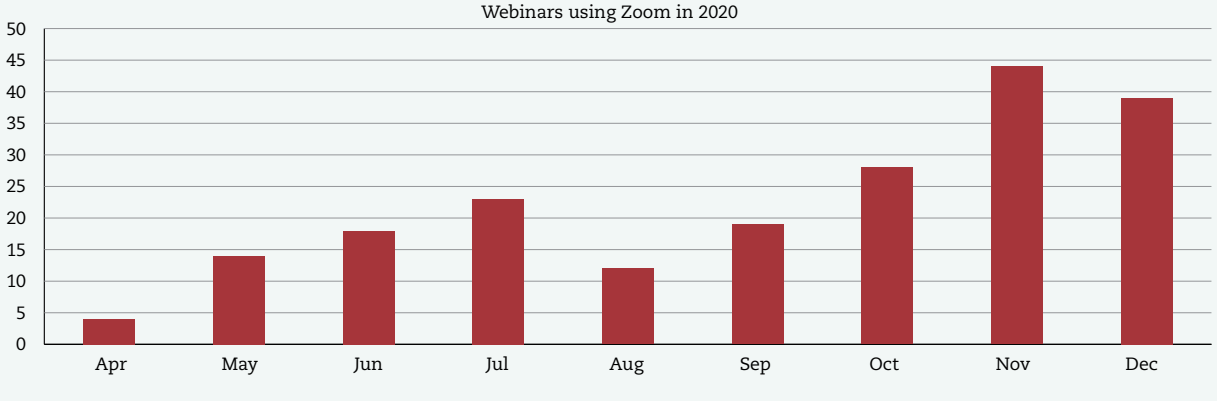
A single Transferring the Family Farm webinar attracted an audience of 1,500 and subsequently in excess of 2,500 views on YouTube. The promotion of family discussion around succession and inheritance on Irish farms, is critical to incorporating young trained farmers into the family farm business at an early age, thereby, improving the efficiencies of the farm business through the promotion of improved knowledge, skills and technologies.

Again, in spite of the pandemic, Teagasc advisory colleagues exceeded their 2020 targets for client numbers, income, and consultations, albeit many of the latter were delivered by telephone or virtually. In addition to normal access available to clients The advisory service operated a dedicated Helpline for farmers struggling with COVID-19 challenges.

In 2020 Teagasc launched a series of webinars and virtual training courses, specifically developed for the Irish food industry, in anticipation of continuing COVID-19 restrictions throughout the year. The webinars covered a range of applied topics such as food product development, packaging and sensory science through to more novel subjects such as insects as an emerging source of protein and using imaging as a tool to study food structure. This was accompanied by the development and delivery of new and existing food industry training courses in an on-line format. Teagasc Food Innovation Gateways, a key biannual event in the industry's calendar, was also delivered virtually.

Researchers from Teagasc Moorepark led a Science Foundation Ireland-funded national consortium of scientists dedicated to the sequencing of variants of SARS-CoV-2, the coronavirus that causes COVID-19. The consortium sequenced the RNA of viruses isolated from patients who had lab-confirmed infections of COVID-19. The sequencing data was shared with the hospitals, the National Virus Reference Laboratory and the general public in order to track the spread of the virus into and within Ireland and identify mutations that may affect its transmission and treatment.

Several years of development work came to fruition in February 2020 with the rollout of a new Customer Relationship Management and Billing system. COVID-19's arrival meant a rapid upgrading of



capabilities to allow a majority of personnel to work from home, and services to be delivered over the internet. All staff now use laptops and Windows 10 replaced Windows 7. The upgrade of data links continued apace.

A new bespoke Learning Management System called T-Learn was launched for Teagasc staff in 2020. The system hosts both asynchronous (selfdirected) and synchronous courses. It will also facilitate the organisation of classroom courses, staff discussion forums, evaluation of training and training records.

Teagasc launched Workvivo, an Internal Communications platform in July 2020. Following the onset of COVID-19 in March 2020 and the onset of large cohorts of staff working from home. This platform is seen as a key engagement tool within the organisation.

The platform is designed around the key drivers of employee engagement which include: two way communications, connecting work to organisational goals and promoting a culture of recognition and community.

Five Teagasc researchers were named among the top 1pc in the world for highly cited papers in the 2020 Clarivate list of 'Highly Cited Researchers'. The highly anticipated annual list identifies researchers who demonstrated significant influence in their chosen field, or fields, through the publication of multiple highly cited papers during the last decade. Their names are drawn from the publications that rank in the top 1% by citations for field and publication year in the Web of Science citation index.

Teagasc, in conjunction with ABP and ICBF, produced results from the Dairy Beef Genetic Research Programme, demonstrating a significant shift in carbon reductions in dairy beef. The findings show the potential to reduce enteric methane emissions by up to 17% within cattle breed, by up to 28% across cattle breed and by up to 36% across different farming systems.

Industry reports (Food Harvest 2020 and FoodWise 2025) highlight the important role that grass plays in livestock production systems. Grass based systems of milk and meat production have a sustainable, green, and high quality image world. In pasture based systems the higher the proportion of grazed pasture in the diet the lower are the costs of producing milk and meat. Ireland's comparative advantage in milk and meat production can be explained by the relative cost of grass, silage and concentrate feeds which are estimated at 7, 15 and 30 cents per Kg DM respectively.

Teagasc analysis has indicated that net profit per hectare is increased by €173/ha for each additional tonne of grass DM utilised on Irish dairy farms, with the corresponding figure for drystock farms being in the region of €105/ha. Against this background, Teagasc launched a four-year Grass10 campaign (2017-2020) to promote sustainable grassland excellence on Irish dairy, beef and sheep farms.

The Grass10 partners are Grassland Agro, AIB, FBD, the Department of Agriculture Food and the Marine and the Irish Farmers Journal. As well as working closely with all partners, the Grass10 programme worked closely with Teagasc's Grassland Science Department.

The primary objective of the Grass10 Campaign was to utilise 10 tonnes of grass DM/ha/year using 10 grazings per paddock on grassland farms in Ireland. The number of dairy farmers completing 20 or more grass measurements increased from 659 in 2016 to 1,623 in 2020. For drystock farmers the figures were 49 in 2016 and 116 in 2020.

In what is a poignant reminder that global catastrophes driven by disease causing organisms are nothing new, 2020 marked the 175 anniversary of research into potato blight.

Even though it is a plant rather than human disease, the importance of Phytophthora infestans, the causal agent of potato late blight, and its arrival in Ireland in 1845, cannot be overemphasised. Prior to this event most of Irish society was dependent on the potato crop, which produced an abundance of nutritious food with relatively low inputs and area. Late blight coevolved with its potato and tomato hosts in the Toluca valley of Mexico.

The first introductions of potato from this region to Europe and North America were blight free, allowing the potato crop to flourish in a relatively disease-free environment. However, shipments of infected potato from South America to New York in 1844 introduced blight there, and further shipments to Belgium in 1845 introduced it to Europe. From there it rapidly spread throughout Europe, eventually making its way to Ireland by the end of the summer of 1845.

The challenge to understand the disease and methods to control it sparked a flurry of scientific developments (just as we have seen in 2020 with COVID-19) leading to the foundation of the science of plant pathology and the initiation of plant breeding for disease resistance. Through the scientific endeavour of people like George Pethybridge and Paul Murphy, who established some of the earliest research on the pathogen at their research station in Clifden, Co. Galway in the early 20th century, Austin Bourke who devised the forecasting model used to this day, and Leslie Dowley, Eugene O'Sullivan and Harry Kehoe, who led combined research into the pathogen and potato breeding at An Foras Talúntais (later Teagasc), substantive advances in protecting Irish potato crops have been made.

Yet, the next challenge is how we can protect these advances while meeting the ambitious 50% reductions in pesticide usage as set down by the EU's Farm to Fork strategy.

However, just as with the sequencing of variants of COVID-19, Teagasc will contribute to finding solutions to some of the greatest challenges facing society.

During the year two of our senior colleagues, Tom Doherty and Professor Tom Kelly retired.

I wish Alan Phelan, who was appointed as Chief Operating Officer, and Dr. Stan Lalor, who was appointed as Head of the Knowledge Transfer Directorate, the very best in their new posts.

AUTHORITY MEMBERS


Mr. John Buckley


Mr. Tommy Cooke


Ms. Martina Donnelly


Mr. Patrick Duffy


Professor Gerald Fitzgerald


Professor Thia Hennessy


Mr. Liam Herlihy (Chairman.)


Mr. Richard Kennedy


Ms. Cliona Murphy


Ms. Eilís O'Connell


Mr. Liam Woulfe


Ms. Elizabeth Reynolds


Mr. Brian Rushe

SENIOR MANAGEMENT

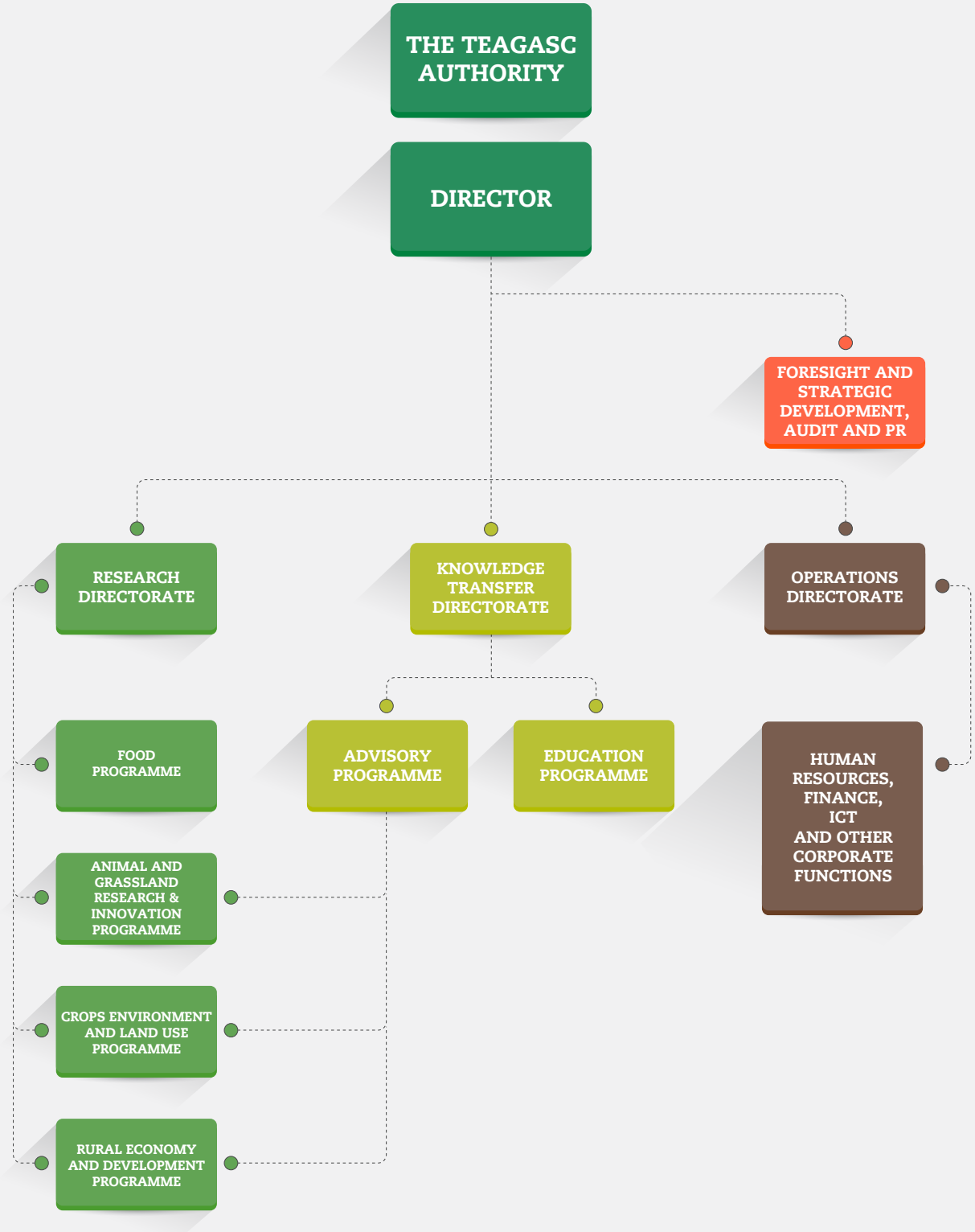
Professor Gerry Boyle
Director

Professor Frank O'Mara
Director of Research

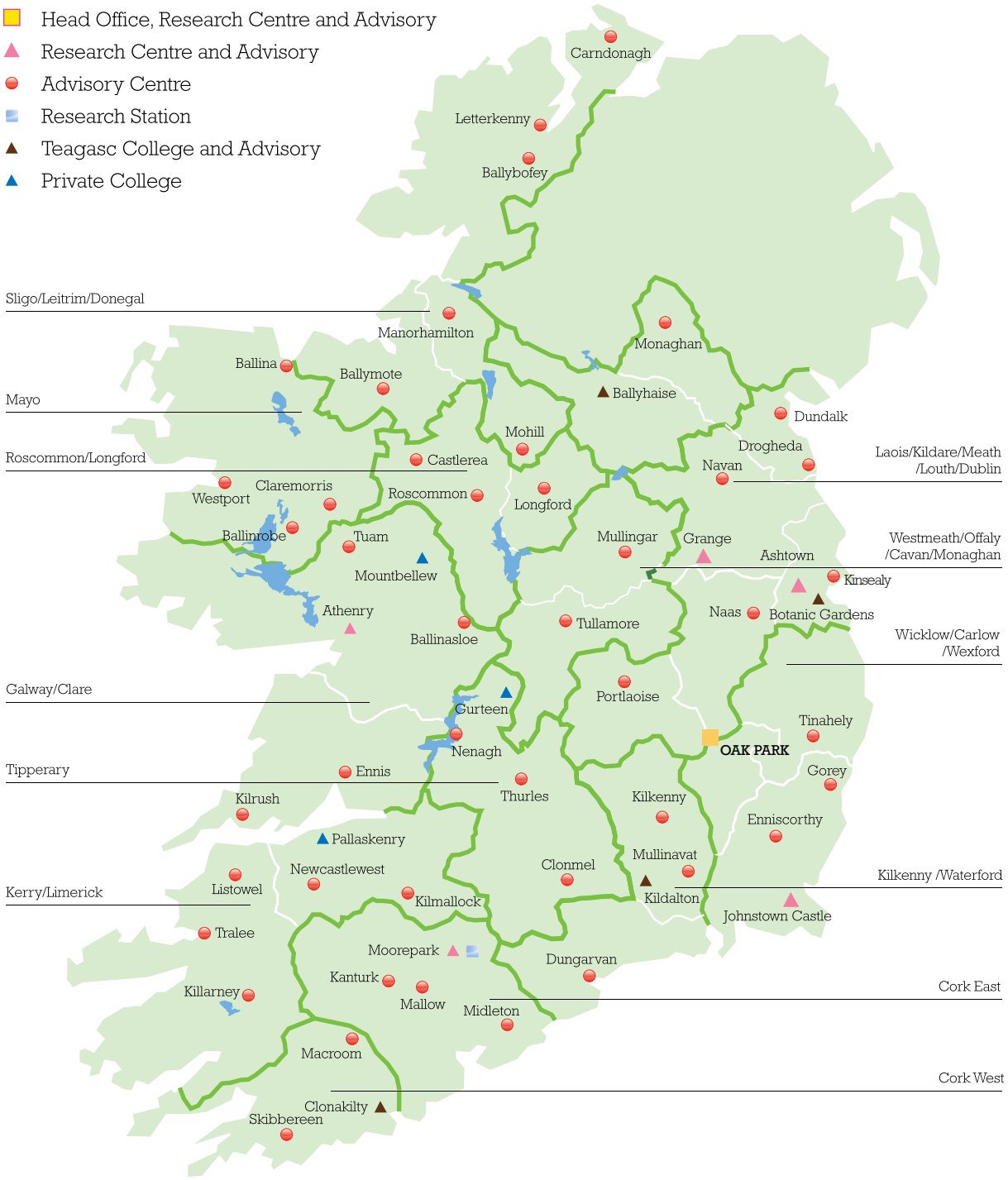
Mr. Alan Phelan
Chief Operating Officer

Dr. Stan Lalor
Director of Knowledge Transfer

ORGANISATIONAL CHART



TEAGASC OFFICES & CENTRES



Special Article

INTRODUCTION: TEAGASC'S RESEARCH EVALUATION SYSTEM

Author:
Professor Gerry Boyle,
Director[1], Teagasc.

Teagasc spends about €75 m on research on agriculture and food each year. These funds are provided by way of a Grant-in-Aid (GIA) as voted by the Dáil, success in winning national and international research awards, producer levies for dairy and pigs, funding from industry for collaborative and contract research, revenue generated through farm activity and the delivery of various analytical and research services, including pilot plant services. These are significant resources and it's important that they generate significant returns for the investment involved.

All research projects that are undertaken by Teagasc are subject to rigorous evaluation involving external expertise. Where Teagasc is successful in winning national and international awards a highly demanding evaluation process is embedded in the application. For other research projects that are primarily funded through the GIA, Teagasc itself seeks to mirror the 'best in class' evaluation processes that are used by those national and international awarding bodies (e.g., Horizon2020, FIRM and STIMULUS (DAFM), Science Foundation Ireland, etc). The processes involved tend to adopt a two-tier system requiring both ex ante economic impact and scientific assessment.

Other evaluation systems within Teagasc serve to validate the process of project selection and optimal resource allocation. All Teagasc research programmes are subject to a cyclical peer-review process. This involves a visiting team of distinguished researchers (usually comprising international scientists) who produce a report on a given research programme over an intensive 2-3 day visit to Teagasc. This report is made available to the Teagasc Authority.

The Teagasc Authority has also established an International Scientific Advisory Board comprised of eminent international scientists which examines Teagasc's entire research activity every two years and which also reports to the Teagasc Authority.

The final stage in evaluation is the tracking of KPIs through the annual Teagasc Business Plan which has to be approved by the Authority. The Business Plan adopts a trilogy of indicators to assess the performance of its research, advisory and education functions. These include output indicators of all activities; a series of practice adoption indicators which are advocated by Teagasc to improve the sustainability of our agricultural and processing sectors; and a number of impact indicators which are designed to illustrate how Teagasc research, advisory and education actions impact on the sustainability of the primary and processing food sectors.

The ability of research, advisory or education activity to influence the behaviour of a myriad of individual actors should not be overstated. Clearly no organisation, irrespective of its mandate, can have complete control over its ability to influence others. Teagasc is of course completely responsible for the outputs it produces. And these have to be subject to the widest possible scrutiny to see whether they measure up to the performance of our international counterparts. However Teagasc does not have complete control over whether any practices it might advocate will, in fact, be adopted by farmers and food companies. The same applies to an even greater extent to the impact of our activities. Farmers and processing companies will be subject to other influences and influencers. The economics and relative

1. I would like to acknowledge the support of my colleagues in the preparation of this article, including, Frank O'Mara, Justin Kidd, Mark Moore, Michael O'Donovan, Donagh Berry, Diarmuid Sheehan, Paul Cotter, John Spink, Stephen Kildea and Kevin Hanrahan. None of these is responsible for any of the views or errors contained herein.

risk of employing recommended practices will have a big influence over their take up. And this will in turn determine the ultimate impact of any research project.

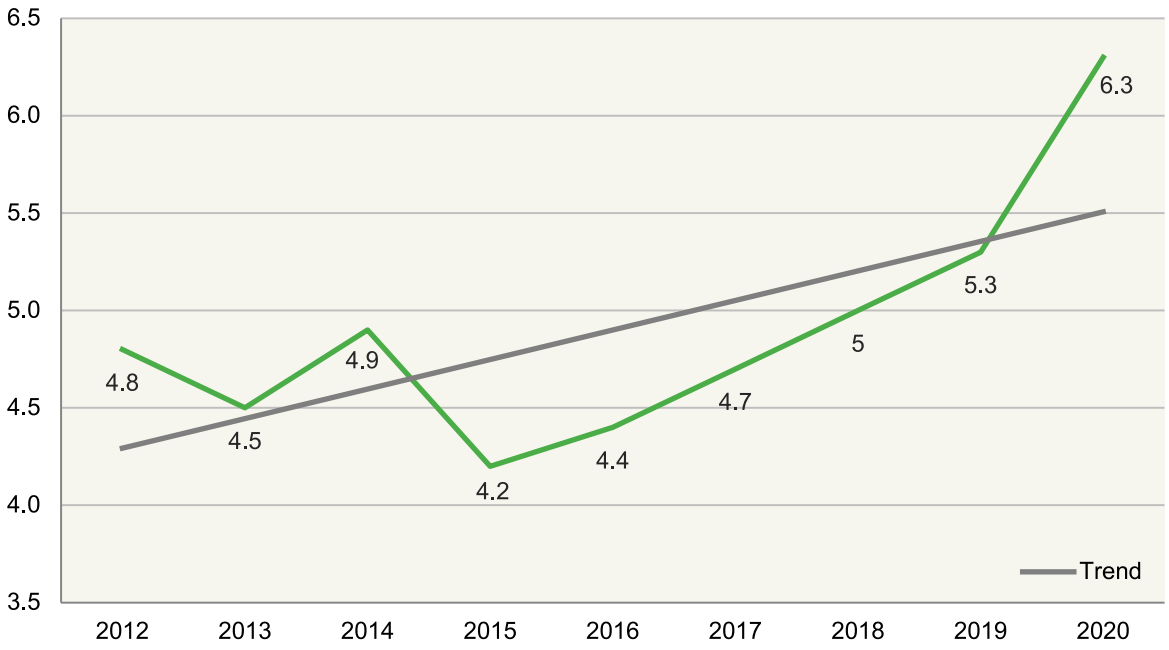
Research performance KPIs

Teagasc sets annual targets in terms of standard internationally accepted KPIs to measure research performance, which comprise publications and citations in refereed scientific journals, success in winning research funding and the supervision of PhD students.

Research publications

Figure 1 shows the trend in the Teagasc performance on research publications.

Figure 1: Annual Teagasc scientific publications per permanent researcher, 2012-2020

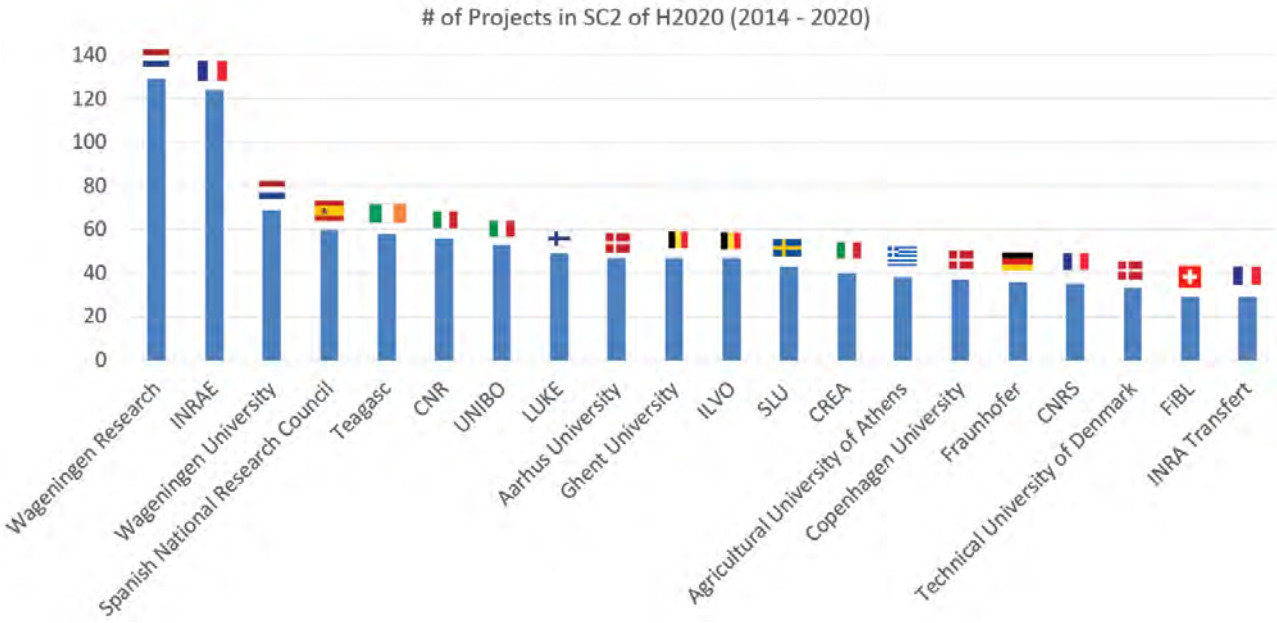


The rate of publications has increased from about 4.5 per permanent researcher in the period up to 2015 to in excess of six last year. In absolute terms this level of productivity is impressive relative to other research performing institutions in Ireland and elsewhere. But the rate of growth is also impressive. The quality of publications has also improved significantly as measured by the impact factor of the journals that Teagasc researchers are increasingly publishing in and by the level of citations that Teagasc publications are receiving. In the most recent review of Teagasc publications, 20% of all Teagasc papers were positioned in the top 10% of relevant globally-cited papers.

External research funding

Teagasc success in winning Horizon2020 research awards is a good indicator of our success in delivering external funds for our research. Figure 2 displays the relative success of Teagasc relative to other organisations right across Europe. For the entire seven-year period Teagasc has consistently been ranked in the top 6 in terms of the number of projects funded in the Societal Challenge 2 (SC2) category that deals with agri-food research. No other Irish or UK institution has featured in the EU-wide top 20 ranking. Moreover Teagasc shares the top 6 position with organisations such as INRAE and France and Wageningen in the Netherlands which are some 9 and 2.5 times larger, respectively than Teagasc in terms of staff numbers.

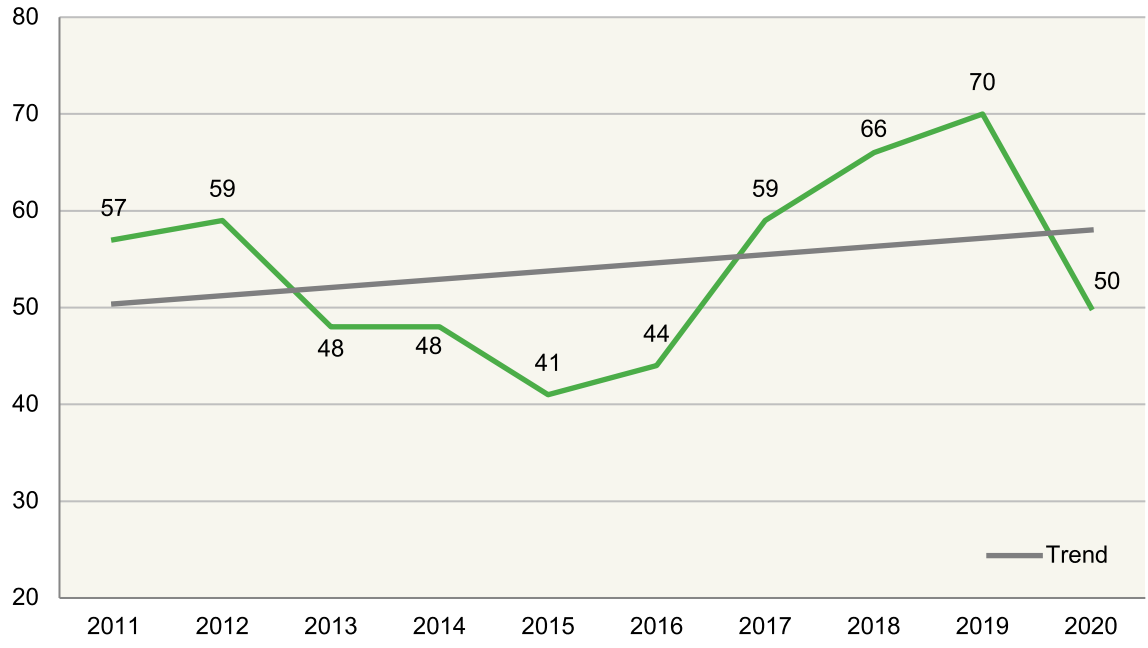
Figure 2: Teagasc ranking in winning EU Horizon 2020 research funding, 2014-2020



PhD supervision

The final important output indicator is the number of Walsh PhD Scholarships that Teagasc researchers supervise in collaboration with university partners in Ireland and across the world. The trend in the numbers of PhDs that have graduated through this system is shown in Figure 3.

Figure 3: Annual PhD graduations from Teagasc Walsh Scholarship Programme, 2011-2020



A steady increase is evident from about an average annual of 50 graduated PhDs up to 2015 to about 60 in recent years. These graduates go on to work throughout the agri-business sector, research and the public sector.

Practice adoption

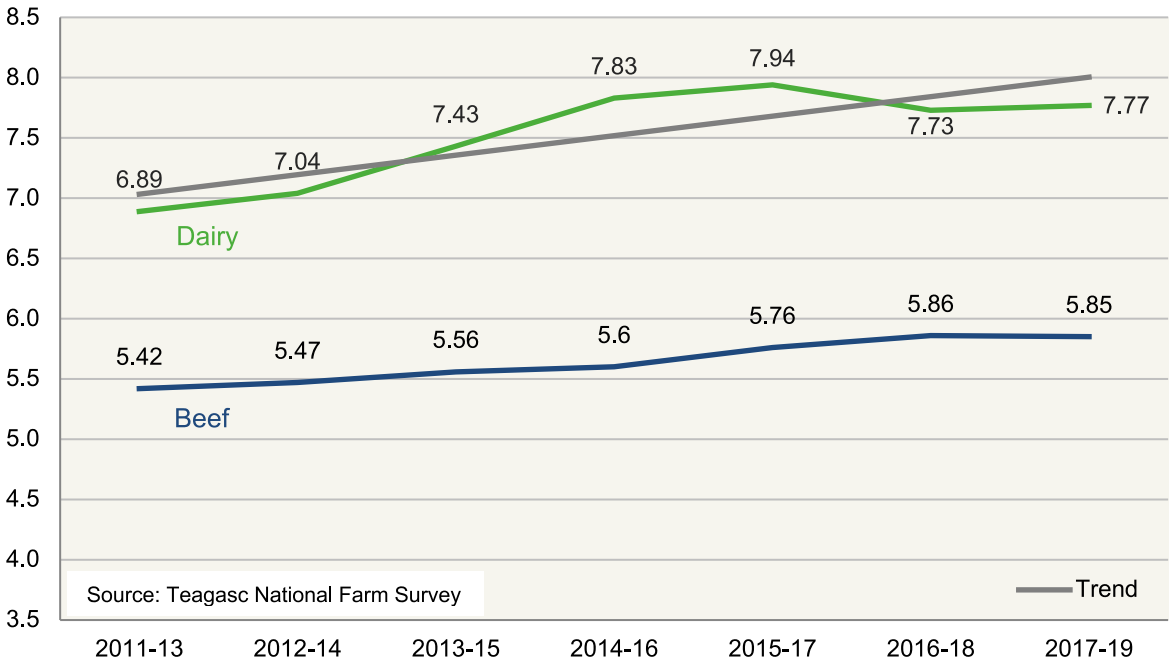
Teagasc advocates farm practices that its research has shown enhances the sustainability of Irish agricultural production. The adoption of recommended practices results from a combination of research, advisory, education and training activity and of course the willingness of farmers to embrace

new technology. Teagasc tracks several of these practice adoption indicators on an annual basis. In the following charts we outline the trends for a selection of these practices. The data are presented as three-year moving average series to smooth out inter-year volatility due to weather and other factors.

Grass utilisation

The promotion of grass utilisation is a central plank of Teagasc's research and advisory programmes. In Figure 4 we show the trends from 2011 to 2019 for the dairy and beef sectors. Over the period, the growth in utilisation levels in dairy enterprises has been about one tonne per hectare. There is a clear and consistent gap of about 1.5 to 2 tonnes per hectare in utilisation between dairy and beef enterprises. Nonetheless there has been a steady increase of about 0.5 tonnes per hectare in utilisation levels on beef farms over the period reviewed.

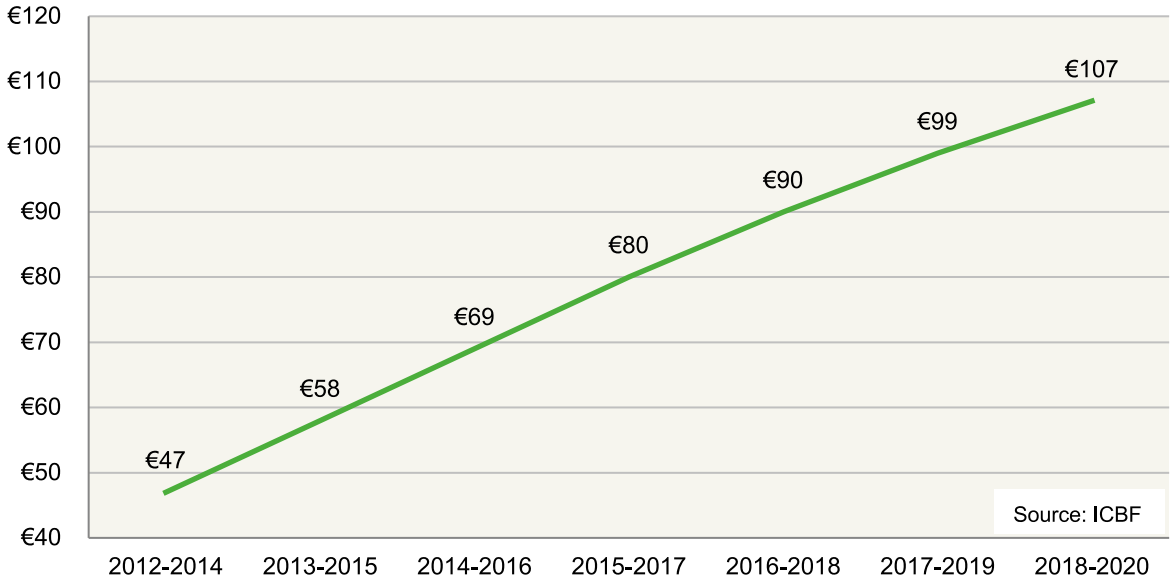
Figure 4: Grass utilisation, tDM/ha, dairy and beef enterprises



Genetic improvement in dairy

One of the great successes of research and knowledge transfer in Ireland over the last 30 years has been the enormous improvement achieved in the genetic quality of our dairy herd in particular. This is captured in Figure 5 which shows that the average EBI of Ireland's dairy herd has increased by €60 over an eight year period from 2012 to 2020.

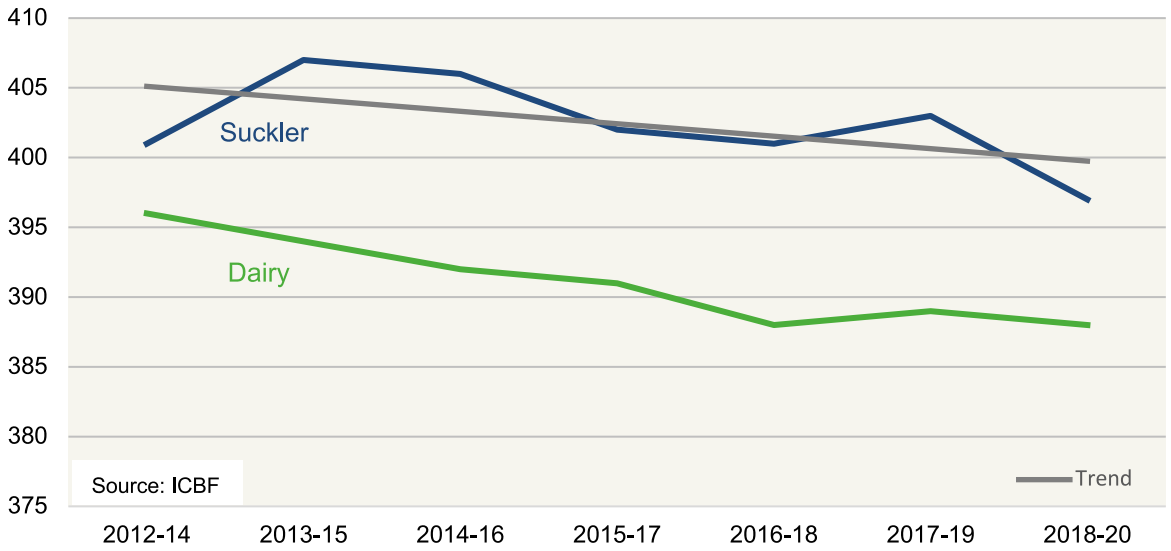
Figure 5: The evolution of EBI on Ireland's dairy herds



Calving interval (days)

Teagasc has consistently advocated for a reduced calving interval for dairy and beef cows. This is a critical indicator of profitability, especially in suckler systems. The desirable outcome should be that cows should calve within a calendar year. The trend is shown in Figure 6.

Figure 6: Calving interval (days) for dairy and suckler cows



The absolute calving interval is of course much more satisfactory in the case of dairy cows. However, the interval has been declining for both herds: about five days for suckler cows and about eight days for dairy cows.

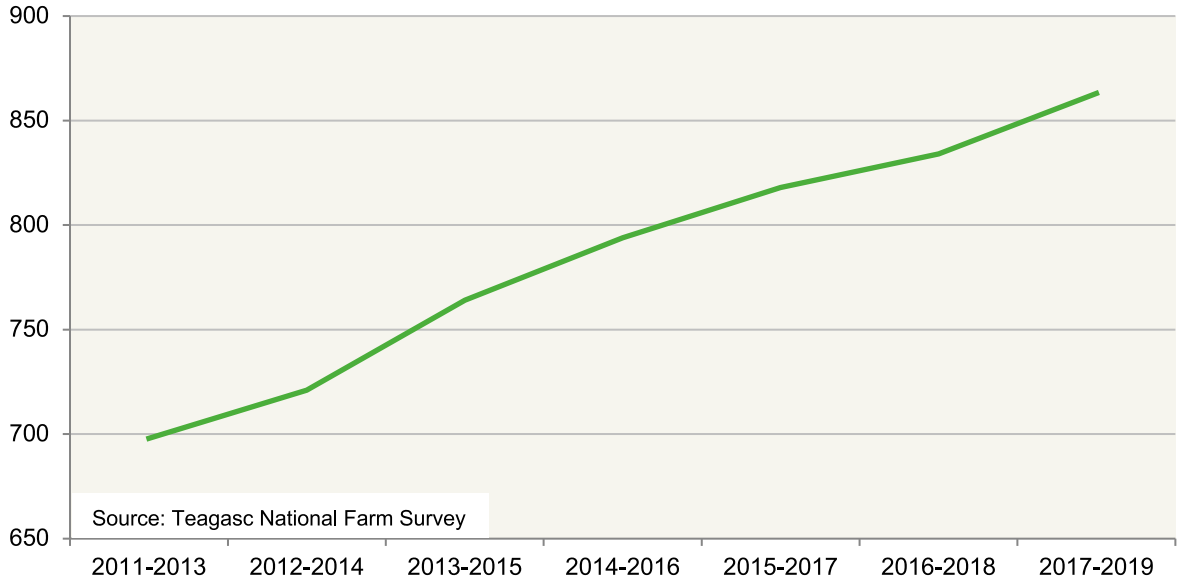
On dairy farms there has also been a significant improvement in compact calving with an increase of about 10% to 65% over the period in the number of herds calving their cows within a six-week period.

Productivity performance in various enterprises

Dairy

The quantity of milk solids produced per ha is a good indicator of productivity in the dairy enterprise as it combines both stocking density and milk yield. The trend in this indicator is shown in Figure 7. While the absolute average performance level is below what our best farmers are achieving or what's possible in a research context, the growth of over 160 kg that has been achieved over the eight years is noteworthy.

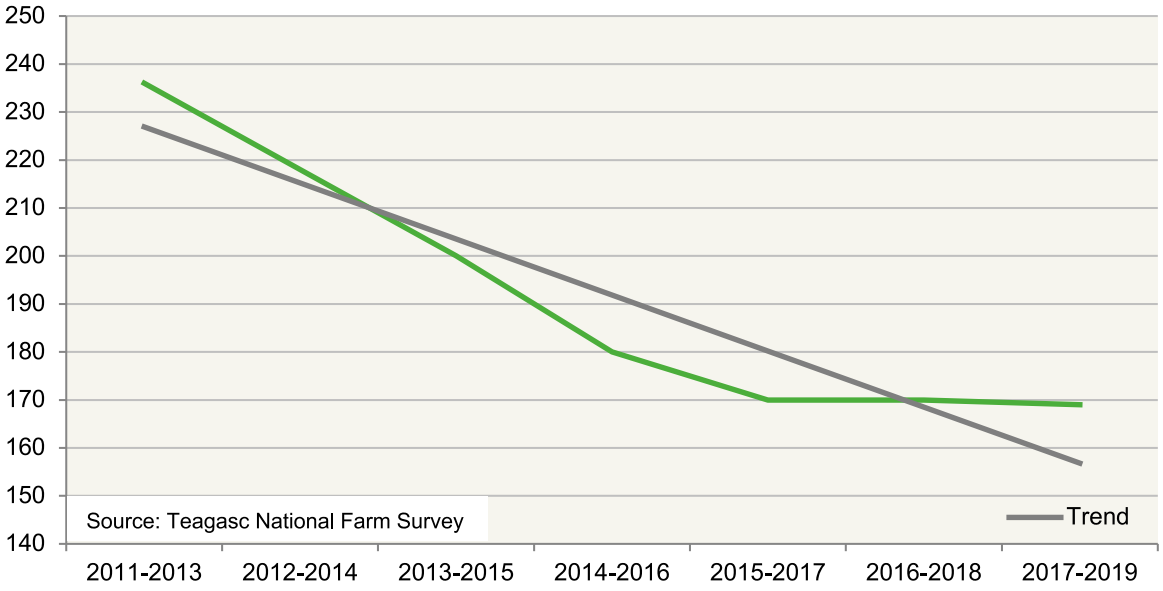
Figure 7: Milk solids production in kg per ha



Somatic cell count (SCC)

Milk quality is a close complement of productivity and has a big influence on the price received for milk. For several years now Teagasc has collaborated with Animal Health Ireland (AHI) in a collective effort to reduce the somatic cell count (SCC) in milk production. The results of this effort are shown in Figure 8. There has been a dramatic reduction in SCC of about 31% over the eight year period. The average level appears to have plateaued in recent years but this might be due to diminishing returns as the level of SCC is reduced to lower and lower levels.

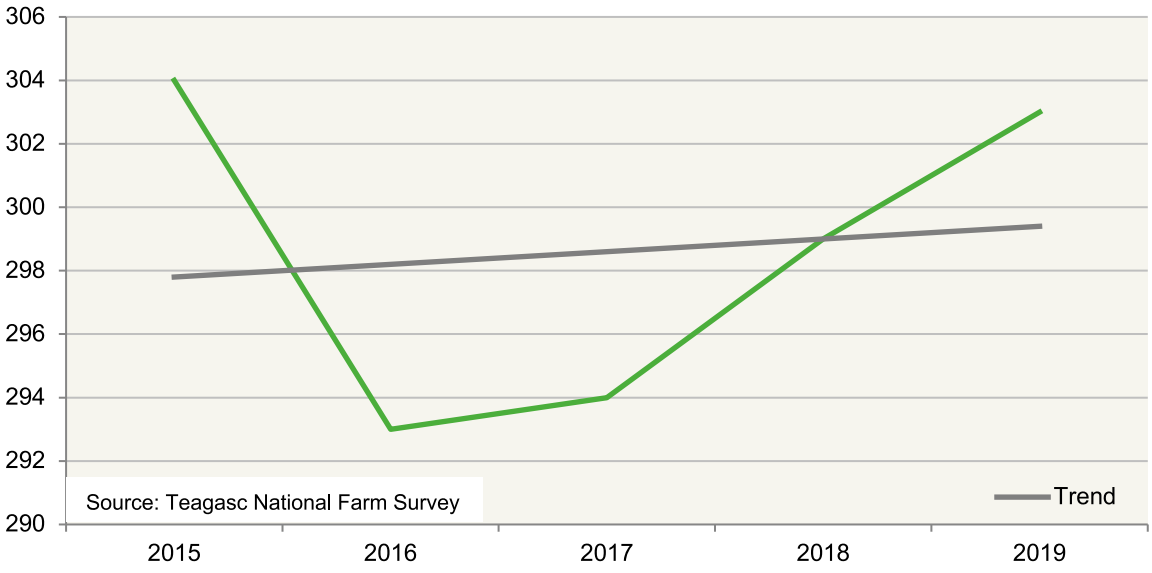
Figure 8: Somatic cell count (SCC), '000 cells/ml



Beef

In Figure 9 we use beef output in kg liveweight per ha as our indicator of productivity for the beef sector. As is apparent over a relatively short period the indicator has been quite volatile with no evident trend.

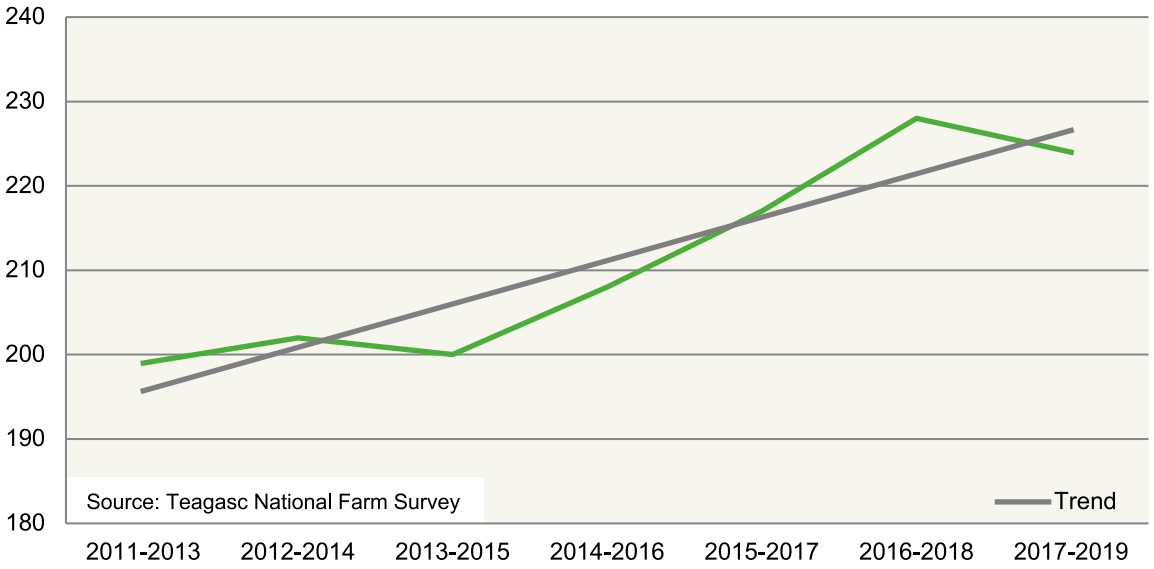
Figure 9: Beef liveweight output kg per ha



Sheep

The productivity of the sheep sector is depicted by the level of carcass output per ha in Figure 10. This indicator is defined as the product of stocking rate times the number of live lambs reared per ewe. Over the eight year period productivity has increased by about 30 kg.

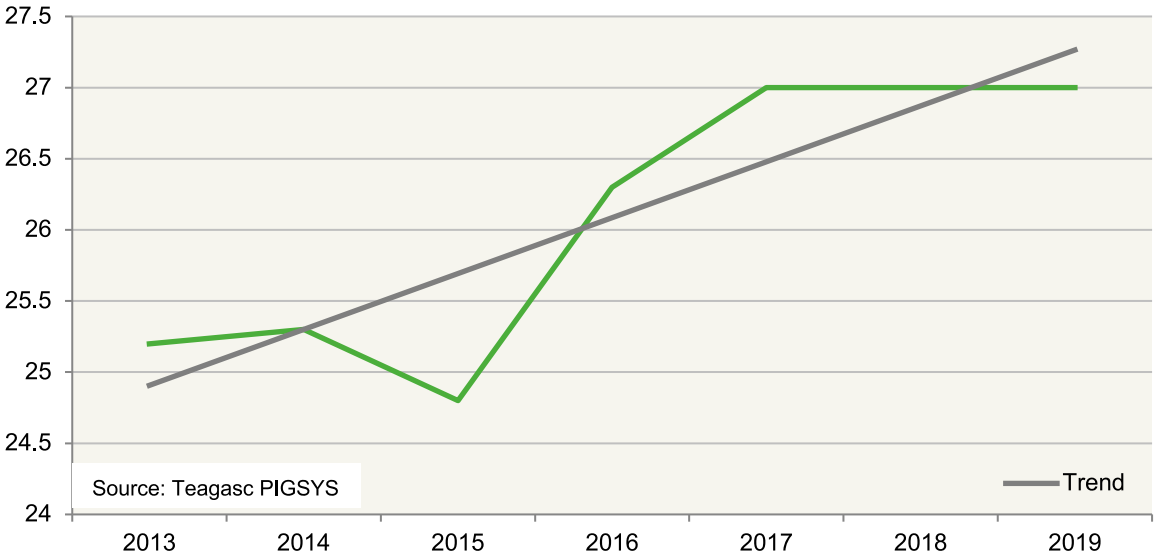
Figure 10: Sheep carcass output (kg per ha)



Pigs

The productivity of pig production, as measured by the number of pigs produced per sow, has increased appreciably in recent years. In the six years between 2013 and 2019 (Figure 11) the number of pigs produced per sow has increased by about 2.5.

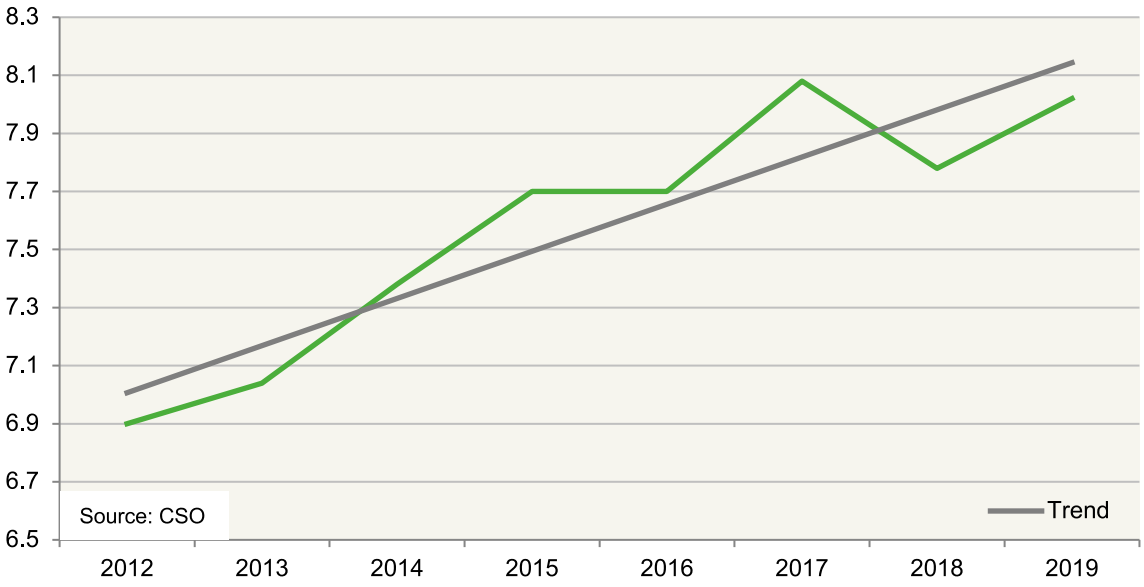
Figure 11: Pigs produced per sow



Cereals

Barley yields are shown in Figure 12 as indicative of the evolution of overall cereal yields. Over the seven years from 2012 trend yield has increased by a little over a tonne/ha.

Figure 12: Yield of barley t/ha



Environmental indicators

Several environmental indicators can be tracked but here we focus on the carbon footprint for the dairy and beef enterprises. In any case most environmental indicators, in respect of water quality and ammonia for example, will be highly correlated with these variables

The annual average trend decline in the carbon footprint (expressed as CO_2 equivalent per kg of "fat and protein corrected milk") for the dairy enterprise is about 1.11% per cent (Figure 13).

Figure 13: Dairy carbon footprint, kg CO_2 equivalent/kg FPCM

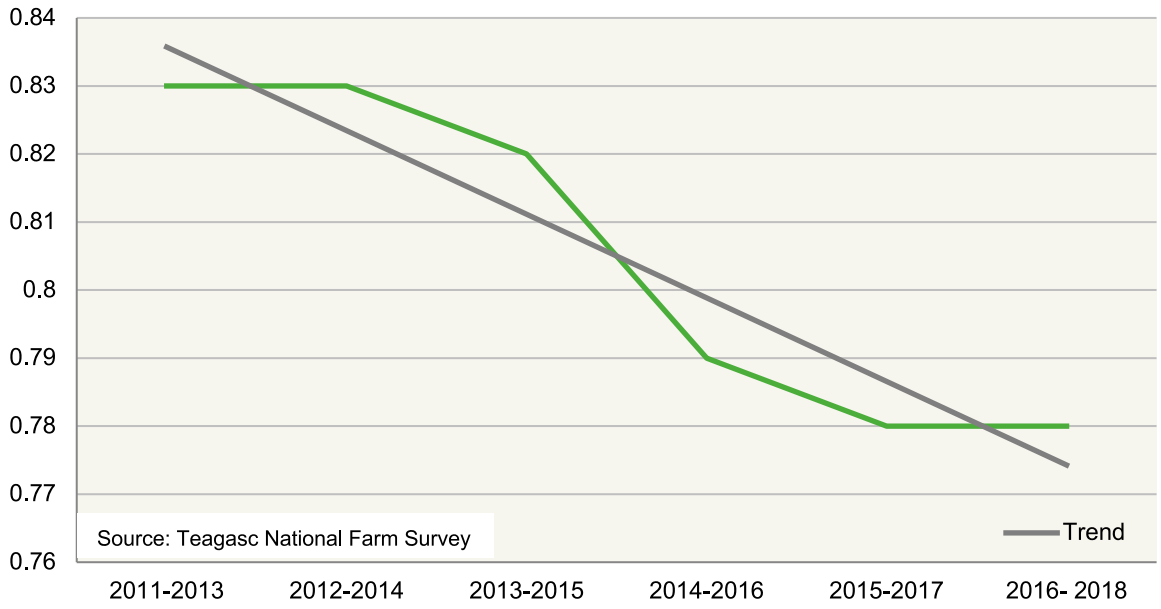
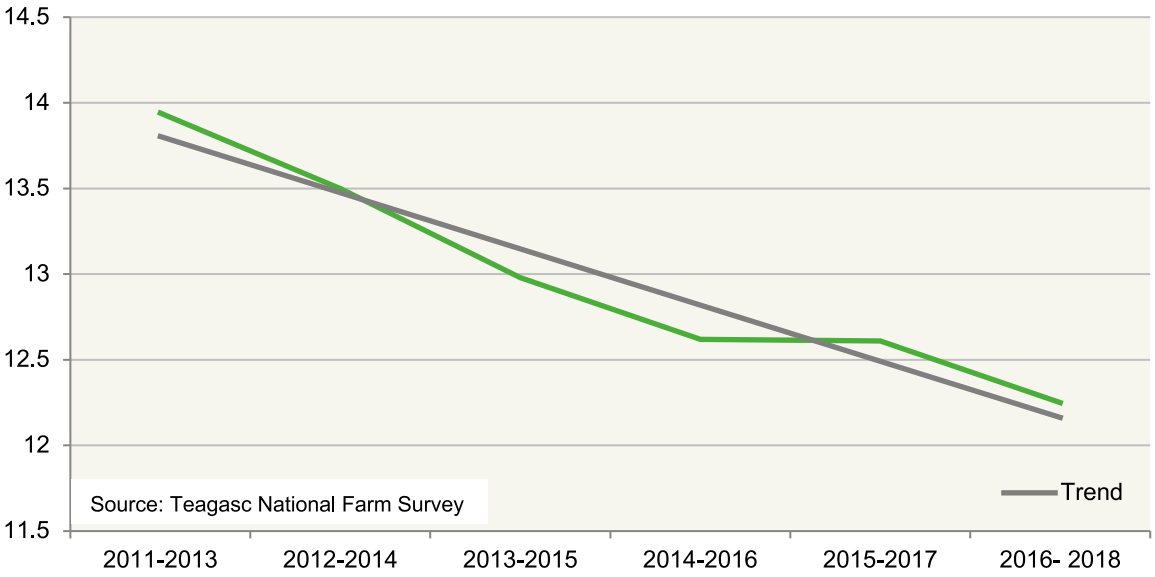


Figure 14 shows the corresponding indicator for the beef sector which is measured as the kg of CO_2 equivalent per kg of liveweight. The annual average decline in this indicator is about 1.66% per annum.

Figure 14: Beef carbon footprint, kg CO_2 Equivalent/liveweight



Case studies of research impact

The high-level indicators that have been set out and discussed in the preceding sections are useful but they don't give a vivid sense of how breakthrough technologies can be so impactful. In this section we select some technologies that have had a clear impact on the agri-food sector in very tangible ways over the last few years. Our selection is not representative of Teagasc work and of course is not exhaustive. We don't include a number of areas that could be the subject of entire articles in their own right. For example, we don't include our work on economic policy, including, analyses of Brexit and CAP Reform. Neither do we examine the internationally renowned work undertaken with our partners in UCC on the human microbiome.

Grassland management

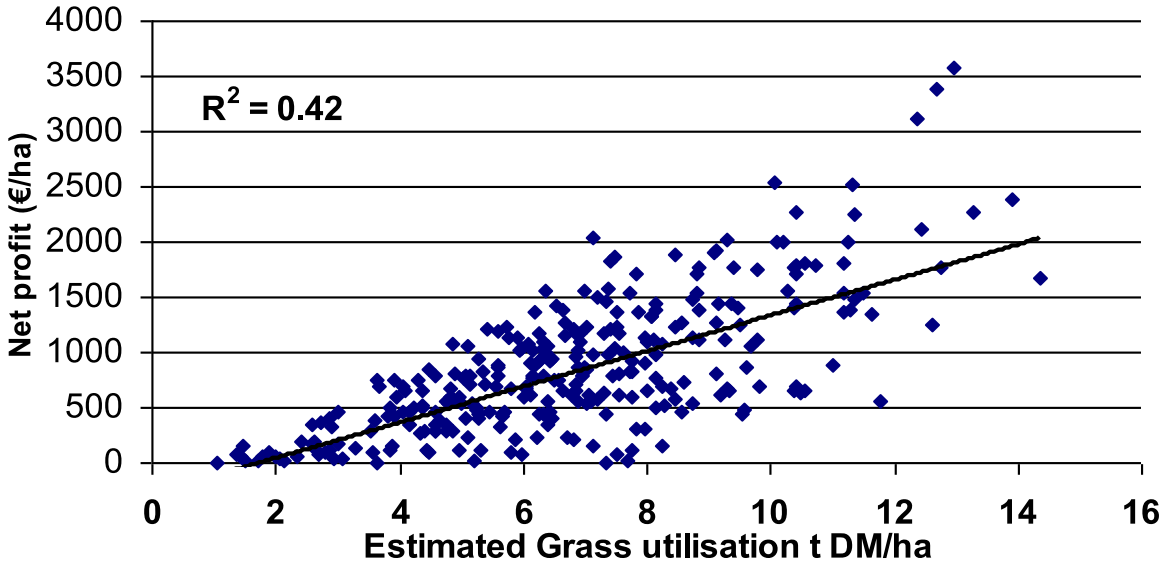
For several years Teagasc has undertaken research and development on increasing grass production and on its direct consumption under grazing conditions. Grass utilisation is most cost effective where soil fertility is optimal, there is excellent grazing infrastructure, the sward has a mixture of perennial ryegrass and white clover and good grazing management practices are employed with a weekly monitoring of grass supply and its demand.

Teagasc has developed PastureBase Ireland (PBI) to assist farmers to effectively manage their grassland resource. The number of farmers using PBI has increased from 2,393 in 2017, completing on average 14 grass cover measurements per year, to 3,664 grassland farmers in 2020, completing on average 19 grass cover measurements per year.

Within Irish grass based systems it has been shown that there is a strong relationship between the amount of grazed pasture consumed by the animal and the profitability of milk and meat production (Figure 15). Teagasc research has consistently indicated the very high returns from the utilisation of grassland[2]. The most recent data indicate that net margin per hectare is increased by €173/ha for each additional tonne of grass dry matter (DM) that's utilised on Irish dairy farms, with a corresponding figure for drystock farms of about €105/ha.

Apart from the clear profitability of using grass as an animal feed, Teagasc research has also demonstrated that pasture-based systems are also optimal in respect of minimising harmful gaseous emissions, improving water quality and biodiversity.

Figure 15. The relationship between grass utilisation and net profit (€/ha)



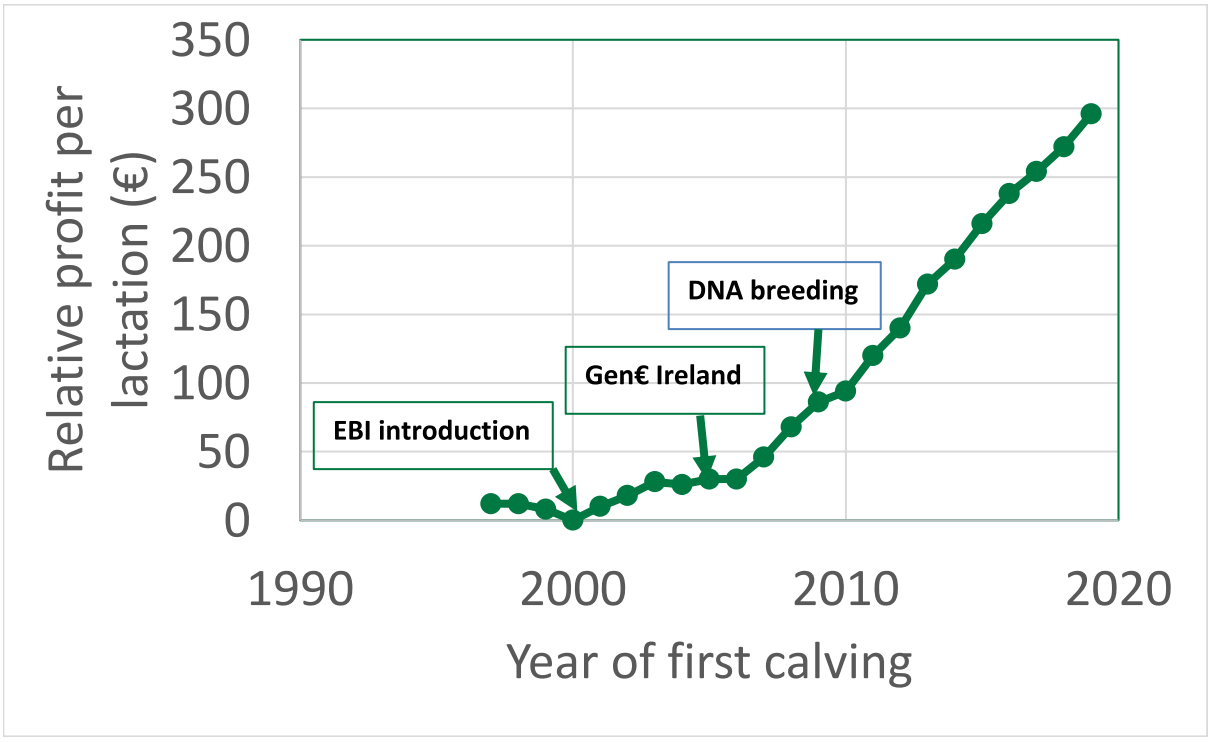
2. Hanrahan, L., N. McHugh, T. Hennessy, B. Moran, R. Kearney, M. Wallace, and L. Shalloo. 2018. Factors associated with profitability in pasture-based systems of milk production. J. Dairy Sci. 101:5474–5485. https: / / doi .org/ 10 .3168/ jds .2017 -13223.

Genetic improvement

Genetic improvement is an excellent example of how research can generate permanent gains in productivity[3]. Animal breeding research at Teagasc investigates new phenotypes, statistical models, genetic and genomic tools and evaluations, breeding goal construction, and breeding scheme design. The success of research undertaken in this area since the late 1980s can be attributed to a number of factors. From the outset of this phase of research the emphasis in devising breeding strategies was to stress the economic benefit, not of single traits such as milk production, but of a combination of traits, including animal fertility. From this approach the Economic Breeding Index (EBI) was developed which has provided a readily understood decision tool for dairy farmers as it is dimensioned in monetary terms. A second success factor was the creation of what is now the largest multi-breed dairy and beef animal database globally. This database is owned by Irish farmers and managed by our partners, the Irish Cattle Breeding Federation (ICBF). A third factor underpinning the success of the programme is the role played by the Teagasc advisory service in the dissemination of the resulting discoveries to farmers. In the dairy sector the level of adoption is exceptionally high because of the pervasive use of AI.

The impact of this research and advisory programme has been a sustainable and consistent improvement in the efficiency of production contributing to an ever-increasing value of the respective sectors. This economic benefit has also been associated with a reduction in the environmental footprint per unit product produced. Using the EBI, the profit per lactation has increased in the past 20 years by, on average, €282 (Figure 16). When we factor in the cost of research programmes over the years, together with an estimated annual implementation cost, a most impressive cost-benefit ratio of about 17:1 is implied. Moreover, the carbon cost per kg milk solids produced over that time period has reduced by 14%. Similar trends exist for the other sectors.

Figure 16: Trend in the Economic Breeding Index, 1997-2020



3. Ruminant breeding with a particular focus on past, present and future Irish endeavours D.P. Berry, F.L. Dunne, N. McHugh, S. McParland, A.C. O'Brien, and A.J. Twomey (submitted to a special issue of the Irish Journal of Agricultural and Food Research).

Teresa Roche is behind the creation of Kylemore Farmhouse Cheese, produced on her family's farm in Galway. An example of the thriving food culture in Galway according to Anne Kinsella (right) of the Teagasc Rural Economy Development Programme, Athenry.

Cheese research

Ireland exported 282,000 tonnes of cheese last year with an associated value of €1.03 bn. This represents a growth of almost 37% since the abolition of dairy quotas.

Teagasc has been involved in cheese research almost from the establishment of An Foras Talúntais. In the past its research has been instrumental in the development of cheese brands such as Dubliner and Pilgrim's Choice. In recent years it has developed a highly successful partnership with Ornua. The success of this partnership was built on clarity from the outset of the respective roles of both organisations. Based on a long history of research on cheese, Teagasc provided key scientific and technological inputs, particularly in the areas of dairy chemistry and technology, which were aligned with Ornua's consumer insights and their global market and distribution network.

The partnership led to the development of over 300 cheese variants for commercial uptake[4]. Among the commercial opportunities that were developed, included a continental-type cheese for European markets and a fresh white cheese widely consumed in the Middle East. The latter cheese was based on a patented technology developed by Teagasc that allows innovative milk protein ingredients to be exported globally and then to be recombined at a local facility to create fresh white cheese products. Subsequently Ornua invested €20 million in Saudi Arabia, including the acquisition of a 75 % interest in Al Wazeen Trading LLC (Al Wazeen) and the development of a new state-of-the-art cheese manufacturing plant at the Al Wazeen facility in Riyadh for production of fresh white cheeses.

Teagasc also is centrally involved in addressing quality issues that arise in the commercial manufacture of cheese from time to time (e.g., consistency in the compositional and aesthetic characteristics of continental eye-type cheeses manufactured from a seasonal Irish milk supply) and also support artisanal cheese producers (e.g. Wicklow Farmhouse Cheese).

In the future, research will be focused on sustainability and the reduction of emissions around cheese manufacture. The implications of grass-fed animal diets on cheese flavour and manufacturing characteristics will also feature. Another avenue will emphasise the role that process and technological factors have on consumer health. Brexit has required dairy processors to diversify their export markets and Teagasc will focus on developing platform technologies for cheese innovation for emerging Chinese and Asian markets.

4. Hickey, C. D., Auty, M.A.E., Wilkinson, M.G., and Sheehan, J.J. (2015). The influence of cheese manufacture parameters on cheese microstructure, microbial activity and their interactions during ripening: A Review. Trends in Food Science and Technology, 41 (2), 135-148.

High Throughput DNA Sequencing and COVID-19

Teagasc's Food Research Centre at Moorepark hosts a national High Throughput DNA Sequencing facility. This facility contains all of the infrastructure required for the extraction, preparation, quality assurance and sequencing of samples for High Throughput sequencing. The facility typically is employed on research concerning microbes and microbial populations of relevance to the food and health area and we work closely with our partners in the APC Institute Ireland and Food for Health Ireland in this regard. During the COVID pandemic, Teagasc researchers have leveraged this infrastructure and expertise to contribute to the national effort to control COVID by establishing and leading the Irish Coronavirus Sequencing Consortium[5]. This Consortium is funded by Science Foundation Ireland to sequence (or "read") the genetic information of SARS-CoV-2, the virus that causes COVID-19.

The SARS-CoV-2 virus contains genetic information that can change over time. The ability to track those changes enables the mapping of how the virus spreads across regions. This can support efforts to respond to clusters of infections as they arise and minimise the spread of the virus. This will also enable important new changes to be captured that could affect the ability of the virus to cause disease or to evade treatments or vaccines.

The Teagasc sequencing initiative has thus contributed in a significant way by facilitating tracking of the spread of the virus and the identification of variants of concern (i.e., those that may affect the disease or its treatment) in Ireland.

The impact of this research cannot be quantified in economic terms, although there are clearly substantial adverse economic impacts associated with the virus. The ability to track the evolution of the virus and its variants is clearly an important tool in arresting its development and hopefully in bringing the pandemic to an early end.

Fungicide resistance in cereals

The mild and damp climate of Ireland is ideal for the production of cereals such as winter wheat, with regular rainfall ensuring an adequate supply of water during the critical period of grain filling. This has resulted in Ireland having exceptionally high yields. However, yields do not equate with competitiveness due to the role of production costs that arise in substantial part to combat weather-related crop disease.

Unfortunately, our climate also provides the perfect conditions for fungal growth, including those pathogenic to wheat. Amongst these *Zymoseptoria tritici,* which is the cause of the disease septoria tritici blotch, is currently the most economically destructive to Irish winter wheat crops. Spreading both via the wind or rain splash, *Z. tritici* can, if left untreated, reduce yields by anything up to 50%. To prevent such reductions intensive control programmes that integrate cultural, varietal and chemical approaches are practised. Key to the effectiveness of these programmes is ensuring that each of these approaches remain effective. With resistance to chemical treatment there is a potential for yields to be reduced by up to 25% which would cost about €375/ha in gross margin terms in the current year.

Through a combination of traditional and molecular microbiological monitoring techniques, Teagasc crop researchers have detected changes in the Irish *Z. tritici* population that would otherwise have adversely affected treatment programmes[6]. This monitoring has detected resistance to key groups of fungicides, including the azoles and Succinate DeHydrogenase Inhibitors (or, SDHIs), very early in their development, whilst virulence to novel varietal resistances have also been detected in recent seasons prior to their widespread commercial cultivation. In parallel, to both assess the impact of these changes and to devise strategies that can alleviate their impact, extensive field trials are carried out each year. These trials have led to recommendations concerning the specific targeting of fungicide applications to match emerging leaf layers and the alternation and mixing of fungicide modes of action to maximise the diversity of chemistries that are applied to the crop. In all cases, the development of strategies resulting from this research have been devised in close consultation with the Teagasc tillage advisors and specialists, ensuring the immediate uptake of remedial practices by farmers.

5. https://www.teagasc.ie/food/research-and-innovation/research-areas/food-bioscience/irish-coronavirus-sequencing-consortium/

6. Burke, J.J. and Dunne, B. 2008. Investigating the effectiveness of the Thies Clima 'Septoria Timer' to schedule fungicide applications to control Mycosphaerella graminicola on winter wheat in Ireland. Crop Protection 27: 710–718.

Cork tillage farmer John Kelleher with Teagasc advisor Michael McCarthy.

Teagasc's role in the mitigation of gaseous emissions

Teagasc has played a central role in influencing policy concerning both greenhouse gas (GHG) and ammonia emissions from agriculture over the last decade. Teagasc published its first GHG Marginal Abatement Cost Curve (MACC) in 2012 which was also one of the first agricultural GHG MACCs published in the world[7]. The MACC essentially provides the relationship between the amount of emissions saved as a result of different technologies, measured in tonnes of CO_2 equivalent, and the cost per tonne of CO_2 equivalent saved. This publication was also the first attempt to chart a low C pathway for Irish agriculture and quantified the mitigation capacity of the sector.

This publication, and the associated preparatory work for the subsequent 2019 publication, formed a key part of the Government's deliberations on the 2019 Climate Action Bill which were preceded by negotiations within the EU on Ireland's contribution to the so-called burden sharing agreement. The availability of the MACC had an impact on Ireland obtaining the largest proportion of flexibilities in reaching its 2030 GHG targets of any member state, in recognition of the large proportion of emissions that arose from agriculture. The second version of the GHG MACC was published in 2018, along with projections of the future emissions from Irish agriculture up to 2030[8].

The two MACC studies have had a major impact on national gaseous emissions policy. They have substantially informed the policy statement on emissions, AgClimatise, which was recently published by the Department of Agriculture Food and the Marine and the new Climate Action (Amendment) Bill 2021.

In 2015 Teagasc published an Ammonia MACC. This report was generated in response to a proposed 10% ammonia reduction target post-2030 from the EU Commission. The Ammonia MACC and the underlying analysis were furnished to the Commission which resulted in a halving of the proposed reduction target to 5%. Teagasc published an updated Ammonia MACC in 2020 and this publication also had an important influence on AgClimatise[9].

The impact of this research on the development of public policy is apparent. But what's of critical importance is that through adoption of the MACCs on farms, Ireland will be enabled to fulfil its national and international obligations on the reduction of gaseous emissions which will thereby crystallise Ireland's contribution to reducing the sectoral adverse impact on global warming and clean air.

7. Schulte, R.P.O., Crosson, P., Donnellan T., Farrelly, N., Finnan, J., Lalor, S., Lanigan, G., O'Brien D., Shalloo L., & Thorne, F. (2012). A Marginal Cost Abatement Curve for Irish Agriculture. Teagasc submission to the public consultation on Climate Policy development. Teagasc, Carlow, 30 April 2012.
https://www.teagasc.ie/media/website/publications/2012/1186_Marginal_Abatement_Cost_Curve_for_Irish_Agriculture.pdf

8. Lanigan, G.J. and Donnellan, T. (Eds.) An Analysis of Abatement Potential of Greenhouse Gas Emissions in Irish Agriculture 2021-2030, Teagasc, Oak Park, Carlow, March 2019. https://www.teagasc.ie/media/website/publications/2018/An-Analysis-of-Abatement-Potential-of-Greenhouse-Gas-Emissions-in-Irish-Agriculture-2021-2030.pdf

9. Buckley, C and Krol, D.J. "An Analysis of the Cost of the Abatement of Ammonia Emissions in Irish Agriculture to 2030". Teagasc, Oak Park, Carlow September 2020.
https://www.teagasc.ie/media/website/publications/2020/NH3-Ammonia-MACC.pdf

If the GHG MACCs were implemented on farms, which would require a substantial advisory effort, they will also have an economic impact. The Department of Public Expenditure and Reform suggest a CO_2 equivalent price of €100 per tonne for 2030[10]. The implementation of Teagasc mitigation technologies could potentially save 3.4m tonnes of CO_2 equivalent between 2018 and 2030. At a carbon price of €100 per tonne of CO_2 equivalent, the total saving would be worth €340m. This saving is equivalent to about 16% of the value of the beef sector.

Conclusions

As the leading agency in Ireland responsible for conducting research and innovation for the agri-food sector it's essential to have robust processes in place to evaluate the impact of our research and innovation investment. We rely substantially on external validation of our research programmes both directly and indirectly. Formal direct evaluation processes are important, such as, the cyclical peer reviews that are conducted for every research programme and the oversight that is provided by the International Scientific Advisory Board. Also every research project that's funded by Teagasc undergoes a 'double hurdle' appraisal system, involving national and international experts external to Teagasc, which assesses each project in terms of its scientific merit and its economic value to the agri-food sector. And of course the Teagasc Authority, its committees, and a large system of advisory committees, which are constituted by farmers and business participants, provide additional layers of reassurance as to scientific quality but particularly economic relevance.

But the indirect validation of the Teagasc research and innovation programme through the ability of our researchers to publish in prestigious international publications, and to have these publications highly cited across the world, together with our ability to win substantial competitive research funding awards both nationally and internationally, is probably of greater importance.

While these indicators are important when judging the performance of Teagasc against other Research Performing Organisations in Ireland and elsewhere, what really matters for us is that we influence our farmers and food companies to improve their productivity and sustainability. On this aspect we can point to several examples where we've had an important input. It's not possible of course to be definitive about influence and impact, nor would we want to claim to be. Farmers, for example, are influenced by a host of factors, including their own experiences and that of their peers, the farming media, the internet, their agri-business suppliers, national and international research and advice, and a host of other channels. Likewise, food companies are hugely influenced by their suppliers, their partners and other research providers. And in recent years while Teagasc has become more and more involved in supporting policy makers, it's clear that policy makers take their inspiration from a myriad of sources.

Notwithstanding the difficulty of attributing cause and effect, it's not unreasonable to point to several areas where Teagasc's research and innovation has had a major influence on the adoption of technology, the processing of food or the design of policy. In this paper clear successes have been considered in areas such as genetic improvement, grassland utilisation, livestock and crop productivity, milk quality, disease resistance, climate change mitigation, cheese production and DNA sequencing in the case of COVID-19. These successes arise due to the combined efforts of researchers, advisors, educators and, of course, the farmers and food companies themselves. They also involve critical partnerships with other RPOs and agencies such as AHI and ICBF.

Alongside our ability to support innovation on our farms and in our food companies, through our research programme we also are training the future generation of scientific leaders for our agri-food industry through the graduation of about 60 Walsh Scholars each year. It's not possible to apply a simple economic calculus to value this contribution but it's one of those impacts that's manifestly of substantial importance.

What generates success in technology and practice adoption cannot be answered definitively. Take the case of farming. Ultimately technology is embodied in the inputs that farmers purchase, whether they be fertilisers, feed ingredients or machinery. The most successful technology that has been considered in this article simply requires the farmer to purchase a set of suitable semen straws for his/her herd. The decision rule is relatively simple whereas the underlying research is relatively complex. Contrast this decision with the adoption of optimal grass utilisation technology. The adoption process is more complex and the farmer is required to consider a multiple of factors and processes. Hence, it's not surprising that while considerable success has been achieved in encouraging greater levels of utilisation, there is a still a good distance to travel. There is a need therefore to undertake research to understand the barriers that farmers face in the adoption of what are complex decision rules. And as always, intensive advisory effort will be required to reach greater levels of adoption.

10. Valuing Greenhouse Gas Emissions in the Public Spending Code, Laura Kevany, Climate Change Unit, Department of Public Expenditure and Reform, July 2019. https://igees.gov.ie/valuing-greenhouse-gas-emissions-in-the-public-spending-code/

Goal 1

Improve the competitiveness of agriculture, food, and the wider bioeconomy

eagasc
Agriculture and Food Development Authority

FORESTRY

Ash Dieback

Tolerance to ash dieback in common ash depends on multiple factors and different genotypes might show different degrees of tolerance to ash dieback ranging from highly tolerant to highly susceptible. Work started in 2017 at Teagasc within the FORM project (DAFM) and Strategic Chalara project (Teagasc) with the aim to identify and propagate tolerant ash and to develop tools to fight ash dieback, respectively.

One thousand Irish ash genotypes were exported to Lithuania to undergo natural screening under high disease pressure and different European institutions were contacted to obtain tolerant genotypes. Today, a gene bank containing over 200 tolerant genotypes exists in Ireland.

Teagasc also carried out a metabolomics study to identify biochemical markers for tolerance to ash dieback in F. excelsior, produced hybrids between common ash and resistant Asiatic species, and developed a set of genetic barcodes to identify and classify ash species.

Training on Continuous Cover Forestry

In 2020 the Teagasc Forestry Development Department adopted a new digital Knowledge Transfer tool developed by the EFI (European Forestry Institute): which is a tablet-based app for use in special forest plots called "marteloscopes". As part of this initiative, in partnership with Coillte, a new marteloscope plot was installed in Curraghchase Forest Park, County Limerick.

This new facility was used as part of a new virtual training course for forest owners as well as InServiceTraining for advisors and researchers. Additional marteloscope plots are being installed at Teagasc Oak Park, to be used for a range of training programmes targeting forest owners, foresters, forestry students and other stakeholders.

Dr. Ian Short, Teagasc Forestry Researcher, pictured with Minister of State for Land Use and Biodiversity, Senator Pippa Hackett...and the winning entry in the Teagasc forest photo competition entitled 'Celebrating Our Forests'.

BEEF

Livestock Systems

Teagasc, in conjunction with ABP and ICBF, produced results from the Dairy Beef Genetic Research Programme, demonstrated a significant shift in carbon reductions in dairy beef. The findings show the potential to reduce enteric methane emissions by up to 17% within cattle breed, by up to 28% across cattle breed and by up to 36% across different farming systems.

Parasite Control

Teagasc research has demonstrated anthelmintic resistance in gastrointestinal nematodes of cattle and sheep as well as in liver fluke. The research programme currently focusses on developing strategies to manage parasites in the face of anthelmintic resistance. This includes the development of new tools such as novel diagnostics and vaccines as well as refined management strategies, such as targeted selective treatment and maximising refugia.

Bovine Respiratory Disease (BRD)

Bovine respiratory disease (BRD) is one of the most significant causes of morbidity and mortality in cattle. An accurate and early diagnosis of clinical (BRD) and sub-clinical bovine respiratory disease (sBRD) is necessary to get a better classification of the disease and guide effective treatment.

At Teagasc, Grange, thoracic ultrasonography (TUS), a novel technique, is being used in cattle to examine the appearance of the lungs and diagnose BRD in conjunction with clinical respiratory signs. The detection of BRD in cattle with lung lesions without showing clinical respiratory signs, can only be confirmed using TUS.

Housing and Cattle Welfare

Space allowance and floor type have been identified as critical factors affecting the welfare of indoor finishing beef cattle. A recent Teagasc study concluded that increasing space allowance above 3.0 m^2 per animal on concrete slatted floors (CSF) was of no benefit to animal performance but it did improve animal cleanliness. Housing heifers on straw instead of CSF increased lying time by one hour per day; however carcass weight was not affected.

Methane Abatement Strategies

Teagasc work has been progressing at the ICBF performance testing station (Tully) on measuring methane emissions and feed efficiency in a large number of beef cattle through a number of projects such as RumenPredict (ERA-GAS funded) and MASTER (EU H2020 funded) with the aim of establishing the link between the rumen microbiome, feed efficiency and methane emissions, and the host genomics.

Preliminary data show that enteric methane emissions and feed efficiency are negatively correlated providing evidence that low methane producing cattle are more feed efficient. This work will contribute to the development of breeding values for low methane output for both beef and dairy sires for the cattle industry.

Feed Additives

A Teagasc study funded by the Department of Agriculture, Food and the Marine is currently assessing a range of feed additives including seaweeds, 3-NOP, oils, halides, yucca extracts etc. for their methane mitigating potential in vitro. Promising candidates will be evaluated for sheep, dairy cows and beef cattle. Work on encapsulation strategies for these additives so they can be delivered, at pasture, in slow release bolus forms is also proceeding.

Mindful of COVID-19 (picture taken pre level five restrictions) are Alan Dillon and Sean Cummins of the Teagasc Green Acres Calf-toBeef Programme, Joe Hand (local Teagasc advisor) and farmer JP Hammersley.

Return on Labour on Beef Farms

Farmers participating in the Teagasc Green Acres Calf-to-Beef Programme recorded their labour hours throughout 2020. A large number of farmers in Ireland have off-farm employment – many of these jobs pay well (> €35,000), the size of farms may be too small to deliver a full-time income, or land quality may not lend itself to intensive agriculture.

In these situations, farmers farm within the hours available outside of their off-farm employment and family time. When return per hour is calculated on a well laid out farm, it equates to quite a favourable return per hour. The study showed that the key to success is often to avoid complicating the system by diversifying away from the core target of producing beef from dairy-bred calves at 24-28 months and to follow best practice and to avoid any unwanted upsets to time input on the farm. Herd health protocols, grassland management and silage quality are also key to success on beef farms.

The Beef Edge Podcast

The Beef Edge Podcast was launched in December 2019. It is led and presented by Teagasc cattle specialist Catherine Egan and, due to the success of the release of the first 12 episodes and because of the COVID-19 lockdown in Mid-March 2020, its frequency was increased to weekly. The first 45 episodes reached a total of 25,000 listeners.

The podcasts cover news, information and advice on how to improve beef farm performance. With the launch of a number of beef schemes in 2020 such as the beef environmental efficiency programme - suckler (BEEP-S) and the beef finishers programme (BFP) the podcast aided the dissemination of scheme details to farmers.

Virtual Beef Week

The Teagasc Virtual Beef Week ran in the second week of July, 2020. Each day covered a different theme including a one-hour pre-recorded BeefTalk webinar in conjunction with the Irish Farmers Journal each morning and video and fact sheet releases throughout the day. A one-hour interactive discussion in conjunction with AgriLand called Live@Grange was delivered each evening with viewers having the opportunity to question an expert panel.

On Monday the focus was on suckler beef production; Tuesday covered calf to beef; Wednesday the topic of environmental sustainability. On Thursday, attention switched to grassland and nutrition; Friday looked at economics and policy in Irish beef production. There was a large amount of material also broadcast on social media each day the response from both farmers and the industry to this initiative was extremely positive.

Drystock Online Events

Throughout most of 2020 the majority of the drystock events and workshops that were planned for the year were moved to virtual online formats. This included a virtual beef farm walk on the Teagasc Green Acres calf-to-beef farm of Martin Connolly in Co. Roscommon and the Teagasc National Beef Conference in December. Drystock advisors and specialists also produced a large number of short videos for farmers on a wide range of topics. Teagasc also started a regular "Let's Talk Cattle And Sheep" webinar series and is building its viewer numbers.

The Teagasc Newford suckler-to-beef demonstration farm in association with Dawn Meats produced eight short videos in 2020. These videos covered silage production, grassland management, breeding, weaning and cattle finishing. These videos had over 100,000 views on Facebook and over 20,000 views on YouTube

Royal Visit

Guests from the United Kingdom, the Duke and Duchess of Cambridge, together with the British Ambassador to Ireland Mr. Robin Barnett, visited Teagasc Grange on a visit to Ireland in early March, 2020. The couple were welcomed to Teagasc by Michael Creed TD, Minister for Agriculture, Food and the Marine, and Liam Herlihy, Chairman of Teagasc.

They were introduced to Professor Gerry Boyle, Director of Teagasc, Councillor Wayne Harding, Cathaoirleach of Meath County Council, and Jackie Maguire, Chief Executive of Meath County Council. Members of the Teagasc Authority were also present.

Paul Crosson and Edward O'Riordan, beef researchers at Teagasc Grange, showed the royal couple three cows, each with twin calves, which are part of the Derrypatrick demonstration suckler herd at the Teagasc Animal & Grassland Research and Innovation Centre (AGRIC) in Grange, Co. Meath.

Paul and Edward outlined the steps taken on Irish cattle farms to ensure that beef is produced in an environmentally sustainable way, and also spoke about the technologies that have been developed and adopted to reduce greenhouse gas emissions from the herd.

Teagasc Countryside Management Specialist, Catherine Keena, described initiatives to promote biodiversity and develop hedgerows so they are fit for both 'birds and bees', providing suitable nesting sites and berries for the birds, and flowers for pollinators.

The couple then met Teagasc advisors Eilish Burke and William Byrne, who introduced them to farmers Ronan Hughes, Justin Walsh, Teleri Thomas, David Hannon, and Donal Keane, who spoke about what they are doing to farm 'with nature' by using the best animal genetics, grass-based production systems focused on reseeding and good paddock organisation, and in the case of Donal Keane, how he is an organic demonstration farmer.

The Duke and Duchess were presented with a gift of crafted bog oak produced by Christy Slattery, Latteragh, Co. Tipperary by Liam Herlihy, Chairman of Teagasc.

Teagasc chairman, Liam Herlihy (centre) introduces Prince William to Prof. Gerry Boyle, Teagasc Director during the visit of the Duke and Duchess of Cambridge to Teagasc Grange.

Prince William, Dr. Paul Crossan, the Duchess of Cambridge, and Dr. Eddie O'Riordan provided a guided tour for the royal couple.

SHEEP

Finishing Systems

The DAFM sheep census for 2019 showed that just under half of the national ewe flock is accounted for by mountain and mountain cross type ewes (pictured). However, the hill sheep sector is restrained by comparatively low levels of lamb output and frequently weak markets for hill lambs. Preliminary analyses from on-going Teagasc studies show that there is potential for store lamb purchasers to finish hill bred lambs on forage brassica crops with lambs achieving target carcass weights and specifications.

Once lambs have adapted to the brassica crops lamb average daily gain ranged from 100g/head/day to 150g/ hd/day. Starting lamb live weight and crop yield had a significant effect on lamb performance and drafting rates with 20% of lambs drafted for slaughter from the lowest yielding crop up to 60% on the highest yielding crop.

OviCast Podcast

OviCast, the sheep podcast, was launched in May 2019. Presented by Teagasc sheep specialist Ciaran Lynch it discusses the latest advice, insights and technical updates for the sheep industry. In response to the COVID-19 Lockdown the frequency of Ovicast was increased from monthly to weekly episodes. During 2020 the podcast had over 12,000 listeners with a growing following. There are regular contributions from the Teagasc specialist and research teams, industry experts and farmers. Grassland management, flock health, production systems, market and financial updates as well as health and safety topics were discussed during the year.

Sheep Conferences

The annual National Sheep conferences were held in January in Killarney, Co. Kerry and Kilkenny, Co Kilkenny respectively. The focus on each night was on a number of key areas: efficient use of nutrient on sheep farms; use of commercial data in genetic improvement programmes and managing anthelminthic resistance. 2019 Grass 10 sheep category winner and BETTER farm participant John O'Connell discussed how various technologies helped him develop his farm business.

The National Hill Sheep conference was held in Ballybofey Co Donegal in February. Again the topic of anthelminthic resistance featured, highlighting the challenge the industry faces. The areas of sustainability and the public goods that hill sheep farms provide were discussed prominently. The final segment of the conference featured a panel discussion on the topic of strategies for maintaining High Nature Value (HNV) Farmlands with contributions from a number of expert speakers.

Reducing Lamb Mortality Workshops

The sheep specialist and research team in conjunction with colleagues in the advisory service and Agricultural College staff ran a series of on-farm workshops aimed at reducing lamb mortality and focusing on reduced use of antimicrobials on sheep farms. In total, 15 on farm workshops were held during January and February 2020.

Virtual Sheep Week

This week-long event was held in September and showcased the latest research, advice and initiatives in the sheep sector with each day focused on a specific theme. A wide range of information videos and technical articles were released each day culminating in a live interactive webinar each evening called Live@Athenry.

DAIRYING

DairyEdge Podcast

Started in January 2018, the DairyEdge podcast has seen a steady increase in listenership. In 2020, the weekly podcasts attracted over 120,000 listeners. The podcast, organised by Emma-Louise Coffey, Teagasc Moorepark, deals with a variety of dairy-related topics including environment and the social and economic sustainability of dairy farming.

CalfCare and Dry Cow Events

Teagasc and Animal Health Ireland (AHI) have run January CalfCare events for over a decade. September 2020 was the second time to run Dry Cow events. The events highlight practices that improve animal health and reduce the need for antibiotic use in calves and cows. The spring and autumn events attracted audiences of over 1,200 and 400 respectively.

Online Discussion Group Meetings

Teagasc's dairy discussion groups traditionally run face to face. With over 4,200 members in approximately 300 groups, the disruption caused by COVID-19 meant a rapid change to online meetings to ensure their continuity. As a result, approximately half of all meetings took place online in 2020.

Teagasc Kerry Agribusiness Programme Renewed

Over 3,000 dairy farmers supply 1.1 billion litres of milk annually to Kerry Agribusiness. Teagasc's joint industry programme with Kerry Agribusiness which was renewed in November 2020. With fourteen monitor farmers identified, the focus of the programme includes improving supplier sustainability through improving milk production, financial and labour efficiency.

Johne's Disease

Johne's disease is an important endemic disease in many dairy herds in Ireland and it is challenging to diagnose infected animals. A study is underway in Teagasc Moorepark to assess the performance of an alternative herd screening method for Johne's disease in dairy herds. Currently available test methods are costly and lacking in accuracy.

Herd environmental sampling involves taking samples of manure and slurry from sheds and yards when cows are housed, and testing these

The Dairymis group which was established by Teagasc Moorepark in 1979, celebrated its 40th year anniversary in early 2020.

samples for the bacteria that cause Johne's disease. Initial results show that this strategy correctly identified 38% of infected herds out of a sample of 63 herds.

Teagasc Next Generation Herd

The Next Generation Dairy Research Herd at Teagasc Moorepark was established in 2013 as a sentinel research herd to validate the performance of futuristic cows selected using our national breeding tool, the Economic Breeding Index (EBI). The herd compares ELITE cows representative of the top 1% nationally with national average cows (NA), based on EBI.

The performance of the ELITE cows, demonstrates that selection using EBI will deliver cows that are more productive and fertile, and will perform in line with industry targets. ELITE cows produced less milk volume compared to NA (-205kg), but by having higher milk fat and protein content (+0.28 fat % and +0.18 protein %) produce higher yields of milk solids (fat plus protein yield; +8kg).

Elite cows maintained higher body condition (+0.18), were slightly lighter (-6kg), and had substantially better reproductive efficiency (e.g. six week in-calf rate +15 percentage units) and survival to 5th lactation (+20 percentage units). Feed intake was similar for both ELITE and NA. Intake capacity, the amount of feed consumed relative to body weight, was greatest for the ELITE animas, a trait implying better suitability to a pasture-based diet.

Farm profit was considerably better for the ELITE compared to the NA cows (over €200 per cow per lactation) and ELITE cows produced milk with a 15% lower carbon footprint.

Dairymis

The Dairymis group which was established by Teagasc Moorepark in 1979, celebrated its 40th year anniversary in early 2020. The group was established to act as a benchmark group where dairy management information could be assessed and disseminated to dairy farmers.

One of the main objectives of Dairymis was that the data collected from the farms were developed into a computer management information system, and used to assess the efficiency of individual farm systems for comparative analysis. Many of the initial reports have been refined and adapted by Co–ops, ICBF, Agri software companies and Teagasc itself.

The group is closely linked to Teagasc Moorepark and has always been co-ordinated and facilitated by a Moorepark staff member. Pictured at the celebrations in Rochestown, Cork are group members with Liam Herlihy, Teagasc and FBD chairman, Michael Gowen, Dairymis Group Chairman, group facilitator Michael O'Donovan, Teagasc and group co-ordinator Katie Sugrue, Teagasc.

GRASS

Grass10

Industry reports (Food Harvest 2020 and Food Wise 2025) highlighted the important role that grass plays in livestock production systems. Grass based systems of milk and meat production have a sustainable, green, and high quality image world.

In pasture-based systems the higher the proportion of grazed pasture in the diet the lower are the costs of producing milk and meat. Ireland's comparative advantage in milk and meat production can be explained by the relative cost of grass, silage and concentrate feeds which are estimated at 7, 15 and 30 cents per kg respectively.

Teagasc analysis has indicated that net profit per hectare is increased by €173/ha for each additional tonne of grass DM utilised on Irish dairy farms, with the corresponding figure for drystock farms being in the region of €105/ha.

Against this background, Teagasc launched a four-year Grass10 campaign (2017-2020) to promote sustainable grassland excellence on Irish dairy, beef and sheep farms. This campaign embeds the use of PastureBase Ireland (PBI).

The Grass10 partners are Grassland Agro, AIB, FBD, the Department of Agriculture Food and the Marine and the Irish Farmers Journal. As well as working closely with all partners, the Grass10 programme works with Teagasc's Grassland Science Department.

The primary objective of the Grass10 Campaign was to utilise 10 tonnes of grass DM/ha/year using 10 grazings per paddock on grassland farms in Ireland.

Table 1: Number of dairy and drystock farms who have completed 20 or more grass measurements on PBI over the 2016-2020 period.

Year	Dairy farms	Drystock farms	Total
2020	1623	116	1739
2019	1014	106	1120
2018	731	93	824
2017	739	70	809
2016	659	49	708

Teagasc National Farm Survey data indicates that grass utilisation per ha increased by 0.3 tonnes

(7.7-8.0 tonnes of DM/ha) on dairy farms, while it remained static at 5.9 tonnes on drystock farms over the last few years.

This corresponds to annual grass production of 10.7 and 7.9 tonnes of DM/ha on dairy and drystock farms in 2019 respectively. On dairy farms where PBI is used, an average of 13.6 tonnes of DM/ha grass was grown in 2019. This suggests that there is still significant potential to grow more grass on the average dairy farm. There was a significant improvement in soil fertility over the period as well with about 20% of soil samples tested now at optimal soil fertility compared to 10% at the start of the Grass10 campaign.

John Douglas of the Teagasc Grass10 Programme, farmer Seamus Sweeney and his local Teagasc advisor, Martin Doyle.

Predicting Grass Growth

"Since 2018, the MoSt GG model has been used to predict grass growth on farm," according to Elodie Ruelle, research officer at Teagasc Moorepark. "Initially 30 farms were used where the grass growth was predicted for their farm, this has increased to 59, which mostly are commercial farms."

"The predictions are run twice a week on Tuesday and Friday, the Friday prediction is sent directly to Met Eireann to be presented each Sunday on National Irish television, RTE 1 during the 'Farmer Forecast' (pictured below), as well as on the Met Eireann twitter account."

PIGS

Virtual Pig Week

Teagasc Pig Development Department hosted Virtual Pig Week in October 2020, with live interactive webinars over four days. The week featured: A virtual tour of Teagasc Moorepark Pig Research Facility; key husbandry practices in pig production; a virtual farm visit to a progressive pig farm focusing on biosecurity and alternative energy sources; and a webinar with Dr. Scott Dee from Pipestone Veterinary Services in Minnesota on The Role of Feed Ingredients in Disease Transmission. Each day featured a questions and answers session with a live panel.

Ciarán Carroll, Emer McCrum, Aisling Holmes and Tomás Ryan, on Day One of Virtual Pig Week 2020: Virtual Tour of the Teagasc Moorepark Pig Research Facility.

Let's Talk Pigs

The Let's Talk Pigs Webinar Series ran every second Friday for six instalments from June to September. Topics covered included Becoming Lean; biosecurity; advances in weaning pig nutrition; rearing pigs with intact tails; antibiotic use & reduction; and supplementary milk in the farrowing room.

The Pig Edge Podcast

The Pig Edge Podcast was launched in 2020 and gained over 2,000 listens from April to December. The show invited a different guest speaker for each episode to discuss pig farming news, information and advice, from African swine fever to energy costs on farm. The Pig Edge was listed number 6 in the Feedspot.com recommended "Top 15 Swine Industry Podcasts You Must Follow in 2021". New episodes are available monthly.

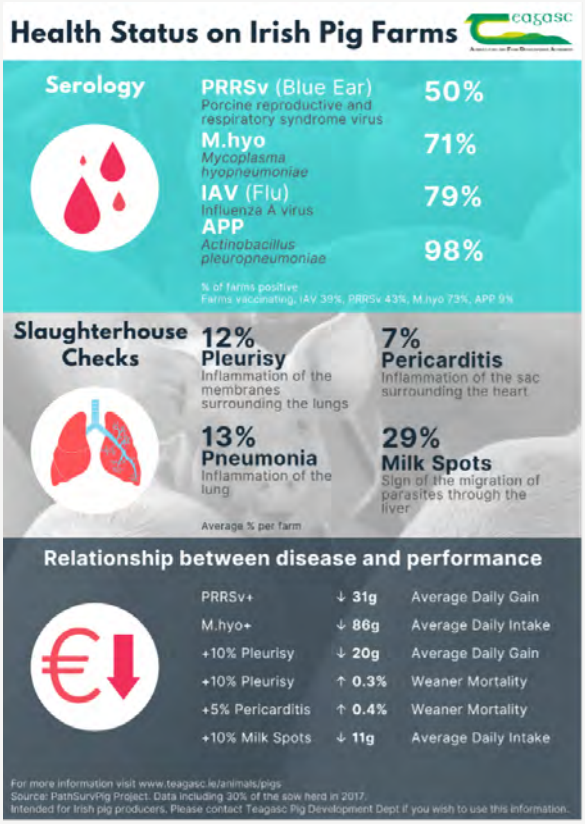
Skills Series Videos and Factsheets

The Pig Development Department began recording the Skills Series in 2020, a series of informational videos and factsheets focusing on essential practices in pig production.

John Condon and Aisling Holmes, demonstrate best practice for ear tagging pigs in a skills series video.

Posters and Infographics

The Pig Development Department produced informative content in the form of posters and infographics in 2020, covering a range of topics of interest for the sector.



An infographic by the Pig Development Department. The prevalence of disease on Irish pig farms, and their impacts on production.

EU PiG Winners

European Pig Innovation Group EU PiG is a Horizon 2020 funded project, involving a network of 19 organisations from 13 EU countries. EU PiG aims to raise the competitiveness of the European pig industry by linking producers and sharing best practices and innovations.

Project themes include: Health Management, Meat Quality, Animal Welfare and Precision Production and each theme has two challenges per year. Best practice is identified via the EU PiG Grand Prix, an annual EU-wide contest, with more than 300 producers competing to be one of eight EU PiG Ambassadors, by sharing their ideas and best practices.

Ireland had two winners in 2020, one on the use of Lean Management Principles in the Precision Production section and another in the use of slaughter data to improve pig health in the Health Management section.

TILLAGE

Virus Characterization

A study published as part of DAFM funded SCOPE project detailed the first full characterization of potato virus Y populations in Irish commercial fields. The work delivers an important knowledge base for DAFM and Teagasc in regards to current/future disease management strategies and highlights the potential of portable MinIon sequencing to answer fundamental epidemiological questions on PVY diversity. This is critical information that will be needed to support the expansion of potato seed production in Ireland.

Crop Report Web App

The Teagasc Crop Report has been an important industry publication for the past 30 years. It brings together Irish and other relevant research and the best practice on farm, to produce strategies for crop husbandry through the year.

Navigating the vast breath of information in the Crop Report was becoming an issue especially for use with digital devices. The solution was to develop a web app to consolidate and make information easier to find was devised.

As the Crop Report is a 'paid for' publication and the new app has a built in paywall. In 2020 the Crop Report app had close to 2,200 users, covering 7,000 sessions, 35,000 page views at close to five minutes per session (from launch in March 2020-Jan 2021), which is extremely good for a bespoke publication like this.

Precise Application of Fertilizers

Teagasc, in conjunction with the Fertiliser Association of Ireland, Fertilisers Spreader Manufacturers and Farm Agricultural Contractors Association have worked together over the last five years to ensure chemical fertilisers are applied as precisely as possible.

Every year a regional catchment is targeted to train farm contractors and their advisors delivering a fertiliser advice and spreading service to farmers. For example, in 2020 Gurteen Agricultural College was the location for the Precise Application of Fertilisers event.

These events bring together leading experts in Teagasc (researchers, advisors and specialists) and industry to share knowledge and expertise to ensure nutrients are applied at the correct rate, time and in the right place while protecting the environment.

Field Headlands

Ireland's relatively small field size makes field headlands important areas for production. A survey of 40 field sites indicated yield reductions of up to 44% on headlands. While machinery turning on headlands did affect soil structure, uneven fertiliser spreading contributed too, with huge application variation across headlands. Addressing how we use machinery will help protect our headlands.

Spatial Field App for Tillage Weed Surveying

The Enable Conservation Tillage (ECT) project is a major Teagasc Knowledge Transfer and Research programme collaboration focusing on Conservation Tillage practises. This year the project team surveyed 135 tillage farmers across the industry. Using Geographic Information Systems (GIS) technology, the Spatial Analysis Unit in the Teagasc Rural Economy and Development Programme developed a mobile-based App to enable direct data recording of crop information in the field. The field app has enabled multiple users to efficiently and accurately collect paper-less, location-based crop information throughout the season and will enable accurate revisits to sample locations in the follow up field season in 2021.

HORTICULTURE

Labour Shortage

Teagasc horticulture development department developed an online portal as part of a national recruitment campaign with the aim of recruiting a large number of temporary workers for the horticulture sector from the Live Register within Ireland. This campaign was led by the Department of Employment Affairs and Social Protection (DEASP) and supported by DAFM, Teagasc, and the IFA.

Horticultural Communication

A large number of materials/communications have been developed for the Teagasc website including newsletters, factsheets, guides, and general technical notes and information. Key publications regarding COVID-19 contingency planning were provided to industry through the dedicated COVID-19 section of the website.

A significant number of online consultations were undertaken by specialised advisors, replacing visits to growers. Numerous online KT events, including a series of technical webinars for the vegetable, fruit, nursery stock and mushroom sectors were delivered.

Food Safety

In 2020 Teagasc secured DAFM funding as part of the HortAssure project, as well as funding from the WF scheme for a four year PhD student to work on Horticultural Food Safety. Teagasc also secured funding through the Agri ICT ERANET scheme for a four year PhD student to develop automatic crop monitoring systems (focusing on insect pests) and a Walsh Scholarship project with Harper Adams University to develop trapping systems for adult weevils.

Robotic Harvesting

Teagasc Horticulture Development Department secured funding under H2020 for Softgrip project with a technical consortium to assess the functionality of robotic gripper efficacy for mushroom harvesting. In addition, the department attracted internal project support to examine peat replacement alternatives for mushroom casing.

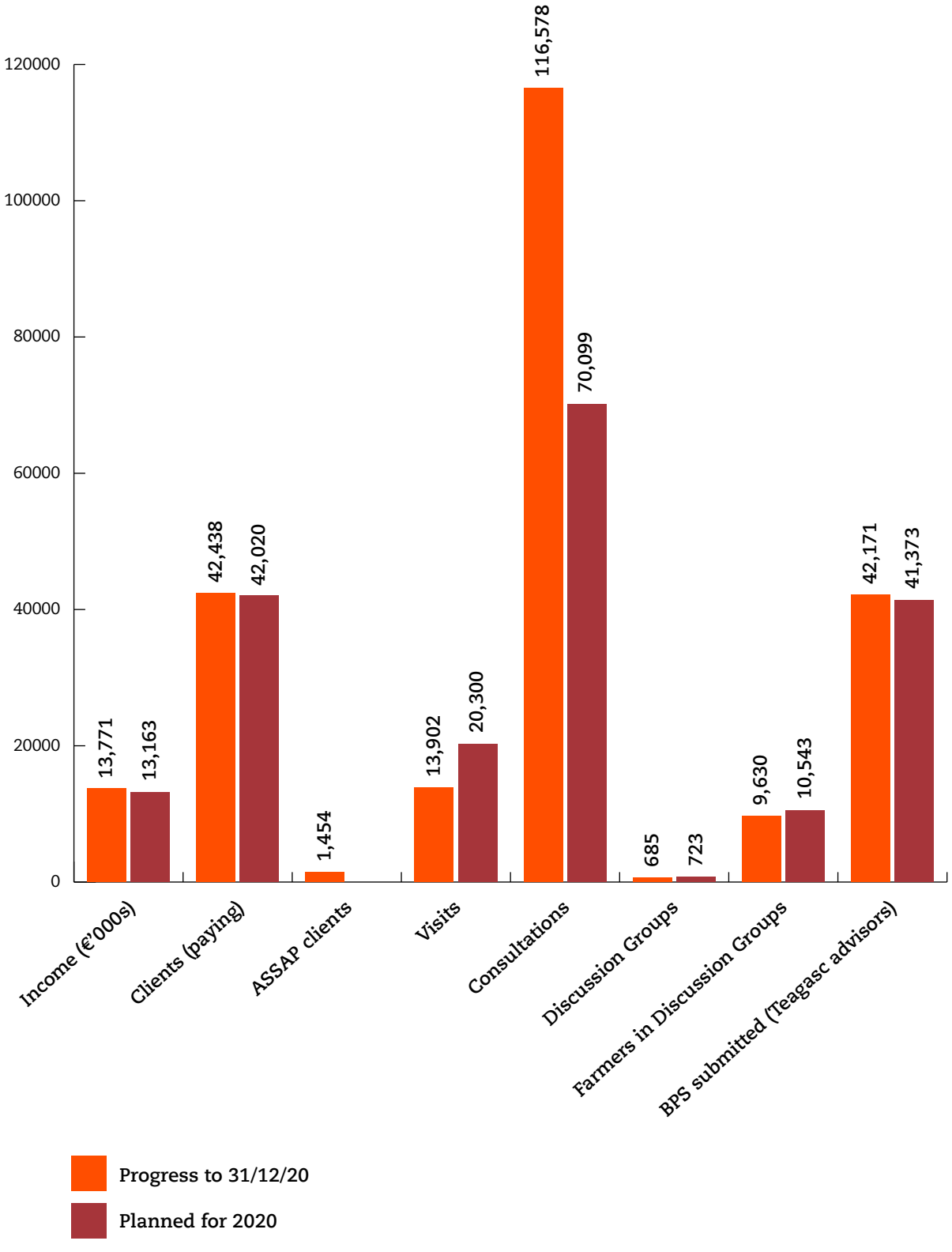
Cut Foliage

The New Leaves project which ended in December 2020 developed new plant varieties and propagation tools for the commercial cut-foliage sector. Of particular interest are new polyploidy lines of Hebe speciose. These lines have sturdier stems, larger leaves and fewer flowers - traits of importance for cut foliage.

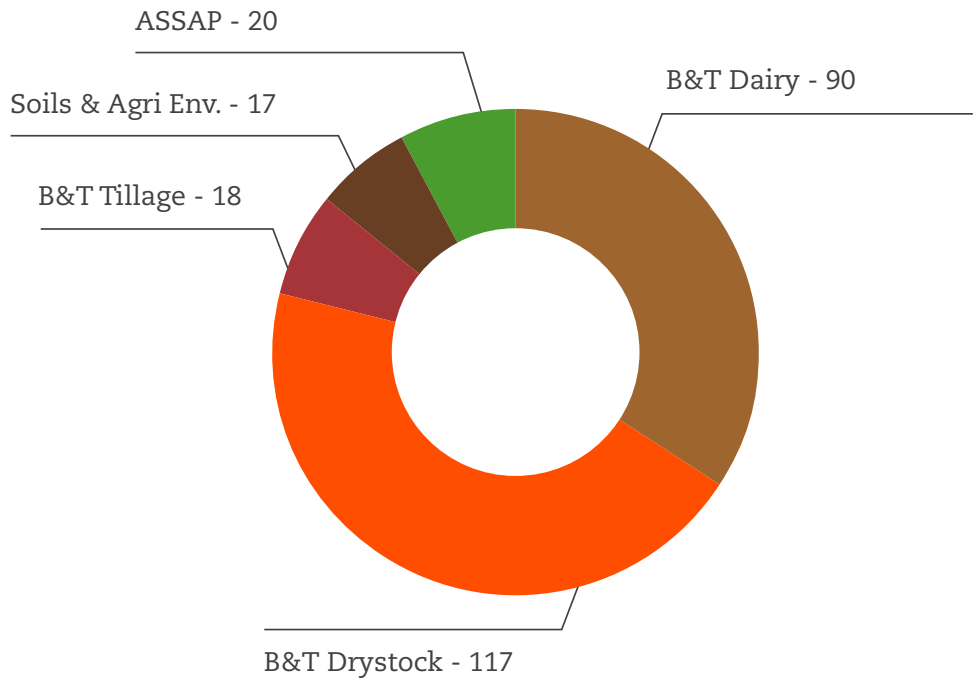
Micro-propagation protocols have also been developed for difficult-to-propagate Eucalyptus spp. and Viburnum tinus ‘Purpureum’ meaning that elite high-quality individual plants can be successfully produced in bulk.

ADVISORY SERVICES (BUSINESS GOALS)

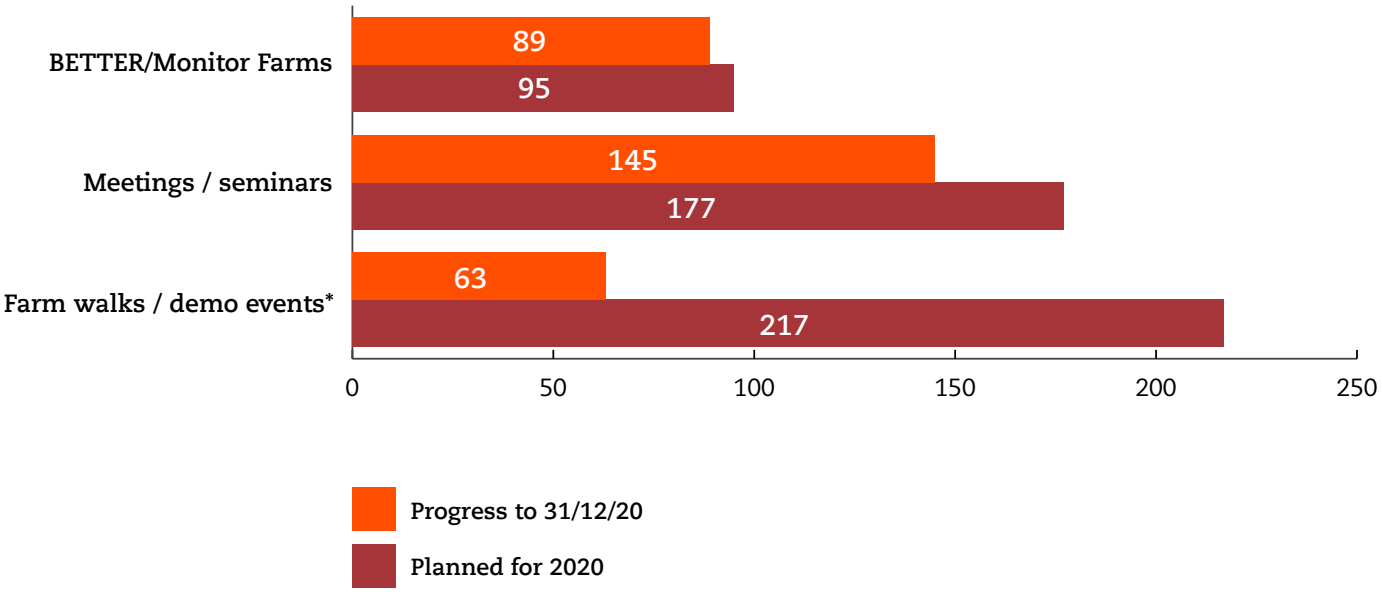
Teagasc Advisory Goals



Teagasc Advisor Numbers



Teagasc Activities



*The impact of COVID-19 restrictions is particularly noticable here.

EDUCATION

Teagasc maintained its education programme delivery in 2020 despite the major impact of COVID-19. The organisation adapted to a hybrid delivery model combining face to face and remote delivery within the national guidance parameters set out for education institutions under the Level 1 to 5 COVID-19 measures. Ensuring the safety of learners and staff was the primary focus.

A Teagasc COVID-19 management plan was put in place across all Teagasc delivery locations. Teagasc maintained completion and QQI certification schedules for its 2019/2020 full-time programmes. Programmes for the 2020/ 2021 year commenced on schedule in September 2020. Likewise, Teagasc maintained delivery for its adult education part-time and distance Green Cert education programmes with courses continuing to commence and complete on a rolling basis.

Teagasc introduced COVID-19 support measures include for Teagasc full-time learners in line with supports provided to full-time learners across the wider education sector.

These supports included a maintenance grant top up or equivalent rebate on course charges and a laptop scheme for learners at risk of being digitally disadvantaged. As for all education providers, challenges arose with remote delivery, notably in regard to learner engagement and digital connectivity.

Nevertheless, the COVID-19 pandemic has proved to be a permanent tipping point in accelerating the widespread adoption of blended learning approaches across Teagasc education delivery.

Despite COVID-19, overall enrolments for 2020 across Teagasc Level 5 and 6 full-time, part-time and distance education programmes, and Teagasc linked higher education programmes totalled about 2,700, slightly exceeding 2019 levels. Demand continued to be particularly robust for Teagasc adult Green Cert education.

Teagasc enrolled circa 6,500 learners across its part-time and distance education programmes for the period 2016 to 2020 with an average annual intake of about 1,300 enrolments for these courses. This exceptional level of enrolment was facilitated by DAFM sanctioning a total of 97 Teagasc temporary education officer posts on a two year contract basis and seven temporary education administration posts over the 2014 to 2019 period.

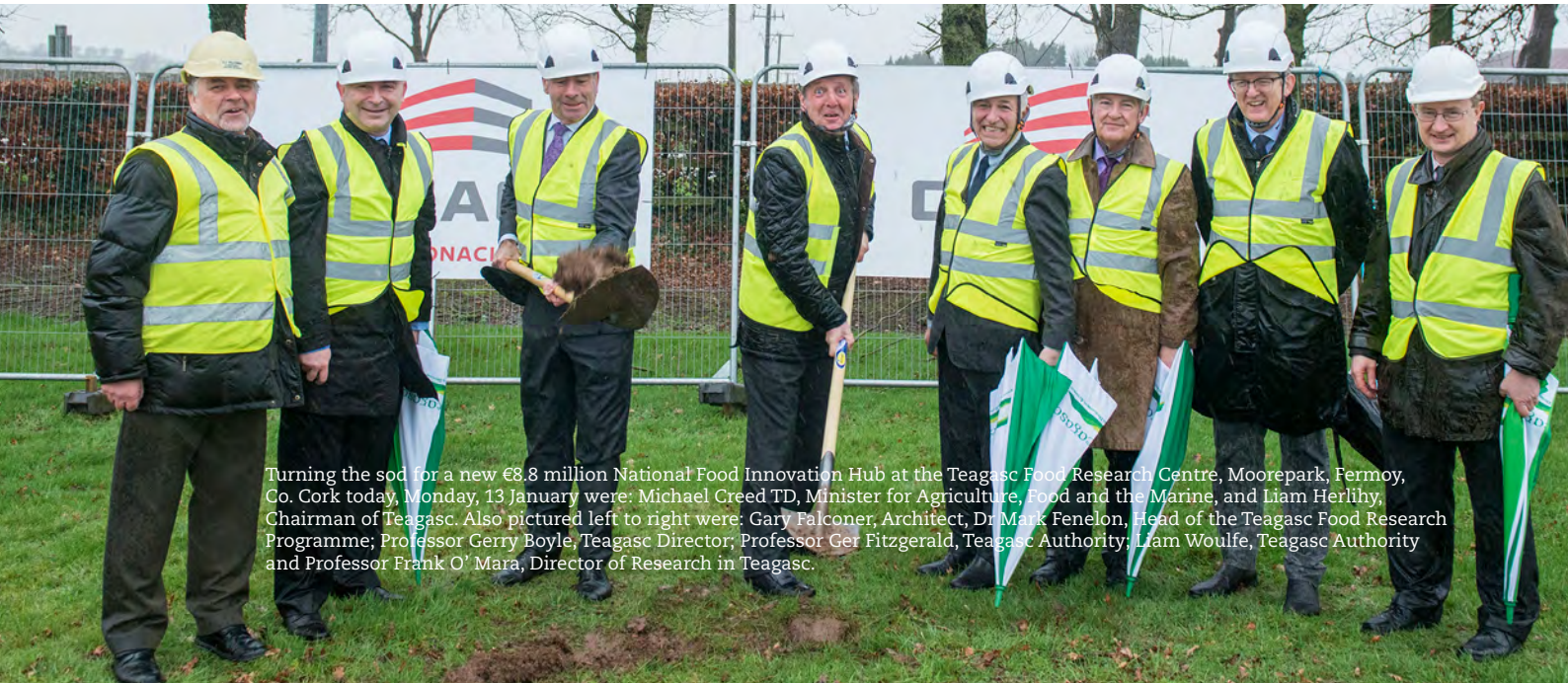
The strong demand for these Teagasc courses is projected to continue given the need for, or advantage of, a Green Cert qualification for farm schemes and financial measures directed at young farmers.

FOOD

National Food Innovation Hub

The National Food Innovation Hub is a new world-class facility which will allow (national or international, dairy and non-dairy) companies to rent high quality laboratories and offices to locate their own Research & Development (R&D) teams within the Teagasc Moorepark Research Centre.

These teams will collaborate with Teagasc researchers and access state of the art laboratory equipment and the upgraded (€10 million investment) adjacent ultra-modern Moorepark Technology Limited (MTL) pilot plant facility.



Turning the sod for a new €8.8 million National Food Innovation Hub at the Teagasc Food Research Centre, Moorepark, Fermoy, Co. Cork today, Monday, 13 January were: Michael Creed TD, Minister for Agriculture, Food and the Marine, and Liam Herlihy, Chairman of Teagasc. Also pictured left to right were: Gary Falconer, Architect, Dr Mark Fenelon, Head of the Teagasc Food Research Programme; Professor Gerry Boyle, Teagasc Director; Professor Ger Fitzgerald, Teagasc Authority; Liam Woulfe, Teagasc Authority and Professor Frank O' Mara, Director of Research in Teagasc.

The Irish Coronavirus Sequencing Consortium

Researchers from Teagasc Moorepark led a Science Foundation Ireland-funded national consortium of scientists dedicated to the sequencing of variants of SARS-CoV-2, the coronavirus that causes COVID-19.

The consortium sequenced the RNA of viruses isolated from patients who had lab-confirmed infections of COVID-19. The sequencing data was shared with the hospitals, the National Virus Reference Laboratory and the general public in order to track the spread of the virus into and within Ireland and identify mutations that may affect its transmission and treatment.

Major Infant Health Collaboration

The MiMIC research project, a €6.3 million, four year collaboration between the APC Microbiome Ireland SFI Research Centre (University College Cork and Teagasc Moorepark) and DuPont Nutrition and Biosciences was launched in Washington DC in 2020. The MiMIC project aims to develop microbiome-based solutions to help establish a healthy microbiome in early life to facilitate the long-term health of individuals. The patented probiotic strain Lactobacillus brevis DPC6108 from the culture collection at Teagasc Moorepark was licensed to DuPont in 2020 and will be launched on the US market in 2021.

Gut Barrier Health

Teagasc has expanded its research activity in gut barrier health for different life stages. How food digesta can promote gut barrier health is a central focus of this activity. Teagasc leadership in this field is exemplified by a 2020 invention disclosure; the leading role Teagasc scientists play in the international INFOGEST network; the successful Teagasc bid to host the 7th international food digestion conference in Cork in 2022; recent industry research agreements and the acquisition of public (Irish and EU) funding.

Fitness and the Gut Microbiome

Researchers at Teagasc Moorepark investigated the longitudinal impacts of fitness on the gut microbiome. This in-depth analysis of participants embarking on an intensive fitness plan demonstrated that as fitness improved so also did gut microbial diversity, an indicator of health.

In a separate study, OlympicMet studied the Irish Olympic team on the road to Rio. The study showed that the gut microbiome differs depending on the type of sport. These landmark studies are a step towards exploiting microbiome analysis for personalised nutrition and training programmes.

Sensory Panels for National Genetic Evaluations of Beef-Eating Quality

The quality of beef is strongly linked to perceived sensory characteristics such as tenderness, juiciness and flavour. As part of a Meat Technology Ireland (MTI) project, a sensory panel was trained at Teagasc Ashtown using descriptive analysis techniques to detect and describe small differences in meat quality characteristics in fresh beef samples.

The sensory research has to date generated the largest known sensory meat database globally on genotyped animals. From the results it was discovered that a variation of about 15% in meat tenderness can be attributed to genetics. These results were used by the Irish Cattle Breeders Federation (ICBF) in the development of a Beef Eating Quality Index.

Whisk(e)y Terroir Project

Teagasc researchers, in collaboration with Waterford Distillery and Oregon State University, published a ground-breaking study proving that the concept of "Terroir" could be applied to the production of single malt whisk(e)y.

Terroir is the set of environmental factors that affect a crop's phenotype, unique environment contexts and farming practices, when the crop is grown in a specific habitat. The study found that barley variety, geographical environment and the interaction of variety and geographical environment impacted the sensory character of the 'new make' spirit, with pungent and fresh fruit sensory attributes impacted by all factors (variety, environment and season).

New Packaging Capabilities

A significant investment has been made by Teagasc in state-of-the-art equipment to develop, test and validate conventional and novel food packaging materials. DAFM funded this investment as part of the National Prepared Consumer Food Centre development at Teagasc Ashtown. In-house expertise, and a growing network of collaborators, supports critical research and development in this area, particularly in relation to sustainability and shelf life.

Virtual Food Industry Training and Webinars

Teagasc launched a series of webinars and virtual training courses, specifically developed for the Irish food industry, in anticipation of continuing COVID-19 restrictions throughout 2020. The webinars covered a range of applied topics such as food product development, packaging and sensory science through to more novel subjects such as insects as an emerging source of protein and using imaging as a tool to study food structure.

Staff Profiles

Zerlina Pratt, Teagasc Kildalton.

Zerlina graduated from UCD in 2013 with a BAgrSc in Animal Science. She then completed a Masters degree in Agricultural Innovation Support Research in conjunction with UCD and Teagasc. In 2014 she began her career as an agricultural teacher in Kildalton Agricultural college teaching Distance Education and also Part Time students. Since 2015 she has been teaching full-time Level 5 and Level 6 agriculture students in Kildalton Agricultural College. She also teaches dairy modules to agriculture and agricultural science students from WIT.

She is the enterprise manager of the dairy enterprise in the college. She also co-ordinates the Livestock Transport, Small Animal Transport and Poultry Transport courses for the Department of Agriculture, Food and the Marine (DAFM) in the Southern Region of Ireland.

Goal 2
Support sustainable farming and the environment

Teagasc
Agriculture and Food Development Authority

SUSTAINABILITY

National Agricultural Soil Carbon Observatory

The establishment of a National Agricultural Soil Carbon Observatory (NASCO) was funded by DAFM in 2020. This platform will consist of a series of CO_2 flux monitoring towers which are being established at long-term long term monitoring benchmark sites in order to a) assess the carbon sequestration capacity of grassland and cropland, b) assess the impact of management practices on carbon sequestration and c) quantify the impact of drainage and re-wetting on peat soils.

Two of the NASCO sites will be incorporated into the EU Integrated Carbon Observation System (ICOS). Several NASCO sites will integrate into both the Signpost Farm and Agricultural Catchments Programmes. The platform will establish living laboratories that will holistically evaluate the impact of rewetting on GHGs, biodiversity, water quality and flooding. These data from NSACO will be used to validate soil carbon models and incorporate management practices into national greenhouse gas inventories.

Improved Soil Fertility Reduces Greenhouse Gas Emissions

The impact of improving soil pH and phosphorous levels on increasing grass and crop production has been known for decades and farmers have optimised soil fertility to improve productivity. Research carried out on the long term phosphorous and liming experiments has now been found to be directly related to the emission of the potent greenhouse gas nitrous oxide (N_2O).

Two milestone papers were published which show that nitrous oxide emissions reduce as soil pH and soil phosphorous are increased. Both of these new findings can further contribute to reducing greenhouse gas emissions and improving the carbon footprint of Irish agricultural produce.

Marginal Abatement Cost Curve

In September 2020, Teagasc published an ammonia marginal abatement cost curve (MACC) called 'An Analysis of the Cost of the Abatement of Ammonia Emissions in Irish Agriculture to 2030'. It estimated the potential to abate ammonia emissions from agriculture and the associated cost and provided a useful benchmark and outlined pathways towards meeting sustainability targets by the agricultural industry.

Upskilling Farmers

The year 2020 provided many challenges and none more so than upskilling farmers on sustainability issues. Ireland has 6,500 farmers who apply yearly for a derogation to farm above 170 kg NpH up to 250 kg NpH. This cohort of farmers must attend training to meet the terms and conditions of being in derogation.

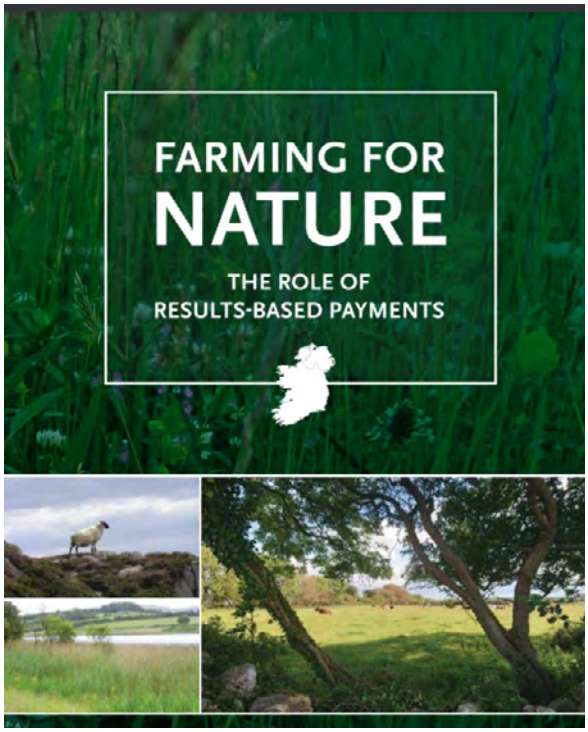
The training consists of modules dealing with Nutrient Use Efficiency, Farming Sustainably Under Derogation (Water Quality, Gaseous Emissions and Biodiversity), and Grassland Management. Teagasc KT specialists and advisors delivered interactive modular training to 3,000 of these farmers in 2020 during over 100 courses through the online platform Zoom.

Multi-species Mixtures for Grassland Production Under Lower-nitrogen Conditions

Plot experiments on multi-species mixtures at 150 kg ha-1 yr-1 of inorganic nitrogen at Johnstown Castle have shown that they consistently outyield monocultures of perennial ryegrass up to 300 kg ha-1 yr-1 of nitrogen. So, under these conditions, we achieved higher yields from less inputs.
Most mixture experiments have been conducted under cutting conditions (simulated grazing). At Teagasc Johnstown Castle, researchers are now comparing lower-nitrogen multi-species mixtures and higher-nitrogen ryegrass-clover swards in grazing systems on our dairy and beef farm with nitrogen fertiliser inputs <100 kg ha-1. Complementary reasearch is also underway at Teagasc Moorepark.

Results-based Payments for Environmental Objectives

Results-based payments provide farmers with performance-related payments for delivering agreed environmental objectives e.g. protection of indicator species, improved habitat quality, soil health, and water quality. A book published in 2020 by Teagasc and the National Parks and Wildlife Service highlights several Irish case studies of results-based payments for biodiversity conservation. It provides details on farm plans, scoring sheets, governance mechanisms, the role of advisory services, the choice of indicators, and monitoring results.



FARM_ECOS

The EU Farm to Fork Strategy has placed increased emphasis on improving the quality of farmland habitats. Results-based approaches provide farmers with performance-related payments for delivery of environmental objectives (e.g. habitat quality). Robust quality assessment methods are needed to support result-based approaches.

The FARM_ECOS project has developed quality assessment scorecards for key farmland habitats. Iterations of the scorecards have been employed by a number of European Innovation Partnerships. The scorecards could support new policy initiatives such as the proposed Agri-Environment Results-Based Pilot Project.

Spatial Field App for Tillage Weed Surveying

The Enable Conservation Tillage (ECT) project is a major Teagasc Knowledge Transfer and Research programme collaboration focusing on Conservation Tillage practises. This year the project team surveyed 135 tillage farmers across the industry.

Using Geographic Information Systems (GIS) technology, the Spatial Analysis Unit in Teagasc's Rural Economy and Development Programme developed a mobile-based App to enable direct data recording of crop information in the field. The field app has enabled multiple users to efficiently and accurately collect paper-less, location-based crop information throughout the season and will enable accurate revisits to sample locations in the follow up field season in 2021.

Conservation Agriculture

In 2018 Teagasc commenced a knowledge transfer and research project called 'Enable Conservation Tillage'. The project focuses on Conservation Agriculture practices in the tillage industry. This project is a European Innovation Partnership funded project which works closely with ten Focus Farms (and other industry groups) across Ireland who have different crop establishment systems.

These systems range from plough based, strip tillage, min-till and direct drill. The project focuses on one of the main barriers for widespread adoption of Conservation Agriculture systems which is grass weed spread and control.

A series of videos was produced on grass weed identification to help the industry identify these problematic weeds. The project also carried out a large grower survey across the main tillage areas to evaluate farmer knowledge in identifying and

assessing grass weed levels on farms, physically sample grass weeds and screen them for herbicide resistance and evaluate how on-farm management factors drive weed populations.

Initial findings from the surveys suggest there is a reasonable understanding of herbicide resistance issues but some divergence as to this understanding and practice in the field.

The project has identified a number of herbicide resistant wild oat, black grass and evolving herbicide resistance in sterile brome.

Hedgerow Week

Teagasc Hedgerow Week was launched by Minister Hackett on 4 December. The event featured on Mooney Goes Wild on RTE Radio. During the week 30 separate aspects of good hedgerow management were communicated through webinars, articles and videos (which received 95,000 views).

Engagement with hedge-cutting contractors was a key focus. Hedge cutting contractor, Liam Herlihy, Kingsland, Bruree, County Limerick changed his hedge cutting practice in 2020. For the sake of the birds and the environment, he changed from cutting the hedges as a flat top to an 'A roof', resulting in thicker hedges which are better for wildlife.

Liam said: "It is actually easier and faster to cut the hedge as a slope because you can run your machine at a 45 degree angle on both sides and move on. When you're cutting hedges flat-topped, you have to cut them and go over them two or three times to get them nice and level".

Francis Quigley, Teagasc Machinery Specialist said: "Farmers and contractors need to communicate with each other in order to change the perception of what is a well-kept hedge".

Biodiversity plans are in place on all Teagasc farms. Existing habitats including woodland, hedgerows and watercourses comprise approximately 17% of the area on average on Teagasc farms. It is planned to plant 25 km on Teagasc farms over a five-year period and create grassy margins in tillage fields and also between grass paddocks.

Teagasc environment specialist Catherine Keena, hedgeing contractor, Tony Mullins, Ballybeg, Mitchelstown, County Cork and his local Teagasc advisor.

ASSAP advisors Clare Donovan of Dairygold and Lane Giles from Teagasc with John and Jerry McCarthy who farm within the Caha Catchment.

Agricultural Sustainabilty Support and Advice Programme (ASSAP)

A total of 30 ASSAP advisors work within a unified partnership structure which encompasses Teagasc, the Co-ops and LAWCO - the local authorities Water and Communities Office. Sustainability advisors work with farmers to protect and improve water quality.

The Caha Priority Area for Action is one of the first which ASSAP teams have worked in. The Caha is the headwater to the Bandon River and has a 'High Water Status' objective. Much of the lower section of the sub-catchment is also located within a Special Area of Conservation, primarily due to the presence of the critically endangered Freshwater Pearl Mussel.

Agricultural Catchments Programme

2020 saw the commencement of a fourth phase for the Agricultural Catchments Programme, with an expanded remit to include Gaseous Emissions and Carbon Sequestration in addition to water quality for the next four years. Additional research and technical staff have been recruited and the programme now employs 22 staff. 300+ farmers from the six catchment study areas continue to work with Teagasc in evaluating the efficacy of environmental regulations, which in turn supports Irelands Nitrates Derogation approval.

Methane Abatement Strategies

Teagasc work has been progressing at the ICBF performance testing station (Tully) on measuring methane emissions and feed efficiency in a large number of beef cattle through a number of projects such as RumenPredict (ERA-GAS funded) and MASTER (EU H2020 funded) with the aim of establishing the link between the rumen microbiome, feed efficiency and methane emissions, and the host genomics.

Preliminary data show that enteric methane emissions and feed efficiency are negatively correlated providing evidence that low methane producing cattle are more feed efficient. This work will contribute to the development of breeding values for low methane output for both beef and dairy sires for the cattle industry.

A new Teagasc Biodiversity Management Practice Index (BMPI) is showing farmers how well they score on biodiversity management practices. Members of the Tallow Lismore Knockanore Discussion Group with Teagasc Walsh Fellow student Aoife Leader, advisor Eamonn Lynch and host Brian Ronayne.

SUPPORTING INTERNATIONAL AGRICULTURAL DEVELOPMENT

Eritrea

An EU-funded project entitled 'Climate Smart Agriculture Research and Innovation Support for Dairy Value Chains in Eritrea', with a total budget €4,250,000 (EU contribution €4,000,000), formally commenced on 3 February 2020 and will run for a period of 52 months.

The Teagasc-led international consortium aims to promote inclusive, sustainable and climate-relevant transformation of the Eritrean dairy value chain to enhance food and nutrition security, reduce poverty, create job opportunities for young people, and promote resilience to climate change while mitigating greenhouse gas emissions.

The outbreak of COVID-19 in Eritrea adversely affected implementation on the ground during the year. Despite this setback, the project team has made good progress in putting in place many of the key supports needed for project delivery in the long term.

Kenya

Climate Smart Research and Innovation for Livestock Development in Kenya with a focus on dairying was granted €1m in funding by the Irish Government via its embassy in Kenya. An Irish-Kenyan consortium led by Teagasc continued work on this project during 2020. The team made good progress in developing an active research program at KALRO (the Kenyan Agriculture and Livestock Research Organisation) focusing on the technologies for improved forage systems to underpin climate-smart dairy production.

The project team established an Innovation Support Unit at KALRO and is translating research knowledge for use by extension agents and farmers and supporting its dissemination through five outreach nodes (demo sites), which in turn, are linked to 18 lead farmers.

Tanzania

The Irish Embassey in Tanzania is supporting a project entitled 'Greening the Dairy Value Chain in Tanzania: Institutional Relationships and Innovations for Sustainable Milk Production 2021 to 2025'. The project focuses on productivity in dairying and the development of the dairy value chain while promoting green economy principles and climate resilience. Teagasc will initially work with the Tanzania Livestock Research Institute (TALIRI) in delivering the project, which was due to commence in late 2020, but will now commence in 2021.

Uganda

The Irish embassy in Kampala Uganda developed a proposal and multi-year plan for a partnership and knowledge exchange project between Irish and Ugandan partners on the topic of Innovative and Climate-Smart Livestock Development in Uganda.

The objectives are: creating sustainable improvements in production, productivity, management and health of dairy and beef cattle; strengthening the complete dairy and beef value chains; and bolstering institutional knowledge support for the sectors. The project partners were required first to undertake a design assignment, scheduled between September and end December 2020, and agree with the Embassy on a final project plan and budget, with a view to implementation between 2021 and 2025.

Ethiopia

Teagasc is part-funding three Walsh Scholars on the project entitled 'Agricultural Fertility and Environmental Resources 'plus' (AFER+)' in collaboration with GIZ (the German Aid Agency) and Wageningen University and Research. The objective of the AFER+ project is to develop a prototype Decision Support Tool (DST) of relevance to smallholder farmers for crop and soil specific nutrient advice, based on data that can easily (e.g. visually) be obtained in the field. Teagasc is part-funding three Walsh Scholars on the project in collaboration with GIZ (the German Aid Agency) and Wageningen University and Research.

Irish Aid

Teagasc was represented on the National Task Team on Rural Africa (NTTRA) which was established by the Government to further develop a comprehensive and coordinated approach through which Ireland could maximise its engagement with African countries.

The NTTRA report sets out a new framework to enhance Ireland's existing contribution to the transformation of Africa's agriculture and rural economy by harnessing the collective expertise of government departments, state agencies such as Teagasc, the private sector, civil society, academia and the African diaspora.

FAO and IFAD

Teagasc engaged, as part of a wider national team, in a series of dialogues with the key UN-based agencies in Rome- the FAO and IFAD (International Fund for Agricultural Development). The key outcome will be the signing in 2021 of an MoU to formalise the relationship between Irish organisations (DAFM, Teagasc, SFSI, Bord Bia and IFSA) and FAO/IFAD.

Goal 3

Encourage diversification of the rural economy and enhance the quality of life in rural areas

teagasc
Agriculture and Food Development Authority

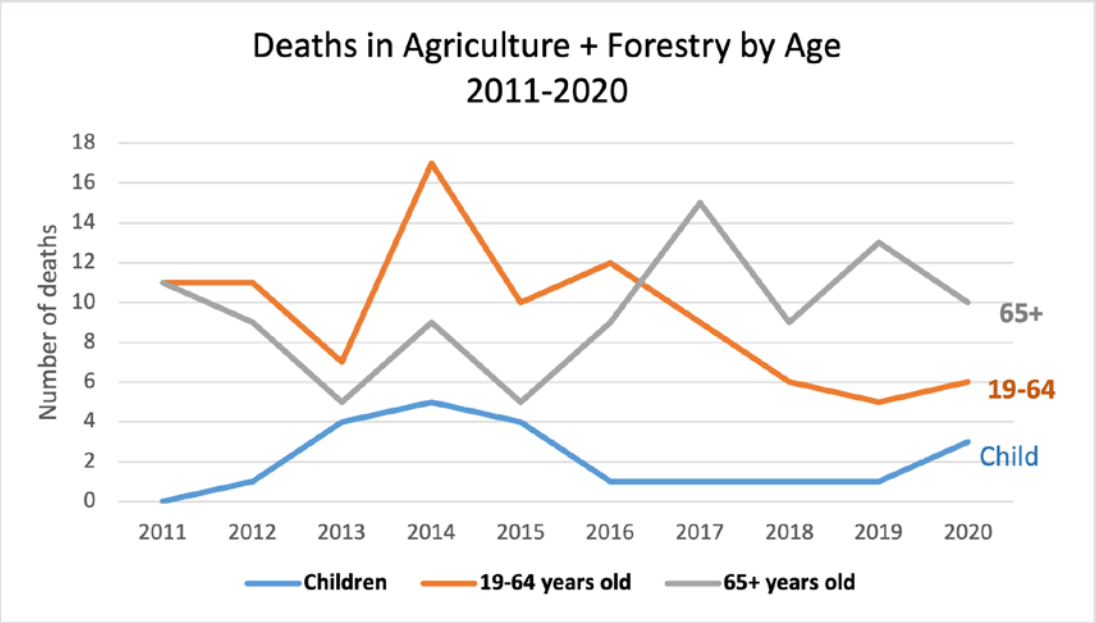
HEALTH AND SAFETY

The agriculture sector presents a major challenge to improving occupational health and safety due to the hazardous nature of farm work and the socio-economic profile of the sector. Teagasc operates a Joint Initiative with the Health and Safety Authority and farming organisations to promote farm health and safety.

The Teagasc occupational safety and health (OSH) programme encompasses both Research and Knowledge Transfer through media, education and training and advice provision. The Teagasc OSH programme adopts the 'Total Health' model where both safety and health are promoted in an integrated manner.

Key Developments 2020

- In 2020, 20 persons died of work related injury out of 53 workplace deaths, with 10 being aged 65 or older. The following graphic shows trends in Fatal Farm Injuries over the last decade. It indicates an increasing incidence among older farmers and a reducing number among younger farmers. Childhood fatalities increased in 2020. (Source: H.S.A.).



- In 2020, a major 'Review on the future of Agriculture and Occupational Safety and Health' was co-authored by Dr John McNamara, OSH Specialist. The Review was commissioned by European Agency of Safety and Health at Work (EU OSHA). The Review will inform policy makers and stakeholders of key issues related to progressing OSH in Agriculture in Europe. The Document can be accessed at EU-OSHA Web.: ***https://osha.europa.eu/en/publications/future-agriculture-and-forestry-implications-managing-worker-safety-and-health/view***

- Teagasc Agricultural College students were urged to become Farm 'Champions for Safety' at seminars organised in advance of commencement of student on-farm work practice in February 2020. A victim who described the consequences of their injury addressed the seminars. The seminars were held in conjunction with HSA, ESB Networks and sponsored by FBD Insurance. This seminar series augments the comprehensive QQI accredited farm health and training provided to students.

- Teagasc continues to provide 'Farm Safety Code of Practice (COP)' training to farmers nationally. In 2020, an additional 66 advisors were trained to provide this training and associated advice on OSH based on the COP. Due to COVID-19, an on-line option of the training was initiated in 2020.

- Teagasc continued implementation of the Department of Agriculture, Food and the Marine (DAFM) Stimulus Research Grant to investigate Behavioural approaches to improve Farm Safety. The Funding has facilitated the appointment of a Post-Doctoral Researcher and two PhD Walsh Scholars. Among the achievement of this project in 2020 were completion of a Masters study on livestock behaviour, drafting of two papers on farm fatal injury trends and a survey of facilitators who participated in the DAFM KT programme related to occupational safety and health. Dr. David Meredith Teagasc is the Principal Investigator for this grant.

- A project named 'On Feirm Ground', sponsored by DAFM and DOH, aims to develop, deliver and evaluate bespoke training that equips Teagasc advisors and consultants with the knowledge, skills and competencies to engage farmers on health issues, including mental health. It is being delivered in association with the National Men's Health Development Network. A Teagasc PhD Walsh Scholarship at IT Carlow and UCD has been awarded to evaluate the Project. A preliminary Evaluation on this project is available on Teagasc Web (***https://www.teagasc.ie/publications/2020/on-feirm-ground---wellbeing-for-farmers.php***)

- A major study on approaches to prevention of Cardiovascular Disease (CVD) among farmers continued in 2020. This study is being implemented by Centre for Men's Health IT Carlow, Glanbia, Irish Heart Foundation, and UCD School of Health Sciences. A Teagasc PhD Walsh Scholarship to conduct the evaluation of this study is in place. Health checks to farmers at marts and agri co-op branches, related to the study were completed. A preliminary Evaluation on this project is available on Teagasc Web. (***https://www.teagasc.ie/publications/2020/farmers-have-hearts-cardiovascular-health-programme.php***).

- Teagasc actively promotes Farm Health and Safety through its publications, (Today's Farm, TResearch, Teagasc Daily and Newsletters) and through the agricultural media. Particular use is made of Web-based media such as Twitter, Facebook and Instagram. In 2020, 10 national press releases and about 120 social media messages were issued, associated with major Teagasc initiatives and occupational health and safety study reports. COVID-19 related prevention issues received particular attention, particularly in the first half of 2020, as the pandemic developed.

- Four scientific papers were co-authored by Teagasc staff in 2020. The papers related to Discussion Group engagement in OSH, Intervention Mapping; Farm Injuries based on the Teagasc National Farm Survey and Vulnerability of the Farming community to COVID-19.

- The EU COST Action - Safety Culture and Risk Management in Agriculture (acronym SACURIMA) This Action is a network of scientists from 39 countries which aims to improve farm safety across Europe. The Vice Chair is Dr. John McNamara, Teagasc Health and Safety Specialist. In 2020, the Action was judged as 'highly effective' based on its Policy Recommendations.

Teagasc advisor, Rachel Taylor, says the stigma around mental health issues and asking for help can prevent farmers seeking help.

RURAL DEVELOPMENT

Equine

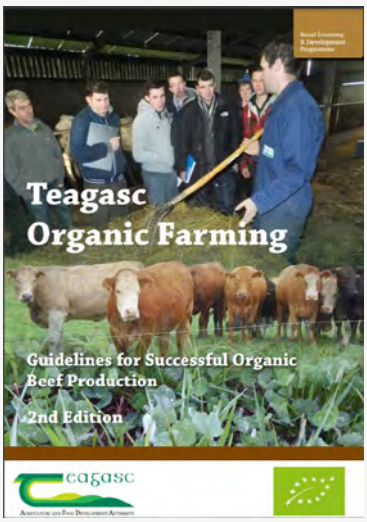
Let's Talk Equine' webinar series was initiated in May 2020 with nine webinars delivered by year end. Average live attendance was 100; average recording views 589; average total views 688 (highest total views for an individual webinar 1,245). Topics have provided an opportunity to discuss different models of breeding enterprises, foundation stock, market requirements and assessment of produce, husbandry practices and decision making.

Blended learning short breeding course (25 hour) was delivered to 50 participants using zoom and moodle platforms providing an overview of husbandry practices and considerations for decision making within an equine breeding enterprise.

Kilkenny farmer Eamon Sheehan with Teagasc Equine Advisor Alan Hurley.

Organics

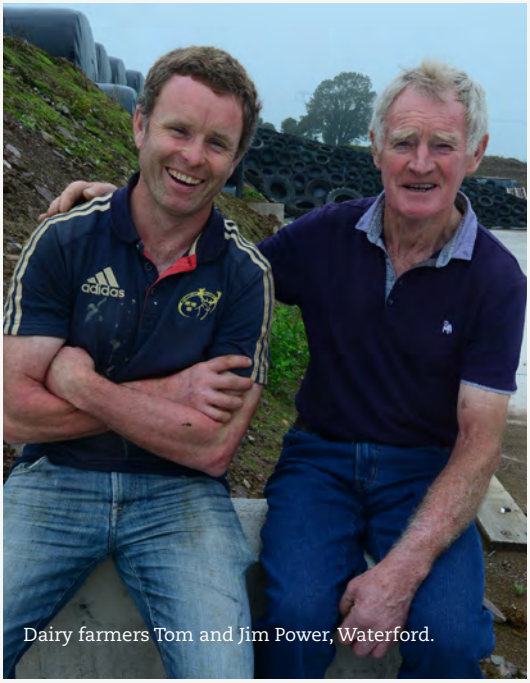
Teagasc provides training, advice and research for those involved in organic production, those considering converting to organic farming and the wider organic sector.



Kildare organic farmer Fergal Byrne, examines a mixed species forage crop.

Succession and Inheritance

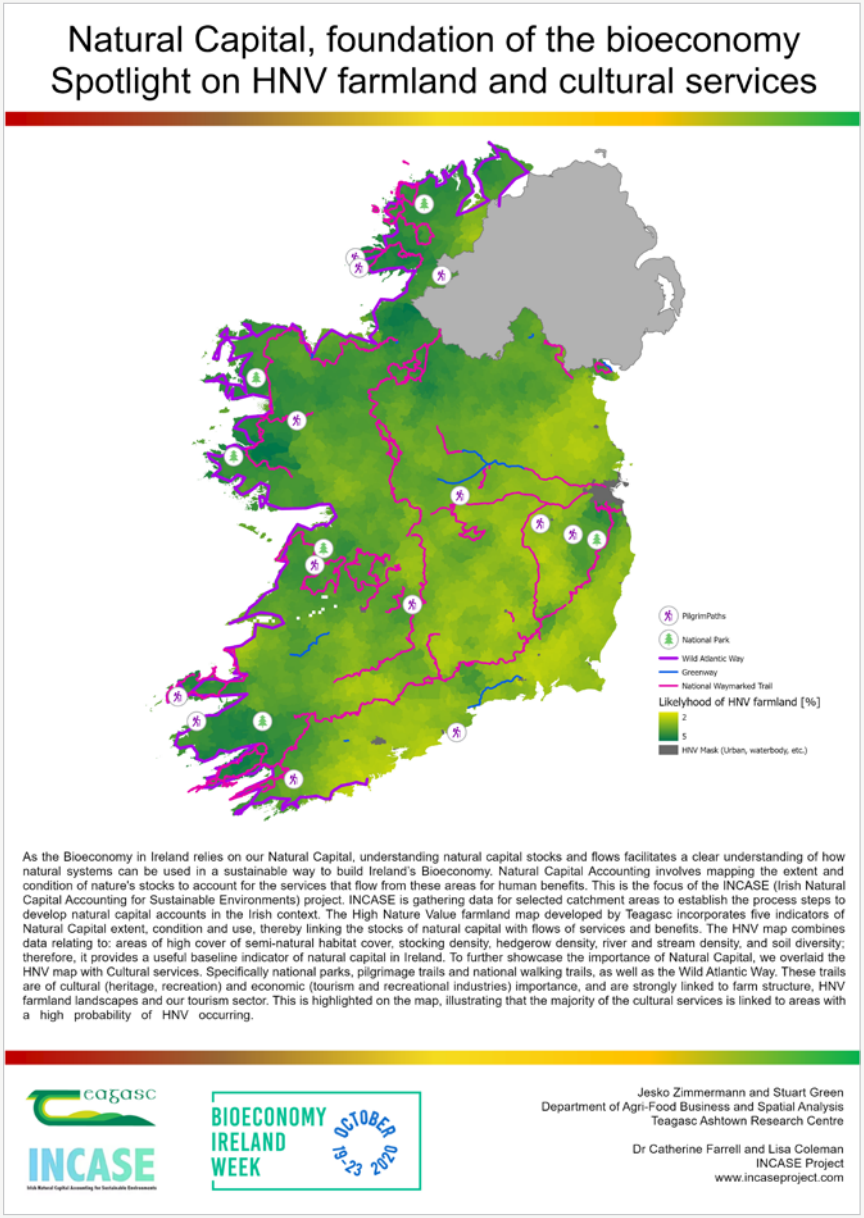
A Transferring the Family Farm webinar attracted an audience of 1,500 and subsequently in excess of 2,500 views on YouTube. The promotion of family discussion around succession and inheritance on Irish farms, is critical to involving young trained farmers in the family farm business at an early age, thereby, improving the efficiencies of the farm business through the promotion of improved knowledge, skills and technologies. Health and safety on Irish farms is also improved as a result due to the fact that there are more younger people involved in the running and management of farms.



Dairy farmers Tom and Jim Power, Waterford.

Collaborative Farming

On-going promotion and advice to farmer clients, advisors and stakeholders as to the benefits and necessary steps involved in the formation of Registered Farm Partnerships in Ireland. The numbers of Registered Farm Partnerships in Ireland, currently stands at 3,061 with a projected increase of 10% in 2021.



Also the promotion of the collaborative farming arrangement of long term land leasing has seen a substantial increase in the number of long term land leasing registered with Revenue. There are now in excess of 11,000 leases registered. These long term land lease arrangements have many benefits for both the lessor and lessee.

Basic Payment Scheme

The Basic Payment Scheme provides a large proportion of their income for many of the 130,000 farmers in Ireland. In dealing with in excess of 44,000 farmer clients annually, Teagasc ensures that these supports are successfully availed of by clients. As part of the Basic Payment Support team and as a constant resource for advisors and farmers, Teagasc specialists provide an essential service to customers ensuring that they maximise their payments from EU and DAFM led schemes.

ECONOMICS

Brexit

A the end of January 2020 the UK formally left the EU. Through the remainder of 2020 the UK was in a transition period where the UK remained a member of the EU Single Market. This transition period ended on December 31st 2020. On December 24th 2020 the EU and UK agreed a Trade and Cooperation Agreement (TCA) that allows for tariff and quota free trade in goods originating in the UK and EU.

Given the uncertainty relating to the trade rules that would govern EU-UK trade after the end of the transition period, throughout 2020 economists from the Teagasc Agricultural Economics and Farm Surveys department provided technical support to the Department of Agriculture, Food and the Marine. This economic analysis examined the impact of different Brexit trade EU-UK regimes on the Irish agricultural economy and on Irish farm incomes.

Farm Level Environmental and Economic Sustainability

Economists from Teagasc's Agricultural Economics and Farm Surveys Department together with colleagues from across the EU led by Wageningen Universtity (WUR) are researching how agricultural policy can contribute to environmental objectives and how new technologies (remote sensing and digitalisation) can facilitate developments in the monitoring of the sustainability of European agriculture. This research builds on Teagasc research on the developing sustainability metrics based on the Teagasc National Farm Survey (NFS) and previous work by Teagasc or in the EU FP7 project FLINT.

Outlook Studies and National Farm Survey

On an annual basis the Teagasc National Farm Survey (NFS) collects detailed data from a representative sample of Irish farmers. In 2020 and 2021 the public health measures required to combat the COVID-19 virus disrupted the normal data collection processes used by the Teagasc NFS. With the cooperation of the hundreds of farmers who participate in the NFS, our farm recorders have been collecting farm data in ways that ensure compliance with all public health guidelines.

These processes and the public health policy restrictions on travel have however led to delays in the finalisation of the 2020 Teagasc NFS report. This year, like last year, we provide the estimates of the sector's performance in 2020 published by the economists from Teagasc Agricultural Economics and Farm survey Department in their Outlook 2021 report.

Weather conditions in 2020 were favourable for Irish agriculture's grassland systems but made for a difficult year for many Irish cereal producers. The average farm income in 2020 was estimated to be €24,700, up about €1,300 on the 2019 level. This positive outcome for the "average" farmer however masks contrasting fortunes across the principal farm types that characterise Irish agriculture.

On dairy and drystock farms, total production costs decreased in 2020 due to lower feed, fertiliser and fuel prices, while input usage volumes were relatively stable. Stability in milk prices and increases in both lamb and cattle prices led to a growth in incomes on dairy, cattle rearing and sheep farms, while incomes on 'cattle other' farms – despite lower prices in Spring 2020 due to COVID-19 disruption of European meat markets – remained stable. Due to the below average cereal crop yields in 2020 average tillage farm incomes declined significantly.

Overall in 2020 Irish dairy farmers are estimated to have seen a decrease in their key pasture and forage costs, on both a per hectare and per litre bases. With average farm level milk production continuing to grow in 2020 and stability in the average milk price received, the incomes on Irish dairy farms in 2020 are estimated to have increased by 5% to €69,000.

In 2020, prices for prime finished cattle were on average similar to the levels reported in 2019. In 2020, prices for younger cattle were higher relative to those earned in 2019, leading to an increase in market output value on single suckling enterprises. The market output value on the average cattle finishing enterprise declined in 2020 as a result of higher prices for purchased cattle. Small decreases in feed usage and lower feed prices contributed towards lower feed expenditures on cattle enterprises in 2020.

The introduction of the Beef Environmental Efficiency Programme – Sucklers (BEEP-S) scheme contributed positively to gross output on single suckling farms while the Beef Finisher Payment (BFP) scheme contributed to gross output on cattle finishing enterprises. In 2020, the average family farm income on cattle rearing farms is estimated to have increased by 17% on cattle-rearing farms to

€10,600. The average family farm income earned on 'cattle other' farms is estimated to have remained unchanged in 2020 at €13,800.

The value of Irish sheep meat exports to the EU in 2020 was up 12% on in 2019, driven by higher European lamb prices and an increase in the volume of meat shipped from Ireland. Total direct costs of production for Irish midseason lowland lamb enterprises are estimated to have increased marginally in 2020. With overhead costs of production decreasing by 2% in 2020, family farm income earned from sheep production is estimated to have increased substantially in 2020. Teagasc estimates that family farm income of specialised sheep farms in 2020 increased by 30% to €19,200.

While international cereal prices at harvest in 2020 were higher than in 2019 due to lower production in some regions and relatively low stocks levels, difficult growing and harvest conditions in Ireland were reflected in significantly below average yields. Spring barley and winter wheat yields were both down by over 10% relative to 2019. Lower production volumes were partially offset by some decline in costs but the poor yield outturn in 2020 is estimated to have led to significant reduction in the level of the average income earned on Irish tillage farms. In 2020 Teagasc estimates that the average tillage family farm income declined by 11% to €29,000 per farm.

The conclusion of the *Trade and Cooperation Agreement* (TCA) between the EU and the UK on Christmas Eve 2020 removed the threat of a 'No Deal' Brexit and as a consequence the economic outlook for the Irish agriculture and food industries is more optimistic and less uncertain than it was only a short time ago. At least for the short to medium term, the TCA maintains Ireland's preferential market access to the UK market. The deal allows for continued tariff-free trade between the UK and EU for qualifying goods, but it does mean that new impediments to bilateral EU-UK trade have emerged, in the form of customs, product certification checks and rules of origin checks.

EU Single Market and Customs Union facilitated trade without the need for customs or regulatory checks for EU members. The checks that now apply to EU imports of goods from the UK have to date negatively affected the value and volume of EU imports from the UK.

UK customs and regulatory checks are now expected to begin to apply to EU agri-food exports to the UK in the fourth quarter of 2021 and will negatively affect the demand for Irish agri-food exports in the UK. Nevertheless, despite the additional frictions and costs of trading introduced by Brexit, the general market prospects for 2021 are positive for the Irish agri-food sector. The recovery of the UK, EU and global economies from the impact of the COVID-19 pandemic is expected to be reflected in a relatively positive outlook in terms of farm commodity output prices and incomes in 2021.

Teagasc advisor, James Dunne, discusses forage supplies with Cavan farmer Gene O'Rourke.

Goal 4

Enhance organisational capability and deliver value for money

Agriculture and Food Development Authority

Information and Communications Technology

2020 was a challenging but highly productive year for ICT development and operations in Teagasc. It saw the culmination of several years of development work, with the roll out in February of a new Customer Relationship Management and Billing system. The upgrade of data links continued apace. All but one Teagasc location have been upgraded. Additional backup lines have also been added.

COVID-19
COVID-19's arrival gave rise to the need for a rapid and agile response. Within a period of three weeks, Teagasc's infrastructure was re-configured to double the capacity to handle secure remote access into its ICT systems. Remote access licences were procured, configured and distributed to personnel, and online training sessions were delivered to staff who had not previously worked from home. In parallel with this Zoom was procured and established as a second platform for video calling, and as a platform for webinars, discussion groups and online teaching.

The project to roll out Windows 10 across the organisation was in flight, and had to be re-planned to build in appropriate new measures, so that it could continue safely, under COVID-19 restrictions. Staff who previously used PCs were migrated onto laptops. All of these measures, along with the flexibility shown by staff, have allowed Teagasc to continue to operate very effectively, even under level 5 COVID-19 restrictions.

Finance

Impact of COVID-19
In the first quarter of 2020 as the COVID-19 pandemic began to impact Teagasc the Finance Department undertook a review of the financial outlook for the organisation by carrying out a detailed review of Teagasc budgets, cash flows and assets/liabilities. This exercise was updated repeatedly throughout the year. In financial terms the pandemic had a dampening effect on expenditure as the number of activities that had to be curtailed in compliance with public health guidance tended to outweigh the additional costs resulting from it.

Process Enhancement and System Upgrades
The Finance Department made a swift transition to remote working in March quickly replacing many paper based financial approval processes by electronic workflows. Teagasc suppliers, pensioners and staff continued to be paid on time but using new processes. The financial control environment was monitored closely to ensure no unintended consequences from the new ways of working.

The Integra (finance system) was upgraded and the new version went live in September.

Policy Updates
The Teagasc Credit Control policy was reviewed and updated in 2020. A number of other finance policies were also updated.

Research Grants
The Research Grants Finance team workload was re-organised and expanded in 2020 with the addition of a new staff member. A new database for research projects and claims was implemented in 2020 incorporating controls and workflows enabling higher levels of productivity in the team.

Corporate Services and Procurement

Corporate Services and Procurement added the Health and Safety brief into its overall portfolio of responsibilities in 2020. The two Health and Safety officers joined the department at a busy time with COVID-19 presenting ongoing additional challenges.

Procurement
Corporate Services and Procurement implemented a new software support tool: Supplier and Contracts Management System (SCMS). The SCMS has the functionality to assist in the management of projects, tenders, contracts, suppliers and assets and also in providing expenditure analytics. This will benefit the organisation by having data centralised and processes standardised, streamlined and controlled.

Insurance
In early 2020 Teagasc held a series of liability management and staff, as part of its ongoing risk management control programme. These sessions were developed to enhance knowledge of insurance risks, accident investigation, risk assessment theory and practical training workshops.

Energy / Waste Management
By year end 2020 Teagasc was on course to meet its government mandated energy targets. This entailed reducing energy by 33% from that used in 2009. There was also a reduction of 24% in waste produced while the proportion of recycling increased to 25.6% - both of which were positive improvements from the previous year.

Human Resources

New systems

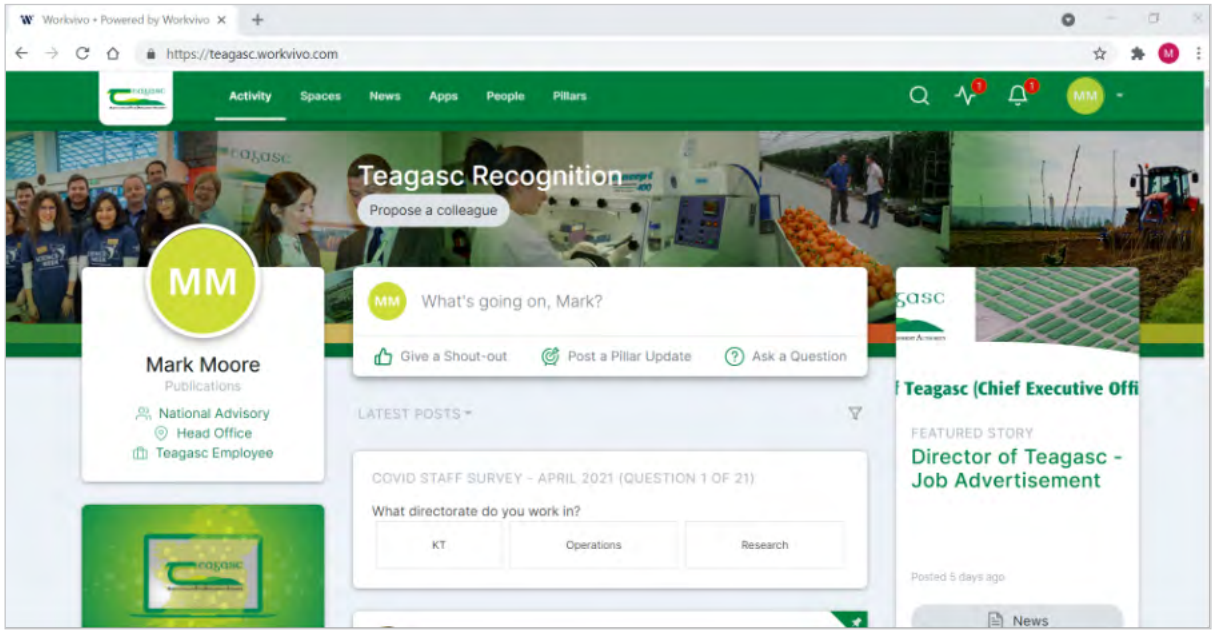
T-Learn

A new bespoke Learning Management System called T-Learn was launched for Teagasc staff in 2020. The system hosts both asynchronous (self-directed) and synchronous courses. It will also facilitate the organisation of classroom courses, staff discussion forums, evaluation of training and training records.

Workvivo

Teagasc launched Workvivo, an Internal Communications platform on in July 2020. Following the onset of COVID-19 in March 2020 and the onset of large cohorts of staff working from home, this platform is seen as a key engagement tool within the organisation.

The platform is designed around the key drivers of employee engagement which include: two way communications, connecting work to organisational goals, a culture of recognition and community.



Mentoring for Career Development

The Explore Mentoring Programme is a new learning and development opportunity introduced in 2020 for Teagasc staff. The objective of the programme is to support staff members in their personal and professional development. Training for mentors and mentees was delivered and staff are also participating in an Advisory Mentoring Circle. Resources and a suite of tools, including frameworks,

handbooks, and an e-Learning programme have been developed and are available on TLearn, the new Learning Management system.

Protected Disclosures

In accordance with the Protected Disclosures Act 2014, Teagasc can confirm it was not in receipt of any Protected Disclosures in 2020.

Staff avail of health screening

Goal Four of the Teagasc People Strategy aims to encourage and support staff to proactively take care of their health and wellbeing. Health screening tests help detect diseases and conditions early, when they are easier to treat. Routine health screenings are recommended for people throughout life as an important part of preventative care. Teagasc facilitated a Corporate Health Screening programme for staff in late 2019/early 2020. Clinics were held in nine locations countrywide. There was a 61.2% uptake of the programme. The gender breakdown of participants was 46% female and 54% male. The feedback from the programme was very positive.

Reaching out to Retirees

Teagasc re-launched a newsletter for its retired staff in 2020.

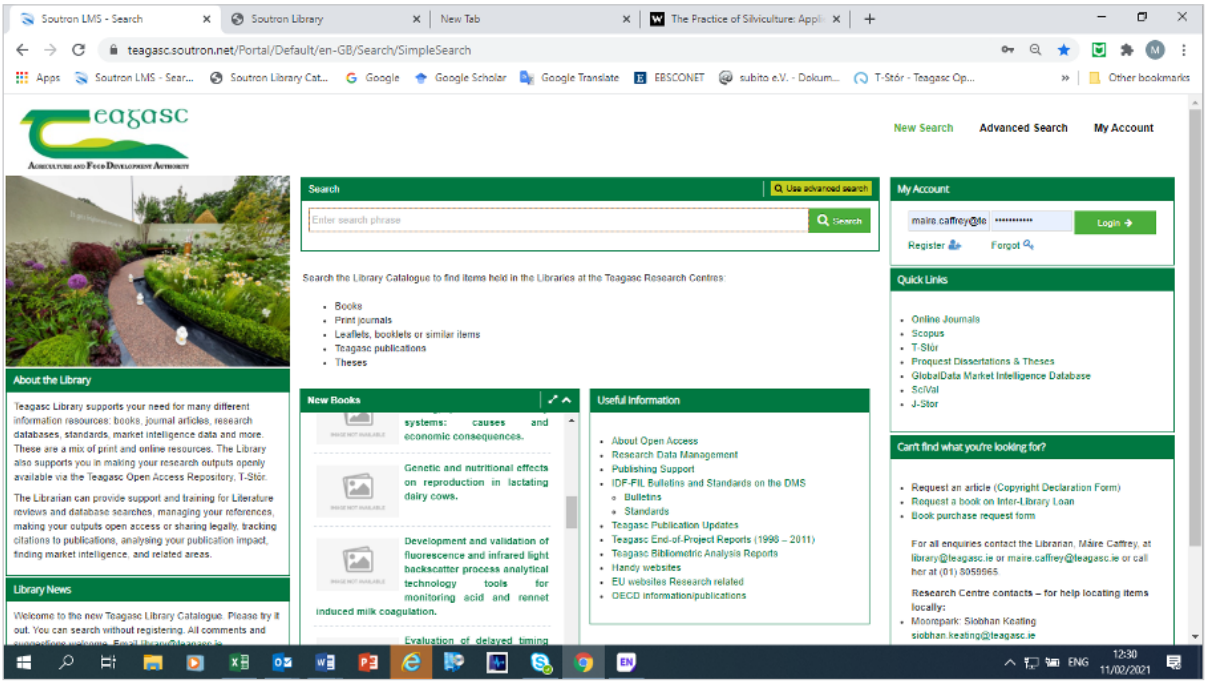
Diversity and Inclusion Strategy

Teagasc launched its new Diversity and Inclusion Strategy in July 2020. The Strategy is made up of a vision for diversity and inclusion and actions to help achieve that vision. Teagasc is made up of men, women, younger staff, older staff, married staff, single staff, staff in same sex marriages, staff from all corners of the world, staff with physical and mental disabilities.

The new Strategy is about ensuring that everyone feels included, has a voice and are valued in the organisation. Teagasc developed a Gender Equality Plan in 2019 and the actions from this are progressing well.

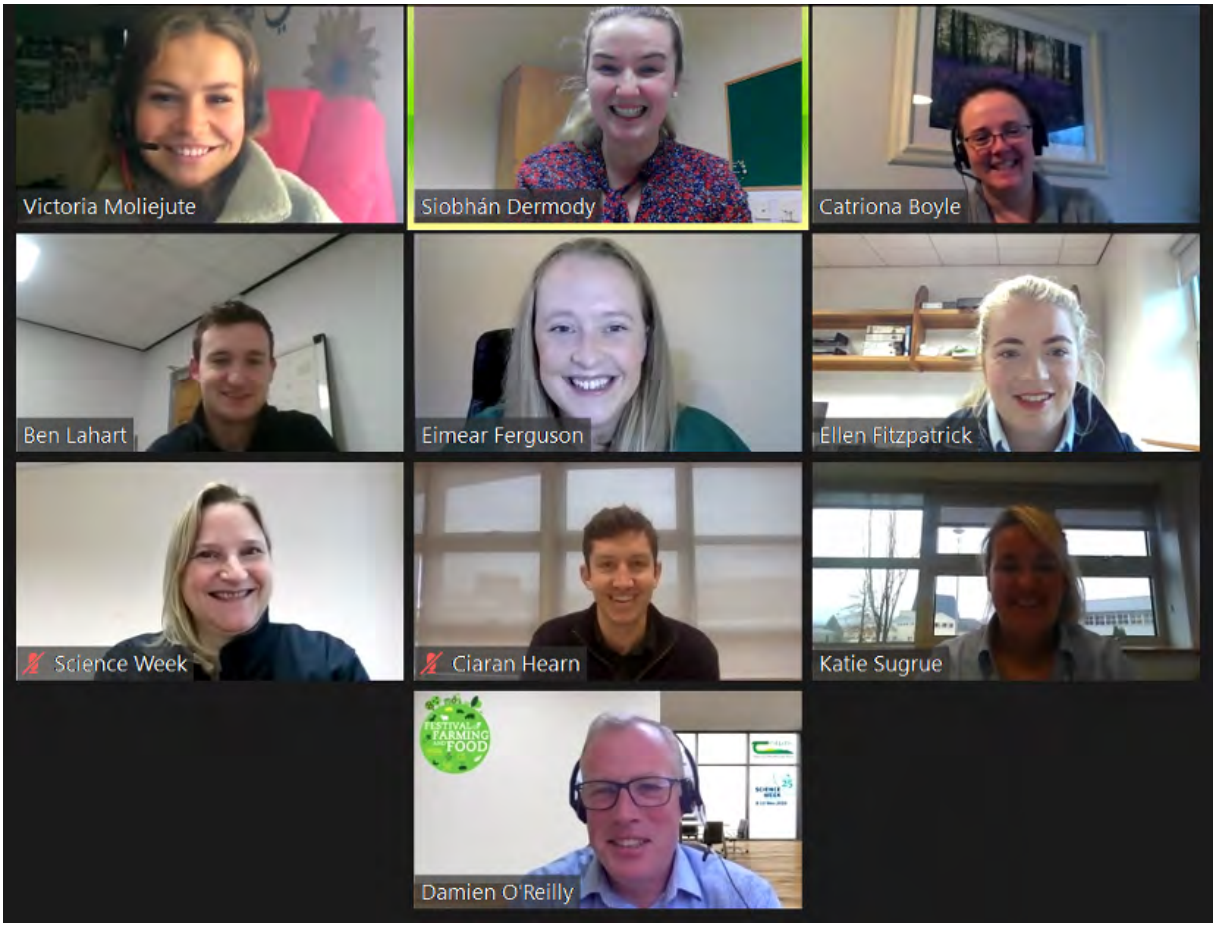
New Library Catalogue

In 2020 the Teagasc Library Service implemented the changeover to a new Library Management System (Catalogue). This new catalogue has an up-to-date, intuitive interface, making it much easier for staff to search for books held by the Research Centre Libraries. The scrolling "New Books" section automatically updates as items are added to the catalogue. The new system enables greater efficiency for the Librarian as it has enhanced functionality, such as importation of "ready-made" catalogue records for new books.



Science Week 2020
Although restrictions due to COVID-19 meant that Science Week activities had to move online, it also meant that there was no geographical restrictions on attendance. Over 15,000 people were reached by Teagasc's Science Week activities and there were attendees from every country in the Republic of Ireland, not to mention from twenty-nine countries around the world, from Australia to Zambia.

The core theme for Science Week 2020 was 'Science Week - Choosing our Future' focusing on how science can improve our lives in the future, and in the present. This explored how science can help us to make positive choices that will impact the environment, our health, and our quality of life.



Teagasc aimed to raise awareness and discussion of items of topical interest in agriculture and food, for example, plant health and biodiversity; soil health; sustainable farming; new food technologies and foods of the future to feed a growing world population.

Human Rights and Equality.

The Irish Human Rights and Equality Commission Act, 2014, places a positive duty on public sector bodies to have regard to the need to eliminate discrimination, promote equality and protect human rights, in their daily work. This is referred to as "The Public Sector Duty". Section 42[1] of the Act. Teagasc has recently completed a comprehensive exercise to identify the human rights and equality issues that are relevant to Teagasc, collated all of the existing policies and practices that are already in place, and developed a plan of actions to address current and future issues to ensure that the human rights of the public are protected. This plan will be published on the Teagasc website in 2021 and highlights on progress reported in future Annual Reports.

GDPR and FOI

Following a Data Protection preparation project which was undertaken in advance of GDPR coming into effect in May 2018, Teagasc has since assigned a dedicated Data Protection Officer to the role. All Teagasc business units in conjunction with the Data Protection Officer, are continuously working towards achieving compliance with the requirements of the GDPR. A communications exercise has been engaged in throughout the organisation. In this exercise, an emphasis has been placed on Teagasc obligations under GDPR including Data Breach reporting, responding to Data Subject requests and the completion of Data Protection Impact Assessments.

Teagasc has marked International Data Protection Day in 2020 and 2021 and all business units have been encouraged to carry out the annual review of the Personal Data Retention Schedule for their unit. Online Data Protection Training is available in Teagasc and hosted on the Teagasc learning platform, TLearn in compliance with GDPR requirements. In terms of data security, Teagasc uses the ISO 27001 as a guideline to set the standard for Teagasc security.

Teagasc comes under Freedom of Information legislation, namely the FOI Act 2014. All FOI requests submitted to Teagasc are dealt with as set out in the legislation.

Energy Report

Teagasc operates out of 55 primary locations nationwide varying in scale from Campus to small local Advisory offices; the locations break down into:

- 10 Large Campuses averaging at just under 6,000m2 of treated/conditioned floor area
- 45 Advisory Offices averaging at just under 340m2 of treated/conditioned floor area

In 2020, Teagasc consumed 24,687,159 kWh of energy, which is a decrease of almost 5% on its 2019 consumption. This is broken down as follows:

- 9,781,919 kWh of electricity (39.6% of total energy);
- 10,586,892 kWh of fossil fuel for space heating (42.9% of total energy);
- 4,318,348 kWh of vehicle fuel, consisting of agricultural, commercial transport and car fleet (17.5% of total energy);
- 666,797 kWh of renewable fuels (2.7% of total energy - this figure does not take account of the portion of purchased electricity which is generated from renewable resources or the renewable fuel element of purchased transport fuels).

The Teagasc built environment is the principal energy consumer accounting for approximately 83% of total consumption. Teagasc is conducting condition surveys on all its buildings which will inform the development and implementation of a building upgrade programme. A Decarbonisation Strategy is currently being developed which will guide the organisation towards meeting its 2030 targets. These entail reaching a 50% energy efficiency improvement, all public buildings to achieve a B BER rating and a new carbon emission reduction target of 50%.

Funds have being ring-fence from the 2021 Minor Capital budget to fund projects that contribute towards reductions in energy consumption and related carbon emissions. Two of the key projects currently being developed are: (1) the role out of electric vehicles to the Teagasc fleet with the concurrent installation of EV charging points on all campuses and colleges and (2) the development of a framework for photovoltaic installations across Teagasc sites.

A number of other projects have been identified such as: insulation and building fabric upgrades; thermal heating upgrades (to include heat pumps or other carbon neutral technology where appropriate); building controls optimisation; and installation of Building Management Systems (BMS).

Work is on-going on a lighting-as-a-service project to retrofit LED lighting across Teagasc which will deliver significant energy savings in the region of 1,550,000 kwh/yr – this project is currently at stage 2 procurement.

AWARDS/ACHIEVEMENTS

Two of the three finalists for this year's Geographical Society of Ireland Doctoral Awards, Dr. Jack McCarthy, a former Teagasc Walsh Scholar, and Dr. Shane Conway, collaborated extensively with Teagasc in the development of their research.

Teagasc Well Represented at Geographical Society of Ireland Doctoral Awards

Dr. McCarthy's PhD explored collaboration and co-operation amongst farmers and rural policy stakeholders involved in the EIP-AGRI initiative. Dr. David Meredith of Teagasc's Rural Economy and Development Programme and Dr. Christine Bonnin of UCD's School of Geography supervised the research.

Five Teagasc Researchers on Highly Cited List

Five Teagasc researchers were named among the top 1pc in the world for highly cited papers in the 2020 Clarivate list of Highly Cited Researchers. The highly anticipated annual list identifies researchers who demonstrated significant influence in their chosen field, or fields, through the publication of multiple highly cited papers during the last decade.

Their names are drawn from the publications that rank in the top 1% by citations for field and publication year in the Web of Science citation index.

Professor Declan Bolton, Principal Research Officer, Food Safety Department at Teagasc Food Research Centre and Adjunct Professor in the School of Veterinary Medicine, University College Dublin, Ireland. His research focuses on controlling bacterial pathogens including Campylobacter, Salmonella and Shiga toxin-producing Escherichia coli (STEC) along the food chain, shelf-life and the prevention of food spoilage, Clostridium spp. (C. estertheticum, C. gasigenes and C. difficile) and the public and veterinary health aspects of green technologies such as anaerobic digestion.

Professor Paul Cotter, Head of Department of Food Biosciences at Teagasc Food Research Centre, Principal Investigator in APC Microbiome Ireland and VistaMilk and CTO of the Teagasc/APC spin-out, SeqBiome. Paul's research focuses on the microbiology and microbiomes of food (especially fermented and other dairy foods), food processing and production environments and the gastrointestinal tract with a view to maintaining/establishing a healthy gut microbiota through dietary interventions, especially in athletes.

Professor Catherine Stanton, Senior Principal Research Officer, Teagasc, Department of Psychiatry, UCC and APC Microbiome Ireland. Her research includes nutritional aspects of dairy and functional foods, probiotic cultures, bioactive metabolite production, infant gut microbiota, and healthy proteins and fats (including conjugated linoleic acid, short chain fatty acids) that are produced by gut bacteria. She is also very interested in the microbiome during pregnancy and in infancy.

Professor Brijesh Tiwari, Principal Research Officer, Food Chemistry and Technology Department at Teagasc Food Research Centre and Professor (Adjunct) University College Dublin, Ireland. His research includes 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 his current research relates to the investigation of green and sustainable solutions to food industry challenges.

Dr. Paul Allen is a retired Principal Research Officer from Teagasc, whose research interests covered a range of cutting-edge approaches to important meat research challenges, including assurance of meat palatability, application of imaging and spectroscopic methods to prediction of meat eating quality, optimising and controlling colour in fresh meat, packaging solutions for fresh meat, objective carcass evaluation, and innovation in healthier meat products.

The methodology that determines the who's who of researchers draws on data and analysis performed by bibliometric experts at the Institute for Scientific Information at Clarivate. It uses InCites and Essential Science Indicators and a unique compilation of science performance metrics and trend data based on scholarly paper publication counts and citation data from the Web of Science, the world's largest publisher-neutral citation index and research intelligence platform.

More than 6,000 researchers around the world (33 in Ireland), in 21 fields of the sciences and social sciences, and cross field categories were selected based on the number of highly cited papers they produced over an 11-year period from January 2009 to December 2019.

Student of the Year

Teagasc/FBD Student of the Year Awards 2019, Enda Farrell from County Longford, is the 2019 Teagasc/FBD Student of the Year. The announcement was made at an online virtual awards ceremony on 16 November, 2020.

Teagasc Walsh Scholars Gold Medal

The Teagasc Walsh Scholars Gold Medal was awarded to Meritxell Grau from Teagasc's Crops, Environment and Land Use Programme. The Gold Medal award was presented at the online event - Walsh Scholars: The Next Generation, which took place in November, and recognises the top Walsh Scholar of the year.
The online event, hosted by Sharon Ní Bheoláin, was a showcase of Teagasc's leading postgraduate agri-food research. Attendees learnt about the Walsh Scholarships Programme and heard about some of the fascinating studies by final year Scholars.

Report of the Authority and Consolidated Financial Statements

Financial Year ended 31 December 2020

teagasc

Agriculture and Food Development Authority

TEAGASC CONSOLIDATED FINANCIAL STATEMENTS
FINANCIAL YEAR ENDED 31 DECEMBER 2020

CONTENTS **Page**

REPORT OF THE COMPTROLLER AND AUDITOR GENERAL FOR PRESENTATION TO THE HOUSES OF THE OIREACHTAS

Opinion on the financial statements

I have audited the financial statements of Teagasc for the year ended 31 December 2020 as required under the provisions of section 12 of the Agriculture (Research, Training and Advice) Act 1988. The financial statements comprise

- the consolidated statement of income and expenditure
- the consolidated statement of comprehensive income
- the statement of financial position of the Group and of Teagasc
- the consolidated statement of changes in capital and reserves
- the statement of changes in capital and reserves of Teagasc
- the consolidated statement of cash flows and
- the related notes, including a summary of significant accounting policies.

In my opinion, the financial statements give a true and fair view of the assets, liabilities and financial position of the group and of Teagasc at 31 December 2020 and of the group's income and expenditure for 2020 in accordance with Financial Reporting Standard (FRS) 102 — *The Financial Reporting Standard applicable in the UK and the Republic of Ireland.*

Basis of opinion

I conducted my audit of the financial statements in accordance with the International Standards on Auditing (ISAs) as promulgated by the International Organisation of Supreme Audit Institutions. My responsibilities under those standards are described in the appendix to this report. I am independent of Teagasc and have fulfilled my other ethical responsibilities in accordance with the standards.

I believe that the audit evidence I have obtained is sufficient and appropriate to provide a basis for my opinion.

Report on information other than the financial statements, and on other matters

Teagasc has presented certain other information together with the financial statements. This comprises the annual report, the governance statement and Authority members' report and the statement on internal control. My responsibilities to report in relation to such information, and on certain other matters upon which I report by exception, are described in the appendix to this report.

I have nothing to report in that regard.

Seamus McCarthy
Comptroller and Auditor General
24 June 2021

Appendix to the report

Responsibilities of Authority members

As detailed in the governance statement and Authority members' report, the Authority members are responsible for

- the preparation of financial statements in the form prescribed under section 12 of the Agriculture (Research, Training and Advice) Act 1988
- ensuring that the financial statements give a true and fair view in accordance with FRS 102
- ensuring the regularity of transactions
- assessing whether the use of the going concern basis of accounting is appropriate, and
- such internal control as they determine is necessary to enable the preparation of financial statements that are free from material misstatement, whether due to fraud or error.

Responsibilities of the Comptroller and Auditor General

I am required under section 12 of the Agriculture (Research, Training and Advice) Act 1988 to audit the financial statements of Teagasc and to report thereon to the Houses of the Oireachtas.

My objective in carrying out the audit is to obtain reasonable assurance about whether the financial statements as a whole are free from material misstatement due to fraud or error. Reasonable assurance is a high level of assurance, but is not a guarantee that an audit conducted in accordance with the ISAs will always detect a material misstatement when it exists. Misstatements can arise from fraud or error and are considered material if, individually or in the aggregate, they could reasonably be expected to influence the economic decisions of users taken on the basis of these financial statements.

As part of an audit in accordance with the ISAs, I exercise professional judgment and maintain professional scepticism throughout the audit. In doing so,

- I identify and assess the risks of material misstatement of the financial statements whether due to fraud or error; design and perform audit procedures responsive to those risks; and obtain audit evidence that is sufficient and appropriate to provide a basis for my opinion. The risk of not detecting a material misstatement resulting from fraud is higher than for one resulting from error, as fraud may involve collusion, forgery, intentional omissions, misrepresentations, or the override of internal control.
- I obtain an understanding of internal control relevant to the audit in order to design audit procedures that are appropriate in the circumstances, but not for the purpose of expressing an opinion on the effectiveness of the internal controls.
- I evaluate the appropriateness of accounting policies used and the reasonableness of accounting estimates and related disclosures.
- I conclude on the appropriateness of the use of the going concern basis of accounting and, based on the audit evidence obtained, on whether a material uncertainty exists related to events or conditions that may cast significant doubt on Teagasc's ability to continue as a going concern. If I conclude that a material uncertainty exists, I am required to draw attention in my report to the related disclosures in the financial statements or, if such disclosures are inadequate, to modify my opinion. My conclusions are based on the audit evidence obtained up to the date of my report. However, future events or conditions may cause Teagasc to cease to continue as a going concern.
- I evaluate the overall presentation, structure and content of the financial statements, including the disclosures, and whether the financial statements represent the underlying transactions and events in a manner that achieves fair presentation.

I communicate with those charged with governance regarding, among other matters, the planned scope and timing of the audit and significant audit findings, including any significant deficiencies in internal control that I identify during my audit.

Information other than the financial statements

My opinion on the financial statements does not cover the other information presented with those statements, and I do not express any form of assurance conclusion thereon.

In connection with my audit of the financial statements, I am required under the ISAs to read the other information presented and, in doing so, consider whether the other information is materially inconsistent with the financial statements or with knowledge obtained during the audit, or if it otherwise appears to be materially misstated. If, based on the work I have performed, I conclude that there is a material misstatement of this other information, I am required to report that fact.

Reporting on other matters

My audit is conducted by reference to the special considerations which attach to State bodies in relation to their management and operation. I report if I identify material matters relating to the manner in which public business has been conducted.

I seek to obtain evidence about the regularity of financial transactions in the course of audit. I report if I identify any material instance where public money has not been applied for the purposes intended or where transactions did not conform to the authorities governing them.

I also report by exception if, in my opinion,

- I have not received all the information and explanations I required for my audit, or
- the accounting records were not sufficient to permit the financial statements to be readily and properly audited, or
- the financial statements are not in agreement with the accounting records.

GOVERNANCE STATEMENT AND AUTHORITY MEMBERS' REPORT

Governance

The Authority of Teagasc was established under the Agriculture (Research, Training and Advice) Act, 1988. The functions of the Authority are set out in the First Schedule of this Act. The Authority is accountable to the Minister for Agriculture, Food and the Marine and is responsible for ensuring good governance and performs this task by setting strategic objectives and targets and taking strategic decisions on all key business issues. The regular day-to-day management, control and direction of Teagasc are the responsibility of the Director and the senior management team. The Director and the senior management team must follow the broad strategic direction set by the Authority, and must ensure that all Authority members have a clear understanding of the key activities and decisions related to the entity, and of any significant risks likely to arise. The Director acts as a direct liaison between the Authority and management of Teagasc.

Authority responsibilities

The work and responsibilities of the Authority are set out in the Agriculture (Research, Training and Advice) Act, 1988, which also contain the matters specifically reserved for Authority decision. Standing items considered by the Authority include:

- declaration of interests,
- reports from committees,
- financial reports/ management accounts,
- performance reports, and
- reserved matters.

Section 12(1) of the Agriculture (Research, Training and Advice) Act, 1988, in conjunction with S.I. No.418 of 2011, requires the Authority of Teagasc to keep, in such form as may be approved by the Minister for Agriculture, Food and the Marine with consent of the Minister for Public Expenditure and Reform, all proper and usual accounts of money received and expended by it.

In preparing these financial statements the Authority of Teagasc is required to:

- select suitable accounting policies and apply them consistently,
- make judgements and estimates that are reasonable and prudent,
- prepare the financial statements on the going concern basis unless it is inappropriate to presume that it will continue in operation, and
- state whether applicable accounting standards have been followed, subject to any material departures disclosed and explained in the financial statements.

The Authority is responsible for keeping adequate accounting records which disclose, with reasonable accuracy at any time, its financial position and enables it to ensure that the financial statements comply with Section 12(1) of the Agriculture (Research, Training and Advice) Act, 1988. The maintenance and integrity of the corporate and financial information on the Teagasc website is the responsibility of the Authority.

Since March 2020 a novel strain of coronavirus (COVID-19), and the government measures taken to mitigate its impact, are having an effect on the activity of Teagasc. The Authority is closely monitoring the impact of the pandemic on the 2021 budgets, cashflows and the associated risks. Teagasc has implemented measures to ensure operations adhere to current health authority guidelines necessary to protect the health of staff, students and clients, while ensuring business continuity.

The risks associated with COVID-19 have been assessed and documented on a risk register which is continually under review by Senior Management.

The Authority is responsible for approving the annual business plan and budget. An evaluation of the performance of Teagasc by reference to the annual business plan and budget was carried out on 03 March 2021.

The Authority is also responsible for safeguarding its assets and hence for taking reasonable steps for the prevention and detection of fraud and other irregularities.

GOVERNANCE STATEMENT AND AUTHORITY MEMBERS' REPORT

The Authority considers that the financial statements of Teagasc give a true and fair view of the financial performance and the financial position of Teagasc at 31 December 2020.

Authority performance review

An external performance evaluation of the how the Board of Teagasc operates was undertaken in 2020.

Authority structure

The Authority consists of a Chairperson and ten ordinary members, all of whom are appointed by the Minister for Agriculture, Food and the Marine. The members of the Authority are typically appointed for a period of five years (and may be re-appointed for a second term) and meet on a monthly basis, except in August. The table below details the appointment period for the Authority members in place during 2020:

Authority member	Role	Period of appointment
Herlihy, Mr. Liam	Chairperson	17 September 2018 – 16 September 2023
Buckley, Mr. John	Ordinary Member	28 September 2018 – 27 September 2023
Cooke, Mr. Tommy	Ordinary Member	05 October 2011 – 04 October 2021
Donnelly, Ms. Martina	Ordinary Member	10 October 2019 – 09 October 2024
Duffy, Mr. Patrick	Ordinary Member	28 September 2018 – 27 September 2023
Fitzgerald, Prof. Gerald	Ordinary Member	15 September 2013 – 14 September 2023
Hennessy, Prof. Thia	Ordinary Member	23 May 2018 – 22 May 2023
Kennedy, Mr. Richard	Ordinary Member	25 May 2016 – 26 January 2020
Murphy, Ms. Cliona	Ordinary Member	29 April 2015 – 28 April 2020
O'Connell, Ms. Eilís	Ordinary Member	30 October 2018 – 21 January 2023
Reynolds, Ms. Elizabeth	Ordinary Member	07 July 2020 – 06 July 2025
Rushe, Mr. Brian	Ordinary Member	27 January 2020 – 26 January 2025
Woulfe, Mr. Liam	Ordinary Member	29 April 2015 – 28 April 2020 and 03 July 2020 – 02 July 2025

The Authority has established five committees, as follows:

1. Audit and Risk Committee (ARC): comprises three Authority members and one external member. The role of the ARC is to support the Authority in relation to its responsibilities for issues of risk, control and governance and associated assurance. The ARC is independent from the financial management of the organisation. In particular the committee ensures that the internal control systems including audit activities are monitored actively and independently. The ARC reports to the Authority after each meeting, and formally in writing annually.

The Authority members of the Audit and Risk Committee during 2020 were: Mr. Liam Woulfe, Chairperson, Prof. Thia Hennessy and Ms. Eilís O'Connell. The external member was Mr. Noel O'Connell. There were six meetings of the ARC in 2020.

2. Operations Committee (OC): comprises four Authority members. The role of the OC is to support the Authority in reviewing and considering matters relating to the Operations Programme in Teagasc and to report and make recommendations to the Authority, as well as adopting good practice. The Authority members of this committee during 2020 were: Mr. Tommy Cooke, Chairperson, Mr. Liam Herlihy, Ms. Cliona Murphy and Ms. Martina Donnelly. There were three meetings of the OC in 2020. During 2020 Ms. Cliona Murphy completed her term on the Authority and was replaced on the committee by Ms. Elizabeth Reynolds.

3. Advisory & Education Committee (AEC): comprises five Authority members. The role of the AEC is to support the Authority in reviewing and considering matters relating to the Advisory and Education Programmes in Teagasc and to report and make recommendations to the Authority, as well as adopting good practice. The Authority members of this committee during 2020 were: Mr. Richard Kennedy, Chairperson, Mr. Patrick Duffy, Ms. Martina Donnelly, Mr. Tommy Cooke and Mr. John Buckley. There were five meetings of the AEC in 2020. During 2020 Mr. Richard Kennedy completed his term on the Authority and was replaced on the committee by Mr. Brian Rushe. Mr. Richard Kennedy was replaced as chairperson of the committee by Mr. John Buckley.

GOVERNANCE STATEMENT AND AUTHORITY MEMBERS' REPORT

4. Research Committee (RC): comprises five Authority members. The role of the RC is to support the Authority in reviewing and considering matters relating to the Research Programmes in Teagasc and to report and make recommendations to the Authority, as well as adopting good practice. The members of this committee during 2020 were: Prof. Gerald Fitzgerald, Chairperson, Mr. Richard Kennedy, Ms. Martina Donnelly, Mr. John Buckley and Prof. Thia Hennessy. There were two meetings of the RC in 2020. During 2020 Mr. Richard Kennedy completed his term on the Authority and was replaced on the committee by Mr. Brian Rushe.

5. Nominations Committee (NC): comprises six Authority members. The role of the NC is to consider vacancies on the Teagasc Authority and make recommendations on how best to fill the vacancies. The members of this committee during 2020 were: Mr. Liam Herlihy, Chairperson, Prof. Gerald Fitzgerald, Mr. Tommy Cooke, Ms. Cliona Murphy, Prof. Thia Hennessy and Mr. Patrick Duffy. There were three meetings of the NC in 2020. During 2020 Ms. Cliona Murphy completed her term on the Authority and was replaced on the committee by Ms. Elizabeth Reynolds.

Schedule of attendance, fees and expenses

Schedule of attendances at the Authority and Committee meetings for 2020 is set out below including the fees and expenses received by each member:

Authority Meetings 2020	08 Jan	05 Feb	04 Mar	01 Apr	06 May	03 Jun	01 Jul	02 Sep	07 Oct	04 Nov	23 Nov	02 Dec	07 Dec	Fees 2020 €	Expenses 2020 €
Herlihy, Mr. Liam	√	√	√	√	√	√	√	√	√	√	√	√	√	20,520	2,007
Buckley, Mr. John	√	√	√	√	√	√	√	√	√	√	√	√	√	11,970	-
Cooke, Mr. Tommy	√	√	√	√	√	√	√	√	√	√	√	√	√	11,970	-
Donnelly, Ms. Martina	√	√	√	√	√	√	√	√	√	√	√	√	√	-	4,139
Duffy, Mr. Patrick	√	√	√	√	√	-	√	√	√	-	√	√	√	11,970	-
Fitzgerald, Prof. Gerald	√	√	√	√	√	√	√	√	-	√	√	√	√	11,970	973
Hennessy, Prof. Thia	√	-	√	√	√	√	√	√	√	√	√	√	√	-	2,185
Kennedy, Mr. Richard	√													-	136
Murphy, Ms. Cliona	√	-	√	√										-	763
O'Connell, Ms. Eilís	√	√	-	√	√	-	-	√	√	√	√	√	√	-	205
Reynolds, Ms. Elizabeth							√	√	√	√	√	√	√	5,985	-
Rushe, Mr. Brian		√	√	√	√	√	√	√	√	√	√	√	√	10,973	73
Woulfe, Mr. Liam	-	√	√	√			√	√	√	√	√	√	√	9,975	1,251
														95,333	**11,732**

Teagasc incurred hospitality and accommodation expenses of €4,167 on behalf of Authority members in 2020. Four Authority members did not receive a fee under the One Person One Salary (OPOS) principle. Ms. Cliona Murphy, who has been entitled to a fee since 2015, waived her right to the entitlement. Mr. Noel O'Connell, external member of the ARC, received fees of €5,200 in 2020.

GOVERNANCE STATEMENT AND AUTHORITY MEMBERS' REPORT

Audit & Risk Committee	22 Jan	21 Feb	28 Apr	01 Jul	07 Oct	02 Dec
Woulfe, Mr. Liam	√	√	√		√	√
Hennessy, Prof. Thia	√	√	√	√	√	√
O'Connell, Ms. Eilís	√	√	√	√	√	√
O'Connell, Mr. Noel	√	√	√	√	√	√

Operations Committee	24 Feb	27 Aug	18 Dec
Cooke, Mr. Tommy	√	√	√
Herlihy, Mr. Liam	√	√	√
Donnelly, Ms. Martina	√	√	√
Murphy, Ms. Cliona	-		
Reynolds, Ms. Elizabeth		-	√

Research Committee	03 Jun	18 Dec
Fitzgerald, Prof. Gerald	√	√
Rushe, Mr. Brian	√	-
Hennessy, Prof. Thia	√	√
Buckley, Mr. John	√	√
Donnelly, Ms. Martina	√	√

Advisory & Education Committee	24 Jan	06 May	11 Jun	17 Jul	27 Oct	25 Nov
Kennedy, Mr. Richard	√					
Buckley, Mr. John	√	√	√	√	√	√
Cooke, Mr. Tommy	√	√	√	√	√	√
Donnelly, Ms. Martina	√	-	-	√	√	√
Duffy, Mr. Patrick	-	√	√	√	√	√
Rushe, Mr. Brian		√	√	√	√	√

Nominations Committee	04 Mar	03 Jun	17 Jun
Herlihy, Mr. Liam	√	√	√
Cooke, Mr. Tommy	√	√	√
Duffy, Mr. Patrick	√	-	√
Fitzgerald, Prof. Gerald	√	√	√
Hennessy, Prof. Thia	√	√	√
Murphy, Ms. Cliona	√		

Key personnel changes

Following two retirements two new members were appointed to the Authority during 2020.

GOVERNANCE STATEMENT AND AUTHORITY MEMBERS' REPORT

Disclosures required by the Code of Practice for the Governance of State Bodies (2016)

The Authority is responsible for ensuring that Teagasc has complied with the requirements of the Code of Practice for the Governance of State Bodies ("the Code"), as published by the Department of Public Expenditure and Reform in August 2016. The following disclosures are required by the Code:

Consultancy costs

Consultancy costs include the cost of external advice to management and exclude outsourced 'business-as-usual' functions.

	2020	2019
	€'000	€'000
Legal advice	186	201
Financial/ tax advice	25	27
Pensions/ human resources	87	76
Architectural/ engineering advice	391	813
Research advice	351	226
Other	258	289
Total consultancy costs	1,298	1,632
Consultancy costs capitalised	345	736
Consultancy costs charged to Income and Expenditure and Retained Revenue Reserves	953	896
Total	1,298	1,632

Legal costs and settlements

The table below provides a breakdown of amounts recognised as expenditure in the reporting period in relation to legal costs, settlements and conciliation and arbitration proceedings relating to contracts with third parties. This does not include expenditure incurred in relation to general legal advice received by Teagasc which is disclosed in Consultancy costs above.

	2020	2019
	€'000	€'000
Legal fees – legal proceedings	12	43
Counterparty legal costs	-	9
Settlements	139	175
Total	151	227

The total number of cases included in the 2020 settlements is 23 (2019: 24).

Travel and subsistence expenditure

Travel and subsistence expenditure is categorised as follows:

	2020	2019
Domestic	€'000	€'000
Authority	12	31
Employees	1,895	4,768
International		
Authority	-	-
Employees	106	837
	2,013	5,636

GOVERNANCE STATEMENT AND AUTHORITY MEMBERS' REPORT

Hospitality expenditure

The Statement of Income and Expenditure includes the following hospitality expenditure:

	2020	2019
	€'000	€'000
Staff hospitality	31	39
Client hospitality	16	18
Total	47	57

In accordance with their employment/ placement agreements some staff and students are entitled to meals in college canteens. The cost of provision of these meals in 2020 was €18,414 (2019: €41,362).

Teagasc has a 10 year premium seat sponsorship agreement with Croke Park at an annual cost of €4,800 for staff incentive and stakeholder entertainment which covers the period October 2012 to September 2022. The costs attributable to staff incentives in 2020 were €4,800.

Statement of compliance

The Authority has adopted the Code of Practice for the Governance of State Bodies (2016) and has put procedures in place to ensure compliance with the Code. Teagasc was in compliance with the Code of Practice for the Governance of State Bodies for 2020.

Mr. Liam Herlihy
Chairman
21 June 2021

Mr. Tommy Cooke
Member of the Authority
21 June 2021

STATEMENT ON INTERNAL CONTROL

Scope of responsibility

On behalf of Teagasc I acknowledge the Authority's responsibility for ensuring that an effective system of internal control is maintained and operated. This responsibility takes account of the requirements of the Code of Practice for the Governance of State Bodies (2016).

Purpose of the system of internal control

The system of internal control is designed to manage risk to a tolerable level rather than to eliminate it. The system can therefore only provide reasonable and not absolute assurance that assets are safeguarded, transactions authorised and properly recorded and that material errors or irregularities are either prevented or detected in a timely way.

The system of internal control, which accords with guidance issued by the Department of Public Expenditure and Reform, has been in place in Teagasc for the year ended 31 December 2020 and up to the date of approval of the financial statements.

Capacity to handle risk

Teagasc has an Audit and Risk Committee (ARC) comprising three Authority members, one of whom is the Chair, and one external member with financial and audit expertise. The ARC met six times in 2020.

Teagasc has also established an internal audit function which is adequately resourced and conducts a programme of work agreed with the ARC. The function is supported by external firms providing internal audit services.

The ARC has reviewed the risk management policy which sets out Teagasc's risk appetite, the risk management processes in place and details the roles and responsibilities of staff in relation to risk. The policy has been issued to all staff who are expected to work within Teagasc's risk management policies, to alert management on emerging risks and control weaknesses and assume responsibility for risks and controls within their own area of work.

Risk and control framework

Teagasc has implemented a risk management system which identifies and reports key risks and the management actions being taken to address and, to the extent possible, to mitigate those risks.

A risk register is in place which identifies the key risks facing Teagasc and these have been identified, evaluated and graded according to their significance. The register is reviewed by the Authority on a monthly basis and by the ARC on a quarterly basis. The outcome of these assessments is used to plan and allocate resources to ensure risks are managed to an acceptable level.

The risk register details the controls and actions needed to mitigate risks and responsibility for operation of controls assigned to specific staff. I confirm that a control environment containing the following elements is in place:

- procedures for all key business processes have been documented,
- financial responsibilities have been assigned at management level with corresponding accountability,
- there is an appropriate budgeting system with an annual budget which is kept under review by senior management,
- there are systems aimed at ensuring the security of the information and communication technology systems,
- there are systems in place to safeguard the assets, and
- control procedures over grant funding to outside agencies ensure adequate control over approval of grants and monitoring and review of grantees to ensure grant funding has been applied for the purpose intended.

STATEMENT ON INTERNAL CONTROL

Ongoing monitoring and review

Formal procedures have been established for monitoring control processes and control deficiencies are communicated to those responsible for taking corrective action and to management and the Authority, where relevant, in a timely way. I confirm that the following ongoing monitoring systems are in place:

- key risks and related controls have been identified and processes have been put in place to monitor the operation of those key controls and report any identified deficiencies,
- reporting arrangements have been established at all levels where responsibility for financial management has been assigned, and
- there are regular reviews by senior management of periodic and annual performance and financial reports which indicate performance against budgets/ forecasts.

Procurement

I confirm that Teagasc has procedures in place to ensure compliance with procurement rules and guidelines. Total procurement related expenditure was €55.1m. Teagasc reviews the compliance status of all purchase orders with a value greater than €25,000. In 2020 Teagasc found that of 232 purchase orders, those relating to five suppliers were non-compliant and the value of the non-compliant purchase orders was €166,180 (2019: €477,743). Notwithstanding that these procurements were non-compliant Teagasc is satisfied that they achieved good value for money.

Delegated sanction

I confirm that Teagasc has procedures in place to ensure compliance with the delegated sanction pay ceiling allocated by the Department of Agriculture, Food and the Marine. In 2015 an updated framework was introduced which capped permanent payroll expenditure and is administered annually by way of 'delegated sanction'. The delegated sanction arrangements require Teagasc to ensure that its pay bill for permanent staff does not exceed the specified annual pay ceiling. In 2020 delegated sanction pay exceeded this ceiling of €67.8m by €967k. Recent changes to retirement rules resulted in many staff deferring retirement and, with recruitment commitments made in advance of the notification of the ceiling, an over-run began to materialise. DAFM agreed some flexibility to ensure services could be maintained and having regard to the challenges posed by COVID-19 and continued to approve recruitment for critical frontline posts and provide for key promotions to management grades in 2020. A more restricted recruitment schedule is implemented by management pending confirmation of the delegated sanction pay ceiling for 2021.

Advance payment of grants

I confirm that Teagasc has procedures in place to ensure compliance with pre-funded grants. Teagasc provides advance grant funding to three private colleges and a number of universities. Teagasc engaged with the Department of Agriculture, Food and the Marine to seek derogated sanction from the Department of Public Expenditure and Reform to continue the practice of pre-funding grants. This was received for 2020.

Impact of COVID-19 pandemic to the control environment

The onset of the COVID-19 pandemic in early 2020, and the resulting public health advice and safety measures, changed the working practices of Teagasc. Teagasc has monitored the developments closely, seeking to mitigate the risks that may affect its business operations, staff and stakeholders. Actions taken by Teagasc have included:

- Initiating a business continuity plan which was an aggregate of plans prepared by each business unit in Teagasc.
- Transitioning the Authority of Teagasc to a remote environment for the purpose of making business decisions.
- Making necessary adaptations to Teagasc's physical office environment in line with published guidance and expert assessment.
- Ongoing COVID-19 risk assessments for staff and stakeholders.
- Continual assessment of significant risks pertaining to the COVID-19 pandemic and the agility of Teagasc to respond effectively.
- Ensuring robust segregation of duties persists and adequate cover is in place should specific approving authorities be unavailable.
- Ensuring all existing data protection and records management policies and procedures continue to apply as normal.
- Assessing potential for weaknesses in internal controls resulting from COVID-19 and taking measures to monitor and update internal controls where necessary.

STATEMENT ON INTERNAL CONTROL

Review of effectiveness

I confirm that Teagasc has procedures to monitor the effectiveness of its risk management and control procedures. Teagasc's monitoring and review of the effectiveness of the system of internal control is informed by the work of the internal and external auditors, the Audit and Risk Committee which oversees their work and the senior management within Teagasc responsible for the development and maintenance of the internal control framework.

I confirm that the Authority conducted an annual review of the effectiveness of the internal controls for 2020 on 03 March 2021.

Internal control issues

No weaknesses in internal control, apart from those noted under procurement and delegated sanction, were identified in relation to 2020 that require disclosure in the financial statements.

Mr. Liam Herlihy
Chairman
21 June 2021

CONSOLIDATED STATEMENT OF INCOME AND EXPENDITURE
YEAR ENDED 31 DECEMBER 2020

	Note	2020 €'000	2019 €'000
Income			
Oireachtas grants	4	152,524	149,594
EU funding	5	3,644	3,440
Livestock trading income		3,661	3,302
Operational income	6	33,887	34,684
Net deferred funding for retirement benefits	10	(8,564)	(6,421)
(Loss)/ gain on disposal of fixed assets	12	(22)	162
Other grants, donations and voluntary levies		3,285	4,665
Sale of goods		84	134
Research and technology services		1,082	1,819
Total Income		189,581	191,379
Expenditure	7	(179,389)	(185,684)
Operating surplus		10,192	5,695
Interest receivable		2	16
Surplus before transfers and taxation		10,194	5,711
Transfer to Capital Account	23	(7,567)	(5,787)
Surplus/ (deficit) for the financial year before taxation		2,627	(76)
Taxation	11	65	(9)
Surplus/ (deficit) for the financial year		2,692	(85)
Surplus/ (deficit) attributable to			
Teagasc		2,898	(98)
Non-controlling interest		(206)	13
		2,692	(85)

The Statement of Cash Flow and Notes 1-35 form part of these financial statements.

Mr. Liam Herlihy
Chairman
21 June 2021

Professor Gerry Boyle
Director
21 June 2021

CONSOLIDATED STATEMENT OF COMPREHENSIVE INCOME
YEAR ENDED 31 DECEMBER 2020

	Note	2020 €'000	2019 €'000
Surplus/ (deficit) for the financial year		2,692	(85)
Actuarial (loss)/ gain on retirement benefit liabilities	10	(75,420)	(156,742)
Adjustment to deferred retirement benefit funding	10	75,420	156,742
Total comprehensive income for the year		2,692	(85)
Teagasc		2,898	(98)
Non-controlling interest		(206)	13
		2,692	(85)

The Statement of Cash Flow and Notes 1-35 form part of these financial statements.

Mr. Liam Herlihy
Chairman
21 June 2021

Professor Gerry Boyle
Director
21 June 2021

STATEMENT OF FINANCIAL POSITION
AS AT 31 DECEMBER 2020

		Group		Teagasc	
		2020	2019	2020	2019
	Note	€'000	€'000	€'000	€'000
Non-current assets					
Property, plant and equipment	12	128,453	121,211	116,335	108,768
Investments	14	598	616	599	617
		129,051	121,827	116,934	109,385
Current assets					
Inventories	15	5,649	5,542	5,649	5,542
Receivables: amounts falling due within one year	17	24,624	27,142	24,194	26,605
Cash and cash equivalents	18	43,342	35,230	40,442	32,127
		73,615	67,914	70,285	64,274
Payables: amounts falling due within one year					
Payables and accruals	19	22,244	21,649	21,171	20,551
Deferred income	21	20,403	19,717	20,357	19,657
		42,647	41,366	41,528	40,208
Net current assets		30,969	26,548	28,757	24,066
Total assets less current liabilities		160,020	148,375	145,691	133,451
Provisions for liabilities					
Deferred tax	22	63	120	-	-
Payables: amounts falling due after one year					
Deferred income	21	12,330	10,919	12,224	10,720
Payables and accruals	20	406	375	-	-
		147,220	136,961	133,467	122,731
Deferred retirement benefit funding	10	1,366,697	1,299,840	1,366,697	1,299,840
Retirement benefit liabilities	10	(1,366,697)	(1,299,840)	(1,366,697)	(1,299,840)
Net assets		**147,220**	**136,961**	**133,467**	**122,731**
Capital and reserves					
Capital account	23	116,335	108,768	116,335	108,768
Revenue reserves	24	18,140	15,448	17,132	13,963
Capital contribution		12,745	12,745	-	-
		147,220	**136,961**	**133,467**	**122,731**
Reserves attributable to Teagasc		140,439	129,974	133,467	122,731
Non-controlling interest		6,781	6,987	-	-
		147,220	**136,961**	**133,467**	**122,731**

The Statement of Cash Flow and Notes 1-35 form part of these financial statements.

Mr. Liam Herlihy
Chairman
21 June 2021

Professor Gerry Boyle
Director
21 June 2021

CONSOLIDATED STATEMENT OF CHANGES IN CAPITAL AND RESERVES AS AT 31 DECEMBER 2020

GROUP

	Note	Capital account	Capital contribution	Revenue reserves		Capital contribution	Total
				Group	Non-controlling interest	Non-controlling interest	
		€'000	€'000	€'000	€'000	€'000	€'000
At 1 January 2019		**102,981**	**2,560**	**14,904**	**629**	**5,456**	**126,530**
(Deficit)/ surplus for the year		-	-	**(98)**	**13**	-	(85)
Actuarial loss on retirement benefit liabilities	10	-	-	**(156,742)**	**-**	-	(156,742)
Adjustment to deferred retirement benefit funding	10	-	-	**156,742**	**-**	-	156,742
Total comprehensive income		-	-	**(98)**	**13**	-	(85)
Addition to capital contribution		-	3,840	**-**	**-**	889	4,729
Amounts capitalised in respect of purchased assets	12	13,136	-	**-**	**-**	-	13,136
Net amount released on disposals	12	(47)	-	**-**	**-**	-	(47)
Less: amortised in line with asset depreciation	12	(7,302)	-	**-**	**-**	-	(7,302)
At 31 December 2019		**108,768**	**6,400**	**14,806**	**642**	**6,345**	**136,961**
			129,974		**6,987**		**136,961**
Surplus/ (deficit) for the year		-	-	**2,898**	**(206)**	-	2,692
Actuarial loss on retirement benefit liabilities	10	-	-	**(75,420)**	**-**	-	(75,420)
Adjustment to deferred retirement benefit funding	10	-	-	**75,420**	**-**	-	75,420
Total comprehensive income		-	-	**2,898**	**(206)**	-	2,692
Addition to capital contribution		-	-	**-**	**-**	-	-
Amounts capitalised in respect of purchased assets	12	15,251	-	**-**	**-**	-	15,251
Net amount released on disposals	12	(30)	-	**-**	**-**	-	(30)
Less: amortised in line with asset depreciation	12	(7,594)	-	**-**	**-**	-	(7,594)
Impairment loss	12	(60)	-	**-**	**-**	-	(60)
At 31 December 2020		**116,335**	**6,400**	**17,704**	**436**	**6,345**	**147,220**
			140,439		**6,781**		**147,220**

The Statement of Cash Flow and Notes 1-35 form part of these financial statements.

STATEMENT OF CHANGES IN CAPITAL AND RESERVES
AS AT 31 DECEMBER 2020

TEAGASC

	Note	Capital account €'000	Revenue reserves €'000	Total €'000
At 1 January 2019		**102,981**	**14,077**	**117,058**
Deficit for the year		-	(114)	(114)
Actuarial loss on retirement benefit liabilities	10	-	(156,742)	(156,742)
Adjustment to deferred retirement benefit funding	10	-	156,742	156,742
Total comprehensive income		-	(114)	(114)
Amounts capitalised in respect of purchased assets	12	13,136	-	13,136
Net amount released on disposals	12	(47)	-	(47)
Less: amortised in line with asset depreciation	12	(7,302)	-	(7,302)
At 31 December 2019		**108,768**	**13,963**	**122,731**
Surplus for the year		-	3,169	3,169
Actuarial loss on retirement benefit liabilities	10	-	(75,420)	(75,420)
Adjustment to deferred retirement benefit funding	10	-	75,420	75,420
Total comprehensive income		-	3,169	3,169
Amounts capitalised in respect of purchased assets	12	15,251	-	15,251
Net amount released on disposals	12	(30)	-	(30)
Less: amortised in line with asset depreciation	12	(7,594)	-	(7,594)
Impairment loss	12	(60)	-	(60)
At 31 December 2020		**116,335**	**17,132**	**133,467**

The Statement of Cash Flow and Notes 1-35 form part of these financial statements.

CONSOLIDATED STATEMENT OF CASH FLOW
AS AT 31 DECEMBER 2020

GROUP

	Note	2020 €'000	2019 €'000
Cash flow from operating activities	27	23,807	21,065
Interest paid		(88)	(91)
Taxation		8	(9)
Net cash flow from operating activities		23,727	20,965
Cash flow from investing activities			
Payments to acquire tangible fixed assets	12	(15,667)	(18,309)
Receipts from sales of tangible fixed assets	12	50	230
Payments to acquire investments	14	-	(70)
Receipts from disposals of investments	14	-	24
Interest received		2	16
Receipt of capital contribution		-	4,729
Net cash used in investing activities		(15,615)	(13,380)
Net increase in cash and cash equivalents		8,112	7,585
Cash and cash equivalents at 1 January		35,230	27,645
Cash and cash equivalents at 31 December		43,342	35,230
Cash and cash equivalents consists of:			
Cash at bank and in hand	18	27,842	19,730
Short term deposits	18	15,500	15,500
Cash and cash equivalents at 31 December		43,342	35,230

The Statement of Cash Flow and Notes 1-35 form part of these financial statements.

NOTES TO THE FINANCIAL STATEMENTS

1. General information

Teagasc (the Agriculture and Food Development Authority of Ireland) was established under the Agriculture (Research, Training and Advice) Act, 1988. The mission of Teagasc is to support science-based innovation in the agri-food sector and the broader bioeconomy that will underpin profitability, competitiveness and sustainability. Teagasc's principal and registered office is at Oak Park, Carlow.

Teagasc owns a 57% share in Moorepark Technology Limited whose principal activity is the provision of services for Research and Development.

2. Summary of significant accounting policies

The basis of accounting, and significant accounting policies adopted by Teagasc, are set out below. They have all been applied consistently throughout the year and for the preceding year.

2.1 Statement of compliance

The financial statements of Teagasc for the year ended 31 December 2020 have been prepared in accordance with FRS 102, the financial reporting standard applicable in the UK and Ireland issued by the Financial Reporting Council (FRC).

2.2 Basis of consolidation

For the purposes of these financial statements, the 'Teagasc Group' comprises the parent entity Teagasc and its subsidiary Moorepark Technology Limited. The accounting policies and accounting period of the subsidiary are consistent with those of the Group. Inter-company transactions and balances and gains on transactions between group companies are eliminated. The investment in the subsidiary is accounted for at cost less impairment. Details of the subsidiary are provided in Note 14.

2.3 Basis of preparation

The financial statements have been prepared under the historical cost convention, except for certain assets and liabilities that are measured at fair values as explained in the accounting policies below. The financial statements are in the form approved by the Minister for Agriculture, Food and the Marine with the concurrence of the Minister for Public Expenditure and Reform under Section 12 of the Agriculture (Research, Training and Advice) Act, 1988, in conjunction with S.I. No.418 of 2011. The following accounting policies have been applied consistently in dealing with items which are considered material in relation to Teagasc's financial statements.

2.4 Revenue recognition

Oireachtas grants
Teagasc receives government grants in respect of research and other projects (revenue grants) and capital grants to fund capital investment. Revenue grants that do not include performance criteria are recognised as income on a cash receipts basis. Grants received which impose specific performance criteria are credited to deferred income and recorded as a creditor until the relevant performance criteria have been met and the grants are recognised as income. Capital grants are released to income over the expected useful life of the relevant asset purchased.

Sale of goods
Revenue from the sale of goods is recognised when the significant risks and rewards of ownership of the goods have passed to the buyer, usually on dispatch of the goods, the amount of revenue can be measured reliably, it is probable that the economic benefits associated with the transaction will flow to the entity and the costs incurred or to be incurred in respect of the transaction can be measured reliably.

NOTES TO THE FINANCIAL STATEMENTS

Advisory fees
Teagasc receives income for annual advisory service contracts, annual discussion group contracts and additional advisory services provided. Income from annual advisory service contracts is recognised in the accounting period when the relevant invoice has issued. Income in relation to discussion group contracts and additional advisory services is recognised in the accounting period in which the service is rendered and the outcome of the contract can be estimated reliably.

Accrued income
Income earned on goods/ services delivered, but unbilled, is recognised in accordance with contractual terms as accrued income on the Statement of Financial Position. Income earned on research projects, but unclaimed, is recognised as accrued income on the Statement of Financial Position, taking into account the individual rules of all funding bodies.

Royalty income
Royalty income is recognised on an accruals basis in accordance with the substance of the relevant agreements.

Tuition fees
Revenue is recognised over the period of instruction.

Comparative figures
Comparative figures have been regrouped and reanalysed, where necessary, on the same basis as those for the current period.

2.5 Employee benefits

The Group provides a range of benefits to employees, including paid holiday arrangements and defined benefit pension plans.

Short term benefits
Short term benefits, including holiday pay and other similar non-monetary benefits, are recognised as an expense in the period in which the service is receivable.

Defined benefit pension plans
The Group operates defined benefit pension schemes which are funded annually on a pay as you go basis from monies available to it, including monies provided by the Department of Agriculture, Food and the Marine, and from contributions deducted from staff salaries. Pension Scheme liabilities are measured on an actuarial basis using the projected unit method. Actuarial valuations are obtained annually and are updated at each Statement of Financial Position date.

Teagasc also operates the Single Public Services Pension Scheme (Single Scheme), which is the defined benefit scheme for pensionable public servants appointed on or after 01 January 2013. Single Scheme members' contributions are paid over to the Department of Public Expenditure and Reform.

Retirement benefit costs reflect retirement benefits earned by employees in the period and are shown net of staff pension contributions which are retained by the Group. The Single Public Services Pension Scheme contributions are remitted to the Department of Public Expenditure and Reform. An amount corresponding to the retirement benefit charge is recognised as income to the extent that it is recoverable, and offset by grants received in the year to discharge retirement benefit payments. Actuarial gains or losses arising from changes in actuarial assumptions and from experience surpluses and deficits are recognised in the Consolidated Statement of Comprehensive Income for the year and a corresponding adjustment is recognised in the amount recoverable from the Department of Agriculture, Food and the Marine.

Retirement benefit liabilities represent the present value of future retirement benefit payments earned by staff to date. Deferred retirement benefit funding represents the corresponding asset to be recovered in future periods from the Department of Agriculture, Food and the Marine.

NOTES TO THE FINANCIAL STATEMENTS

2.6 Leases

At inception Teagasc assesses agreements that transfer the right to use assets. The assessment considers whether the arrangement is, or contains, a lease based on the substance of the arrangement.

Operating leases
Leases that do not transfer all the risks and rewards of ownership are classified as operating leases. Payments under operating leases are charged to the income statement on a straight-line basis over the period of the lease.

2.7 Taxation

The taxation expense for the period comprises current and deferred tax recognised in the reporting period. Tax is recognised in the income statement. Current or deferred taxation assets and liabilities are not discounted.

Current tax
Current tax is the amount of income tax payable in respect of the taxable profit for the year or prior years. Tax is calculated on the basis of tax rates and laws that have been enacted or substantively enacted by the period end.

Management periodically evaluates positions taken in tax returns with respect to situations in which applicable tax regulation is subject to interpretation. It establishes provisions where appropriate on the basis of amounts expected to be paid to the tax authorities.

Deferred tax
Deferred tax arises from timing differences that are differences between taxable profits and total comprehensive income as stated in the financial statements. These timing differences arise from the inclusion of income and expenses in tax assessments in periods different from those in which they are recognised in financial statements.

Deferred tax is recognised on all timing differences at the reporting date except for certain exceptions. Unrelieved tax losses and other deferred tax assets are only recognised when it is probable that they will be recovered against the reversal of deferred tax liabilities or other future taxable profits.

Deferred tax is measured using tax rates and laws that have been enacted or substantively enacted by the period end and that are expected to apply to the reversal of the timing difference.

2.8 Research and development

Expenditure on research activities is recognised as an expense in the period in which it is incurred.

2.9 Tangible assets

Property, plant and equipment
Property, plant and equipment are stated at cost less accumulated depreciation and accumulated impairment losses. Such costs include costs directly attributable to making the asset capable of operating as intended.

Land is not depreciated. Assets under construction are not depreciated. Depreciation is provided on all property, plant and equipment at rates calculated to write off the cost, less estimated residual value, of each asset on a systematic basis over its expected useful life as follows:

Computer equipment	3 years
Plant and vehicles	5 years
Laboratory and office equipment	10 years
Industrial plant and equipment	10 years
Farm buildings	20 years
Industrial and manufacturing buildings	30 years
Other buildings	50 years

A half year's depreciation is charged in the year of acquisition and disposal of assets.

NOTES TO THE FINANCIAL STATEMENTS

The carrying values of property, plant and equipment are reviewed for impairment when events or changes in circumstances indicate that the carrying value may not be recoverable. If there is an indication of impairment the impairment loss, or the reversal of an impairment loss, is recognised immediately in the Consolidated Statement of Income and Expenditure.

The estimated useful lives, residual values and depreciation methods are reviewed, and adjusted as appropriate, at the end of each financial year.

The gain or loss, being the difference between the sales proceeds and the carrying amount of the asset, arising on disposal or retirement of an item of property, plant and equipment is recognised in the Consolidated Statement of Income and Expenditure. Any amount in the revaluation reserve relating to that asset is transferred to retained earnings directly.

Fully depreciated plant and equipment is retained in the financial statements until it is no longer in use.

Assets for re-sale
Tangible assets are classified as held for sale when the carrying amount is expected to be recovered principally through a sale transaction and a sale is highly probable. They are stated at the lower of carrying amount or fair value less cost to sell.

Impairment of non-financial assets
At each financial year end date non-financial assets not carried at fair value are assessed to determine whether there is an indication that the asset (or asset's cash generating unit) may be impaired. If there is such an indication the recoverable amount of the asset (or asset's cash generating unit) is compared to the carrying amount of the asset (or asset's cash generating unit).

2.10 Financial assets

Investment in subsidiary
The investment in the subsidiary Moorepark Technology Limited is measured at cost less impairment. If there is objective evidence of impairment, an impairment loss is recognised in the Consolidated Statement of Income and Expenditure in the year.

Other investments
Investments listed on a recognised stock exchange are measured at their fair value, and movements are recorded through the Consolidated Statement of Income and Expenditure and the Consolidated Statement of Comprehensive Income. Other financial assets comprising investments in unquoted shares and financial investments are measured at their fair value if this can be reliably determined; otherwise they are measured at the value attributed to them at the date of acquisition less impairment. If there is objective evidence of impairment, an impairment loss is recognised in the Consolidated Statement of Income and Expenditure and the Consolidated Statement of Comprehensive Income in the year.

2.11 Inventory

Biological assets
Livestock and own farm produce are valued using the fair value model. Fair value is determined on the basis that animals and own farm produce are sold on the open market. Gains and losses, which arise from these valuations, are reflected in full in operational income.

Other inventory
All other inventory is stated at the lower of cost and net realisable value.

2.12 Receivables

Receivables are recognised at fair value, less a provision for impairments. The provision for impairments is a specific provision, and is established when there is objective evidence that Teagasc will not be able to collect all amounts owed to it. All movements in the provision for impairments are recognised in the Consolidated Statement of Income and Expenditure.

NOTES TO THE FINANCIAL STATEMENTS

2.13 Payables

Payables, including trade and other payables and deferred income, are initially recognised at transaction price, unless the arrangement constitutes a financing transaction, where the debt instrument is measured at the present value of the future receipts discounted at a market rate of interest. Advanced research income, where a portion of the funds is due to be paid to partnering organisations, is included in deferred income.

2.14 Provisions and contingencies

Provisions
Provisions are recognised when the Group has a present legal or constructive obligation as a result of past events; it is probable that an outflow of resources will be required to settle the obligation; and the amount of the obligation can be estimated reliably.

Provisions are measured at the present value of the expenditures expected to be required to settle the obligation using a pre-tax rate that reflects current market assessments of the time value of money and the risks specific to the obligation. The increase in the provision due to passage of time is recognised as a finance cost.

Contingencies
Contingent liabilities, arising as a result of past events, are not recognised when (i) it is not probable that there will be an outflow of resources or that the amount cannot be reliably measured at the reporting date or (ii) when the existence will be confirmed by the occurrence or non-occurrence of uncertain future events not wholly within the Group's control. Contingent liabilities are disclosed in the financial statements unless the probability of an outflow of resources is remote.

Contingent assets are not recognised. Contingent assets are disclosed in the financial statements when an inflow of economic benefits is probable.

3. Critical accounting estimates and judgments

The preparation of the financial statements requires management to make judgements, estimates and assumptions that affect the amounts reported for assets and liabilities as at the Statement of Financial Position date and the amounts reported for revenues and expenses during the year. However, the nature of estimation means that actual outcomes could differ from those estimates. The following judgements have had the most significant effect on amounts recognised in the financial statements:

Useful economic lives of property, plant and equipment
The Group depreciates the tangible fixed assets over their estimated useful lives after taking into account their estimated residual values. The estimated useful life reflects management's estimate of the period that the Group intends to derive future economic benefits from the use of the Group's tangible fixed assets. The residual value reflects management's estimated amount that the Group would currently obtain from the disposal of the asset, after deducting the estimated costs of disposal, as if the asset were already of the age and in the condition expected at the end of its useful life. Changes in the expected level of usage and technological developments could affect the economics, useful lives and the residual values of these assets which could then consequentially impact future depreciation charges. See Note 12 for the carrying amount of tangible fixed assets.

Valuation of investments
At the end of each financial year, an assessment is made on whether there are indicators that Teagasc's investment in the subsidiary is impaired. Where necessary, Teagasc's assessments are based on the estimation of the value-in-use of the assets by forecasting the expected future cash flows for a period of up to 5 years, using a suitable discount rate in order to calculate the present value of those cash flows. See Note 14 for the carrying amount of investments.

NOTES TO THE FINANCIAL STATEMENTS

Impairment of receivables
Teagasc assesses receivables on a continuous basis for any objective evidence of impairment by considering factors, including the ageing profile, the creditworthiness and the past collection history of each debtor. If the financial conditions of these debtors were to deteriorate, resulting in an impairment of their ability to make payments, additional allowances may be required. See Note 17 for the carrying amount of trade and other receivables.

Retirement benefit obligation
Teagasc has an obligation to pay retirement benefits to certain employees. The cost of these benefits and the present value of the obligation depend on a number of factors, including; life expectancy, salary increases, asset valuations and the discount rate on corporate bonds. Management estimates these factors in determining the net retirement benefit obligation in the Statement of Financial Position. The assumptions reflect historical experience and current trends. See Note 10 for the disclosures relating to the retirement benefit scheme.

Provisions
The Group makes provisions for legal and constructive obligations, which it knows to be outstanding at the year-end date. These provisions are generally made based on historical or other pertinent information, adjusted for recent trends where relevant. However, they are estimates of the financial costs of events that may not occur for some years. As a result of this and the level of uncertainty attaching to the financial outcomes, the actual outcome may differ significantly from that estimated.

NOTES TO THE FINANCIAL STATEMENTS

4. Oireachtas grants

	Subhead	2020 €'000	2019 €'000
Vote 30: Agriculture, Food and the Marine Grant-in-aid for general expenses	C.5	133,920	124,220
Grant for human resource purposes	C.5	10,500	10,500
Grant for Johnstown Castle development	C.11	-	1,020
Agricultural sustainability support and advisory programme	B.3	-	130
Food research and agriculture research	C.3	1,861	2,279
Stimulus collaborative research programme	C.3	2,045	2,519
Agricultural catchments programme	B.3	2,400	1,630
GLAS scheme	B.3	-	19
Knowledge transfer programme	B.7	469	3,269
National Prepared Consumer Foods centre	C.4	1,484	4,001
National carbon observatory	C.10	29	-
Grant for forestry publicity and awareness and training	B.10	670	670
Grant for forestry education	B.10	12	26
Single pension scheme members' contributions		(866)	(689)
		152,524	149,594

A grant without any performance criteria is recognised in income when the grant proceeds are received. Oireachtas grants received which impose specified future performance conditions are recognised in income when those conditions have been met. Oireachtas grants, received before income recognition is satisfied, are recorded as separate liabilities in the Statement of Financial Position. At year end, Teagasc had unfilled conditions included in the Statement of Financial Position as liabilities with respect to the following:

	Note	2020 €'000	2019 €'000
Food research and agriculture research	21	1,865	1,671
Stimulus collaborative research programme	21	2,359	2,698
National Prepared Consumer Foods centre	21	1,018	2,503
		5,242	6,872

5. EU funding

	2020 €'000	2019 €'000
Farm Survey Income	144	152
INTERREG	322	253
Marie Curie	309	456
Framework Programme VII	-	241
Horizon 2020	2,701	2,271
Other EU Income	168	67
	3,644	3,440

Horizon 2020 is the main financial tool through which the European Union supports research and development activities covering almost all scientific disciplines. This started in 2015 and ran to the end of 2020.

NOTES TO THE FINANCIAL STATEMENTS

5. EU funding (continued)

A grant without any performance criteria is recognised in income when the grant proceeds are received. EU grants received which impose specified future performance conditions are recognised in income when those conditions have been met. EU grants, received before income recognition is satisfied, are recorded as separate liabilities in the Statement of Financial Position. At year end, Teagasc had unfilled conditions included in the Statement of Financial Position as liabilities with respect to the following:

	Note	2020 €'000	2019 €'000
Horizon 2020		7,261	9,322
Marie Curie		487	881
Other EU Income		433	1,735
	21	8,181	11,938

6. Operational income

	Operations €'000	Knowledge Transfer €'000	Research €'000	2020 €'000	2019 €'000
Advisory service fees	-	10,961	82	11,043	10,331
Course fee income	-	3,619	175	3,794	4,289
Other fees	11	1,509	13,689	15,209	16,614
Other farming operations	-	994	2,322	3,316	3,065
Publications and miscellaneous	17	124	384	525	385
	28	17,207	16,652	33,887	34,684

A grant without any performance criteria is recognised in income when the grant proceeds are received. State agency grants received which impose specified future performance conditions are recognised in income when those conditions have been met. State agency grants, received before income recognition is satisfied, are recorded as separate liabilities in the Statement of Financial Position. At year end, Teagasc had unfilled conditions included in the Statement of Financial Position as liabilities with respect to the following:

	Note	2020 €'000	2019 €'000
Science Foundation Ireland	21	6,339	4,358
Enterprise Ireland	21	3,733	3,000
		10,072	7,358

NOTES TO THE FINANCIAL STATEMENTS

7. Expenditure

	Operations	Knowledge Transfer	Research	2020	2019
	€'000	€'000	€'000	€'000	€'000
Pay (Note 9)	6,841	33,865	40,978	81,684	78,404
Travelling and subsistence	132	1,000	883	2,015	5,642
General operating expenses (Note 8)	10,171	9,242	21,360	40,773	41,725
Financial charges	308	309	14	631	369
Depreciation (Note 12)	230	1,442	6,620	8,292	7,896
Impairment loss (Note 12)	-	-	60	60	-
Grants to private colleges (Note 28)	-	2,868	-	2,868	2,759
Student grants	-	454	6	460	565
Cost of livestock purchases	-	7	483	490	622
Cost of research and development services	-	-	128	128	141
Walsh scholarship grants	-	614	5,020	5,634	6,135
Other grants	335	4	765	1,104	615
Capital contribution to Moorepark Technology Ltd	-	-	-	-	3,840
	18,017	49,805	76,317	144,139	148,713
Staff training				400	652
Retirement benefits (Note 10)				34,850	36,319
				179,389	185,684

In 2020 148 (2019: 150) staff received overtime payments. The highest aggregate amount paid to an individual was €17,722 (2019: €19,345).

NOTES TO THE FINANCIAL STATEMENTS

8. Analysis of general operating expenses

	Operations	Knowledge Transfer	Research	2020	2019
	€'000	€'000	€'000	€'000	€'000
Farming supplies/ services	-	993	4,451	5,444	4,991
Maintenance/ repairs	2,645	2,679	4,709	10,033	8,888
Rents/ rates/ insurances	1,092	450	966	2,508	2,404
Postage/ telephones	593	961	245	1,799	1,859
Power/ fuel/ petrol	116	629	1,706	2,451	2,456
Laboratory supplies	-	-	3,762	3,762	4,070
Printing/ stationery/ publicity	578	887	637	2,102	2,825
Seminar/ classroom/ library supplies	22	985	745	1,752	2,638
Services of external agencies	871	861	624	2,356	3,347
Student and staff canteen supplies	40	217	225	482	785
Audit fee	70	-	14	84	80
ICT supplies/ services	3,851	104	543	4,498	4,956
Legal/ professional fees*	254	244	623	1,121	1,274
Miscellaneous programme costs	5	215	2,077	2,297	1,056
Special events and miscellaneous	34	17	33	84	96
	10,171	9,242	21,360	40,773	41,725

*It was deemed more appropriate to reclassify software licence fees in relation to a number of suppliers from 'Legal/ professional fees' to 'ICT supplies/ services'. The 2019 comparatives have been adjusted accordingly.

9. Staff

The average number of staff employed by the Teagasc during the year was as follows:

	2020	2019
Professional	793	769
Technical	157	154
Administrative/ clerical	233	223
Farm/ domestic	107	112
	1,290	1,258

Additional superannuation contributions of €2,610,218 (2019: €2,822,560) were deducted from salaries and paid to the Department of Agriculture, Food and the Marine. Effective from 1 January 2019, members of public service defined benefit pension schemes pay an additional superannuation contribution (ASC) arising from the Public Service Stability Agreement (2018 - 2020) and the Public Service Pay and Pensions Act 2017.

NOTES TO THE FINANCIAL STATEMENTS

9. Staff (continued)

Employee short-term benefits breakdown

Employees' short-term benefits in excess of €60,000 are categorised into the following bands:

	Teagasc
Employee benefits	**Number of employees**
€60,000 to €69,999	179
€70,000 to €79,999	146
€80,000 to €89,999	46
€90,000 to €99,999	31
€100,000 to €109,999	35
€110,000 to €119,999	22
€120,000 to €129,999	5
€130,000 to €139,999	-
€140,000 to €149,999	-
€150,000 to €159,999	-
€160,000 to €169,999	4

Note: For the purposes of this disclosure, short-term employee benefits in relation to services rendered during the reporting period include salary, overtime, allowances and other payments made on behalf of the employee, but exclude employer's PRSI.

Aggregate employee benefits

	2020	2019
	€'000	€'000
Staff short-term benefits	74,120	71,260
Termination benefits	-	5
Retirement benefit costs	34,850	36,319
Employer's contribution to social welfare	6,770	6,307
	115,740	113,891

The total number of staff employed (WTE) at year end was 1,313 (2019: 1,270). There were no termination benefits in 2020 (2019: 1).

Staff short-term benefits

	2020	2019
	€'000	€'000
Basic pay	71,313	68,457
Overtime	999	1,016
Allowances	1,808	1,787
	74,120	71,260

Termination benefits

	2020	2019
	€'000	€'000
Termination benefits charged to income and expenditure	-	5
	-	5

NOTES TO THE FINANCIAL STATEMENTS

9. Staff (continued)

Key management personnel

Key management personnel in Teagasc consist of the members of the Authority, the Director and three divisional directors reporting to the Director. The total value of employee benefits for key management personnel is set out below:

	2020	2019
	€'000	€'000
Salaries and other short term benefits:		
Key management remuneration	744	719
	744	719

This does not include the value of retirement benefits earned in the period. The key management personnel, except for those on the Authority, are members of the Teagasc pension scheme and their entitlements in that regard do not extend beyond the terms of the model public defined benefit superannuation scheme.

Director's salary and benefits

The Director's remuneration for the financial period was as follows:

	2020	2019
	€'000	€'000
Basic pay	167	163
	167	163

The Director is a member of the Teagasc pension scheme and his entitlements in that regard do not extend beyond the model public sector defined benefit superannuation scheme. The value of retirement benefits earned in the period is not included above.

10. Retirement benefit plans

Section 9 of the Agriculture (Research, Training and Advice) Act, 1988 provides for the establishment of schemes for the granting of retirement benefits in respect of staff appointed by Teagasc and staff transferred to Teagasc from An Chomhairle Oiliuna Talmhaíochta and from An Foras Talúntais.

Pending the approval of draft pension schemes by the Minister for Agriculture, Food and the Marine, the Minister for Finance and the Oireachtas, Teagasc operates pension schemes on an administrative basis. At 31 December 2020 this approval remained outstanding.

Teagasc also administers two pension schemes (the Agricultural Colleges Staff Pension Scheme 1985 and the Agricultural Colleges Spouses' and Children's Contributory Pension Scheme 1985) in respect of certain staff employed by privately owned Colleges of Agriculture and Horticulture, the cost of whose salaries is borne by the Exchequer through the agency of Teagasc.

The above schemes are defined benefit pension schemes. No separate fund is maintained, and no assets are held, to finance the payment of retirement benefits and gratuities. The actuarial estimate of future liabilities accruing in regard to future benefits is shown on the Statement of Financial Position.

The average number of monthly retirement benefits paid during the year was 1,753 (2019: 1,741).

NOTES TO THE FINANCIAL STATEMENTS

10. Retirement benefit plans (continued)

i. Analysis of total retirement benefit costs charged to income and expenditure account

	2020	2019
	€'000	€'000
Current service cost	25,977	19,608
Interest on scheme liabilities	12,781	20,271
Staff contributions	(3,908)	(3,560)
	34,850	36,319

ii. Movement in net retirement benefit liability during the financial year

	2020	2019
	€'000	€'000
Net retirement benefit liability at 01 January	1,299,840	1,149,519
Current service cost	25,977	19,608
Benefits paid	(47,322)	(46,300)
Interest on scheme liabilities	12,781	20,271
Actuarial loss	75,420	156,742
Net retirement benefit liability at 31 December	1,366,697	1,299,840

iii. Deferred funding asset for retirement benefits

Teagasc recognises as an asset an amount corresponding to the unfunded deferred liability for retirement benefits on the basis of the set of assumptions described below and a number of past events. These events include the statutory basis for the establishment of the pension schemes, and the policy and practice currently in place in relation to funding public service pensions including contributions by employees and the annual estimates process. While there is no formal agreement regarding these specific amounts with the Department of Agriculture, Food and the Marine, Teagasc has no evidence that this funding policy will not continue to meet such sums in accordance with current practice.

Net deferred funding for retirement benefits in the year

	2020	2019
	€'000	€'000
Funding recoverable in respect of current years retirement benefits	38,758	39,879
Resources applied to pay retirement benefits	(47,322)	(46,300)
	(8,564)	(6,421)

The deferred funding asset for retirement benefits as at 31 December 2020 was €1,367m (2019: €1,300m).

NOTES TO THE FINANCIAL STATEMENTS

10. Retirement benefit plans (continued)

iv. History of defined benefit obligations

	2020 €'000	2019 €'000	2018 €'000	2017 €'000
Experience (loss)/ gain	(59,697)	(18,834)	70,948	(80,343)
Percentage of present value of scheme liabilities	4.4%	1.4%	6.2%	6.2%
Changes in assumptions	(15,723)	(137,908)	65,728	20,602
Percentage of present value of scheme liabilities	1.2%	10.6%	5.7%	1.6%
Actuarial (loss)/ gain recognised in other comprehensive income	(75,420)	(156,742)	136,676	(59,741)

The cumulative actuarial loss recognised in the Statement of Comprehensive Income amounts to €256.071m (2019: €180.651m).

v. General description of the scheme

The pension schemes are defined benefit final salary pension arrangements with benefits and contributions defined by reference to current "model" public sector scheme regulations. The schemes provide a retirement benefit (one eightieth per year of service), a gratuity lump sum (three eightieths per year of service) and spouse's and children's retirement benefits. Retirement age for pre 01 April 2004 members will be compulsory on reaching age 70. These members also have an entitlement to retire without actuarial reduction from age 60. Public servants appointed on or after 01 April 2004 to the 01 January 2013 have a minimum retirement age of 65. Retirement benefits in payment (and deferment) normally increase or decrease in line with general public sector salary inflation.

Teagasc operates the Single Public Service Retirement Benefits Scheme (Single Scheme) which is the defined benefit scheme for pensionable public servants appointed on or after 01 January 2013. The scheme is based on a career averaging model, retirement for those entrants will be compulsory on reaching age 70.

The valuation used for disclosures has been based on an actuarial valuation by a qualified independent actuary on 12 January 2021 in order to assess the scheme liabilities at 31 December 2020.

The principal actuarial assumptions used to calculate liabilities are as follows:

	2020 % per annum	2019 % per annum
Inflation rate	1.30	1.40
Salary rate	2.80	2.90
State pension	2.80	2.90
Pension rate – Main Scheme	2.05	2.15
Pension rate – Single Scheme	1.30	1.40
Scheme liabilities discount rate	0.85	1.00

NOTES TO THE FINANCIAL STATEMENTS

10. Retirement benefit plans (continued)

The mortality basis adopted allows for improvements in life expectancy over time, so that life expectancy at retirement will depend on the year in which a member attains retirement age (age 65). The table below shows the life expectancy for members attaining age 65 in 2020 and 2040.

Year of attaining 65	**2020**	**2040**
Life expectancy - males	86.5	88.0
Life expectancy - females	89.0	90.5

On the basis of these and other assumptions and applying the projected unit method the present value of pension scheme liabilities is as follows:

	2020	**2019**
	€'000	**€'000**
Total accrued retirement benefit liability	1,366,697	1,299,840

11. Tax on profit on ordinary activities

	2020	**2019**
	€'000	**€'000**
Based on results for the year:		
Current tax charge	-	9
Deferred tax (Note 22)	(56)	-
	(56)	9
Provision in respect of prior years:		
Corporation tax	(9)	-
	(65)	9

The tax charge for the year is lower than the charge that would result from applying the standard rate of Irish corporation tax to the profit on ordinary activities. The differences are explained as follows:

	2020	**2019**
	€'000	**€'000**
Profit/ (loss) on ordinary activities before taxation	2,626	(76)
Profit/ (loss) on ordinary activities multiplied by Standard rate of corporation tax in Ireland -12.5%	328	(10)
Effects of:		
Excess of capital allowances over depreciation	(22)	(27)
Higher tax rate on profits	4	4
Unutilised trading losses	85	27
Parent (profit)/ loss on ordinary activities multiplied by 12.5%	(395)	15
Current tax charge for the year	-	9

The tax charge arises in the operations of the subsidiary Moorepark Technology Limited.

NOTES TO THE FINANCIAL STATEMENTS

12. Property, plant and equipment

GROUP

	Land	Buildings	Assets under construction	Plant and equipment	Total
	€'000	€'000	€'000	€'000	€'000
Cost or valuation					
At 1 January 2019	6,117	142,080	8,941	88,894	246,032
Additions	10	7,905	1,984	8,410	18,309
Buildings completed	-	6,935	(6,935)	-	-
Disposals	-	(33)	-	(830)	(863)
Reclassification	-	-	-	-	-
At 31 December 2019	6,127	156,887	3,990	96,474	263,478
Additions	11	1,770	8,730	5,156	15,667
Buildings completed	-	-	-	-	-
Disposals	(1)	(73)	-	(1,138)	(1,212)
Reclassification	-	22	-	(22)	-
At 31 December 2020	6,137	158,607	12,720	100,470	277,933
Accumulated depreciation and impairment losses					
At 1 January 2019	-	63,450	-	71,716	135,166
Charge for year	-	3,829	-	4,067	7,896
Disposals	-	(23)	-	(772)	(795)
At 31 December 2019	-	67,256	-	75,011	142,267
Charge for year	-	3,980	-	4,312	8,292
Impairment loss	-	-	60	-	60
Disposals	-	(30)	-	(1,108)	(1,138)
At 31 December 2020	-	71,206	60	78,215	149,480
Carrying value					
At 31 December 2020	6,137	87,401	12,660	22,255	128,453
At 31 December 2019	6,127	89,631	3,990	21,463	121,211

NOTES TO THE FINANCIAL STATEMENTS

12. Property, plant and equipment (continued)

TEAGASC

	Land	Buildings	Assets under construction	Plant and equipment	Total
	€'000	€'000	€'000	€'000	€'000
Cost or valuation					
At 1 January 2019	6,117	134,276	7,246	83,092	230,731
Additions	10	4,468	834	7,824	13,136
Buildings completed	-	5,662	(5,662)	-	-
Disposals	-	(18)	-	(780)	(798)
At 31 December 2019	6,127	144,388	2,418	90,136	243,069
Additions	11	1,705	8,629	4,906	15,251
Buildings completed	-	-	-	-	-
Disposals	(1)	-	-	(971)	(972)
Reclassification	-	22	-	(22)	-
At 31 December 2020	6,137	146,115	11,047	94,049	257,348
Accumulated depreciation and impairment losses					
At 1 January 2019	-	60,355	-	67,395	127,750
Charge for year	-	3,490	-	3,812	7,302
Disposals	-	(16)	-	(735)	(751)
At 31 December 2019	-	63,829	-	70,472	134,301
Charge for year	-	3,564	-	4,030	7,594
Impairment loss	-	-	60	-	60
Disposals	-	-	-	(942)	(942)
At 31 December 2020	-	67,393	60	73,560	141,013
Carrying value					
At 31 December 2020	6,137	78,722	10,987	20,489	116,335
At 31 December 2019	6,127	80,559	2,418	19,664	108,768

Certain fixed assets entrusted to Teagasc are protected by statute, and may not be sold.

Teagasc has a total of 55 offices/ centres of which 50 are owned by Teagasc and the remaining 5 are under rental agreements. One of the rental agreements expires in less than one year, three between two and five years and the remaining agreement is a long term lease with an end date of greater than five years.

An impairment loss is incurred on an item of plant which is no longer required. Disposal of the plant is expected to realise less than the carrying value.

NOTES TO THE FINANCIAL STATEMENTS

12. Property, plant and equipment (continued)

Disposal of property, plant and equipment

	Proceeds/ costs 2020 €'000	Proceeds/ costs 2019 €'000
Proceeds from sale of property:		
Property sales during year	8	142
Cost of sales	-	(18)
	8	124
Proceeds from sale of other assets	42	106
	50	230
Net book value of fixed assets disposed:		
Property assets	(43)	(10)
Other assets	(29)	(58)
	(72)	(68)
(Loss)/ gain on disposal of fixed assets	(22)	162

There was no transfer of asset sales proceeds to the exchequer in 2020.

13. Heritage assets

Group and Teagasc

Period houses in Kildalton College, Ballyhaise College and Oak Park Research Centre are part of the working infrastructure of Teagasc, and are as such capitalised on the Statement of Financial Position at original cost.

Certain heritage assets at Johnstown Castle Research Centre, including the castle, Agricultural Museum and walled garden were not originally recognised in the Statement of Financial Position as information on the cost or value of these heritage assets could not be obtained at a cost which was commensurate with the benefits to users of the financial statements. These assets were subsequently developed as a tourist and heritage attraction. The development project involved renovation of the castle and construction of a visitor centre which became operational in 2019. The centre is managed and operated by Irish Heritage Trust. All construction costs have been capitalised and are depreciated in line with Teagasc's property, plant and equipment accounting policy.

NOTES TO THE FINANCIAL STATEMENTS

14. Investments

	Group		Teagasc	
	2020	2019	2020	2019
	€'000	€'000	€'000	€'000
Investment in quoted shares	354	346	354	346
Investment in unquoted shares	244	270	245	271
	598	616	599	617

Investments in quoted shares	Group		Teagasc	
	2020	2019	2020	2019
	€'000	€'000	€'000	€'000
Fair value at 1 January	346	506	346	506
Gain/ (loss) on fair value movement in the year	8	(160)	8	(160)
Fair value at 31 December	354	346	354	346

Investments in unquoted shares	Group		Teagasc	
	2020	2019	2020	2019
Value at acquisition date	€'000	€'000	€'000	€'000
At 1 January	270	213	271	214
Additions	-	70	-	70
Share redemption	-	(24)	-	(24)
Revolving fund reduction	(15)	-	(15)	-
(Loss)/ gain on fair value movement in the year	(11)	11	(11)	11
At 31 December	244	270	245	271

Net book value	Group		Teagasc	
	2020	2019	2020	2019
	€'000	€'000	€'000	€'000
At 1 January	270	213	271	214
Movement in unquoted shares	(26)	57	(26)	57
At 31 December	244	270	245	271

NOTES TO THE FINANCIAL STATEMENTS

14. Investments (continued)

Analysed as:	Group		Teagasc	
	2020	**2019**	**2020**	**2019**
	€'000	**€'000**	**€'000**	**€'000**
Glanbia plc	292	288	292	288
Kerry Group plc	62	58	62	58
Moorepark Technology Limited	-	-	1	1
Wexford Milk Producers Limited	1	1	1	1
Lakeland Dairies	10	10	10	10
Aurivo	2	2	2	2
Glanbia Co-Op Ltd	14	14	14	14
Carbery Creameries Ltd	81	82	81	82
Barryroe Creameries Ltd	3	3	3	3
Dairygold Co-Op Society Ltd	69	71	69	71
Dairygold Co-Op Society (Revolving fund)	64	87	64	87
	598	616	599	617

Details of investments:

Company name	Country of incorporation	Registered number	Number of shares	Nominal value per share at 31.12.2020	Dividend received	Nature of business of company
Glanbia plc	Ireland	129933	28,119	€10.38	2020 - €3,863 2019 - €13,882	Global nutrition company
Kerry Group plc	Ireland	111471	522	€118.50	2020 - €423 2019 - €304	Provider of taste and nutrition technologies
Moorepark Technology Ltd	Ireland	168270	5,102	€0.13	2020 - €nil 2019 - €nil	Provision of services for R&D
Wexford Milk Producers Ltd	Ireland	2640R	767	€1.00	2020 - €nil 2019 - €nil	Milk production and supply
Lakeland Dairies Co-Operative Society Ltd	Ireland	4622R	208,742	€0.05	2020 - €104 2019 - €nil	Milk production and supply
Aurivo Co-Operative Society Ltd	Ireland	5113R	1,715	€1.00	2020 - €34 2019 - €34	Milk production and supply
Glanbia Co-Operative Ltd	Ireland	4928R	13,742	€1.00	2020 - €1,917 2019 - €1,009	Milk production and supply
Kerry Co-Operative Ltd	Ireland	3618R	87	€1.25	2020 - €331 2019 - €309	Milk production and supply
Carbery Creameries Ltd	Ireland	2899R	19,605	€3.99	2020 - €nil 2019 - €nil	Milk production and supply
Carbery Creameries Ltd	Ireland	2899R	2,695	€1.00	2020 - €nil 2019 - €nil	Milk production and supply
Barryroe Co-Operative Ltd	Ireland	1736R	3,133	€1.00	2020 - €nil 2019 - €nil	Milk production and supply
Dairygold Co-Operative Society Ltd	Ireland	4621R	69,271	€1.00	2020 - €nil 2019 - €nil	Milk production and supply

NOTES TO THE FINANCIAL STATEMENTS

14. Investments (continued)

Teagasc has invested €650 in Moorepark Technology Limited and has a 57% holding in the paid up share capital of the company.

The percentage shareholding in all of the other organisations listed is negligible and does not give Teagasc a controlling interest.

15. Inventories

	2020	2019
	€'000	€'000
Livestock	4,775	4,590
Farm produce, fertilisers and feeding stocks	713	756
General supplies	161	196
	5,649	5,542

Stocks are stated after provision for impairment of €nil (2019: €nil).

Reconciliation of movements in livestock:

	2020	2019
	€'000	€'000
Balance at start of year	4,590	4,523
Purchases	490	622
Sales	(2,957)	(2,656)
Births	1,231	1,136
Deaths	(159)	(114)
Fair value adjustments	1,580	1,079
Balance at end of year	4,775	4,590

16. Assets held for sale

At 31 December, included in the carrying value of assets are the following assets held for sale:

	Note	Carrying value at 31 December 2020	Carrying value at 31 December 2019
		€'000	€'000
Kinsealy East, Co. Dublin	12	374	447
		374	447

NOTES TO THE FINANCIAL STATEMENTS

17. Receivables

	Group		Teagasc	
	2020	2019	2020	2019
	€'000	€'000	€'000	€'000
Trade receivables	9,877	12,742	9,516	12,240
Other receivables	195	195	165	180
Accrued operational income	8,494	7,149	8,494	7,149
Accrued Oireachtas grant income	4,217	5,311	4,217	5,311
Prepayments	1,824	1,745	1,802	1,725
VAT and other taxes	17	-	-	-
	24,624	27,142	24,194	26,605

All amounts included above fall due within one year.

Trade receivables are stated after provision for impairment of €190,559 (2019: €206,904).

18. Cash and cash equivalents

	Group		Teagasc	
	2020	2019	2020	2019
	€'000	€'000	€'000	€'000
Cash at bank and in hand	27,842	19,730	24,942	16,627
Short-term deposits	15,500	15,500	15,500	15,500
	43,342	35,230	40,442	32,127

NOTES TO THE FINANCIAL STATEMENTS

19. Payables – amounts falling due within one year

	Group		Teagasc	
	2020	2019	2020	2019
	€'000	€'000	€'000	€'000
Trade payables	645	736	566	812
Other payables and accruals	13,554	15,902	12,603	14,766
Legal provisions	212	194	212	194
PAYE/ PRSI	2,717	2,492	2,692	2,471
Value added tax	1,546	726	1,528	713
Corporation tax	-	1	-	-
Withholding tax/ RCT	197	144	197	141
Other payroll deductions	3,373	1,454	3,373	1,454
	22,244	21,649	21,171	20,551
Payables for taxation and social welfare included above	4,459	3,363	4,418	3,325

Included in Teagasc's other payables and accruals of €12.603m are: repairs and maintenance costs €3.24m, wages, salaries and other payroll related costs €2.57m (including an annual leave accrual of €1.95m), equipment and capital items €1.75m, professional fees including legal and analytical services €1.40m, ICT costs €0.89m, general operating costs including utilities €0.86m, farm running costs €0.62m, other accruals €0.43m, public relations and advertising €0.33m, grants/ seminars €0.23m and travel and subsistence €0.11m.

The payment of trade payables varies between on demand and thirty days. Prompt payment interest and compensation of €49,668 was payable on trade payables in 2020 (2019: €48,143).

PAYE/ PRSI, value added tax and withholding tax are subject to terms of relevant legislation. Interest accrues on late payment of taxes in line with the terms of relevant legislation. The VAT figure above includes a provision of €1,011,585, including interest of €141,785, in respect of a technical VAT adjustment and VAT reclaimed on a capital project. Discussions are ongoing with the Revenue Commissioners with a view to resolving this issue.

Other amounts included with payables not covered by specific note disclosures are unsecured, interest free and repayable on demand.

20. Payables – amounts falling due after more than one year

	Group		Teagasc	
	2020	2019	2020	2019
	€'000	€'000	€'000	€'000
Other payables and accruals	406	375	-	-
	406	375	-	-

NOTES TO THE FINANCIAL STATEMENTS

21. Deferred income

Teagasc carries out public funded research in collaboration with partner research performing organisations in accordance with contracts with other State Institutions, principally the Department of Agriculture, Food and the Marine. Grants in respect of such research are taken into account as income when the corresponding expenditure has been incurred under each contract. Teagasc makes payments to partners when advance grant income received by Teagasc is due to collaborating partner research organisations. Those advances are deferred until payments are made to the partner organisations. At 31 December 2020 the source and amount of deferred income in respect of research and other projects was as follows:

Grant/ other deferrals	Government Funding Department	Note	Opening Deferred	Cash Received	Taken to income	Payment to Partners	Deferred within 1 year	Deferred > 1 year
			€'000	€'000	€'000	€'000	€'000	€'000
Agricultural Catchments Programme	Dept of Agriculture, Food and the Marine		-	2,400	2,400	-	-	-
Bord Iascaigh Mhara	Dept of Agriculture, Food and the Marine		115	7	80	42	-	-
Coford	Dept of Agriculture, Food and the Marine		384	38	209	-	196	17
Era Net	Dept of Agriculture, Food and the Marine		133	162	116	-	118	61
European Innovation Partnership	Dept of Agriculture, Food and the Marine		-	160	160	-	-	-
FIRM	Dept of Agriculture, Food and the Marine	4	1,671	2,180	1,986	-	1,335	530
Marine Institute	Dept of Agriculture, Food and the Marine		-	22	2	-	16	4
National Carbon Observatory	Dept of Agriculture, Food and the Marine		-	2,032	-	-	2,032	-
National Prepared Consumer Foods Centre	Dept of Agriculture, Food and the Marine	4	2,502	-	1,485	-	663	355
Stimulus	Dept of Agriculture, Food and the Marine	4	2,698	2,685	3,025	-	1,580	778
US Ireland	Dept of Agriculture, Food and the Marine		105	-	75	-	30	-
Sub total			7,608	9,686	9,538	42	5,970	1,745

NOTES TO THE FINANCIAL STATEMENTS

21. Deferred income (continued)

Grant/ other deferrals	Government Funding Department	Note	Opening Deferred	Cash Received	Taken to income	Payment to Partners	Deferred within 1 year	Deferred > 1 year
			€'000	€'000	€'000	€'000	€'000	€'000
Sub total			7,608	9,686	9,538	42	5,970	1,745
Enterprise Ireland	Dept of Enterprise, Trade and Employment	6	3,000	4,988	3,911	343	2,447	1,287
Science Foundation Ireland	Dept of Enterprise, Trade and Employment	6	4,358	10,496	4,435	4,080	2,432	3,907
Environmental Protection Agency	Dept of Environment, Climate and Communications		495	151	235	58	334	19
Health & Safety Authority	Dept of Enterprise, Trade and Employment		-	21	-	-	21	-
Irish Aid	Dept of Foreign Affairs		57	576	76	412	136	9
Safefood	Dept of Health		10	142	117	-	35	-
Sustainable Energy Authority of Ireland	Dept of Environment, Climate and Communications		168	11	11	-	67	101
European Union		5	11,938	6,596	3,782	6,571	3,588	4,593
General research and other deferrals			792	2,668	281	66	2,625	488
Course and accommodation fees			1,700	2,445	1,726	-	2,238	181
Amounts received in advance for work associated with the completion of sale of land at Athenry			510	-	-	-	510	-
Group total			30,636	37,780	24,112	11,572	20,403	12,330
Teagasc			30,377	37,780	24,004	11,572	20,357	12,224

NOTES TO THE FINANCIAL STATEMENTS

22. Provision for liabilities

Deferred tax	Group		Teagasc	
	2020	2019	2020	2019
	€'000	€'000	€'000	€'000
At beginning of year	120	119	-	-
Charged to income and expenditure account	(57)	1	-	-
At end of year	63	120	-	-

Components of deferred taxation	Group		Teagasc	
	2020	2019	2020	2019
	€'000	€'000	€'000	€'000
Unutilised trading losses	(112)	(35)	-	-
Accelerated capital allowance	175	155	-	-
	63	120	-	-

23. Capital Account

The balance on this account of €116.335m (2019: €108.768m) represents the unamortised value of funds used to purchase property, plant and equipment, increasing by €7.567m in 2020 (2019: €5.787m).

24. Revenue reserves

The revenue reserves represent cumulative comprehensive income recognised as at reporting date.

25. Non-controlling interest

The non-controlling interest comprises the other shareholders' equity investment together with their capital contribution to expand facilities in Moorepark Technology Limited.

26. Leases

Operating leases
At 31 December Teagasc had future minimum lease payments under non-cancellable operating leases as follows:

	Group		Teagasc	
	2020	2019	2020	2019
	€'000	€'000	€'000	€'000
Leases which expire:				
Within one year	703	672	703	672
Between two and five years	1,013	1,119	1,013	1,119
After five years	1,022	940	1,022	940
	2,738	2,731	2,738	2,731

NOTES TO THE FINANCIAL STATEMENTS

27. Reconciliation of surplus to cash flow from operating activities

	2020	2019
	€'000	€'000
Surplus/ (deficit) for the year before taxation	2,627	(76)
Depreciation expense	8,292	7,896
Impairment loss	60	-
Fair value adjustments on biological assets	(1,580)	(1,168)
Fair value adjustments on investments	18	149
Loss/ (gain) on disposal of tangible fixed assets	22	(162)
Interest paid	88	91
Interest income	(2)	(16)
Transfer to capital account	7,567	5,787
Total operating cash flows before movements in working capital	17,092	12,501
Decrease in inventory	1,474	891
Decrease in receivables	2,518	468
Increase in payables	2,723	7,205
Cash flow from operating activities	23,807	21,065

28. Private colleges

Teagasc provides support to three private colleges, Gurteen Agricultural College, Mountbellew Agricultural College and Salesian Agricultural College Pallaskenry, as follows:

	2020	2019
	€'000	€'000
Grants to private colleges	2,868	2,759
Salary costs of staff seconded to private colleges (included in the total pay expenditure in Note 7 above)	407	434
External service provider costs for teaching services provided to private colleges (included in the general operating expenditure in Note 8 above)	162	131
	3,437	3,324

In addition to grants outlined above Teagasc provided workbooks to private colleges to the value of €59,750 (2019: €60,300). Income of €287,271 (2019: €317,038) was received from private colleges for course resources provided by Teagasc and the agreed share of Rural Development Programme course learner fees.

29. Commitments

Capital commitments
Teagasc had capital commitments outstanding at 31 December 2020 amounting to €3.204m which relate to construction of buildings and facilities at Moorepark €1.909m, Kildalton College €0.883m, Mallow/ Midleton Offices €0.146m, Johnstown Castle €0.138m and Ashtown €0.128m (2019: €7.700m).

Grant commitments
Teagasc had grant commitments outstanding at 31 December 2020 amounting to €10.251m which relate to Walsh Scholars €6.061m, Private College Grants €3.110m and Other Grants €1.080m (2019: €10.226m).

NOTES TO THE FINANCIAL STATEMENTS

30. Authority members – disclosure of transactions

The Authority has adopted procedures in accordance with the guidelines issued in 2016 by the Department of Public Expenditure and Reform in relation to the disclosure of interest by Authority members and the Authority has adhered to these procedures. There were no transactions in the year in relation to the Authority's activities in which the Authority members were involved.

31. Contingent liabilities

The Authority has made provision in the financial statements reflecting its best estimate of the liability arising. The Authority is of the view that there are no contingent liabilities.

32. Related party transactions

The following transactions were carried out with related parties:

Sales of goods and services:

	Group		Teagasc	
	2020	2019	2020	2019
	€'000	€'000	€'000	€'000
Subsidiary	-	-	12	18
	-	-	12	18

Purchases of goods and services:

	Group		Teagasc	
	2020	2019	2020	2019
	€'000	€'000	€'000	€'000
Subsidiary	-	-	824	630
	-	-	824	630

Payable to related parties:

	Group		Teagasc	
	2020	2019	2020	2019
	€'000	€'000	€'000	€'000
Subsidiary	20	129	20	129
	20	129	20	129

The receivables and payables arise mainly from sales and purchase transactions, respectively. The receivables and payables are unsecured in nature and bear no interest. No provisions are held against receivables from related parties during the year (2019: €nil).

Under the terms of the Moorepark Technology Promoter's Agreement, Teagasc has undertaken to provide from its own resources specified staff requirements to include the General Manager, the Company Secretary and one technician.

NOTES TO THE FINANCIAL STATEMENTS

33. Financial instruments

The Group and Teagasc have the following financial instruments:

	Group		Teagasc	
	2020	2019	2020	2019
	€'000	€'000	€'000	€'000
Financial assets that are equity instruments measured at fair value through consolidated statement of income and expenditure				
Listed non-current asset investments	354	346	354	346
Unlisted non-current asset investments	244	270	245	271
Financial assets				
Trade receivables	9,877	12,742	9,516	12,240
Other receivables	195	195	165	180
Cash in hand (including short-term deposits)	43,342	35,230	40,442	32,127
Financial liabilities measured at amortised cost				
Trade payables	645	736	566	812
Other payables	13,554	15,902	12,603	14,766

34. Events after the reporting period

The Authority has considered the impact of COVID-19 on the projected performance of Teagasc for 2021 and expects that management can meet the risks presented by this, accordingly no revision of the figures included in the financial statements for the year ended 31 December 2020 has been made. There have been no other events since the balance sheet date, which necessitate revision of the figures included in the financial statements, or inclusion of a note thereto.

35. Approval of the financial statements

The Authority approved the financial statements on 03 March 2021.