

Annual Report 2019 & Financial Statements





Introduction

The 2019 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.

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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.



CHAIRMAN'S STATEMENT



While this document reports on Teagasc activity and finances for the calendar year 2019, it is produced early in 2020 and for that reason it is relevant to comment on the impact of the COVID pandemic which has had such far reaching implications for the country and Teagasc. Currently in May 2020, Teagasc and the nation are largely in 'Lockdown' with comprehensive restrictions on the movement and activities of Teagasc staff. In spite of these restrictions Teagasc staff have shown flexibility and innovation to continue to serve clients and customers. Discussion Groups, for example, have been conducted via digital tools and platforms.

By May of each year, we would normally have official estimates from the Teagasc National Farm Survey on the outturn for agricultural incomes for the previous year. However, the COVID-19 emergency and related public health measures have had an impact on the data collection activity of the National Farm Survey and have delayed production of the results for 2019.

Therefore, the income estimates that are provided in this report represent an approximation (albeit a good one) and will be subject to some revision when the National Farm Survey is published later in the summer. Given the constraints outlined, our best estimates suggest that the average family farm income in 2019 increased by about 4%, to a little over €24,200. However, the average income on individual farm systems continues to vary greatly.

Average family farm income on Cattle Rearing farms increased to an estimated €9,600 in 2019, an increase of 15% on the 2018 figure, with a fall in production costs and additional support for the sector representing the main drivers. Cattle Other farms, which comprise a range of cattle production systems (e.g. cattle finishers)

experienced an income decrease, despite having lower input costs and higher direct payments. Average Cattle Other farm income in 2019 was about €14,000, a decrease of 4% on the 2018 figure.

In conclusion, 2019 was another particularly challenging year for Ireland's beef industry.

Dairy farms incurred the largest rise in incomes in 2019, with average dairy farm income reaching close to €68,000, representing an increase of 11% on the 2018 income. Concentrate feed use decreased substantially in 2019, due to a return to normal growing conditions following the drought of 2018.

Sheep farms also experienced an increase in income in 2019. Average Sheep farm income increased to about €14,600 an increase of 10% on the 2018 level.

While crop yields on tillage farms in 2019 rebounded from the low levels observed in 2018, there was a substantial reversal in cereal and straw prices, which completely eroded the benefit of improved yields. The average tillage farm income in 2019 is estimated to have been about €35,500, a decrease of 13% on the 2018 figure.

Highlights in 2019 included a €10 million investment in Moorepark Technology Limited (MTL) by Teagasc and industry stakeholders that will provide state-of-the-art pilot plant facilities for food companies to utilise. A further €10 million investment in the National Food Innovation Hub in Teagasc Moorepark has also commenced. Both of these initiatives will assist food companies to adapt to and meet the needs of an ever-changing consumer. Together with a similar investment in the National Prepared Consumer Food Centre at Teagasc Ashtown, Teagasc is enabling the food sector to be 'Brexit ready.'

The expanding dairy herd, coupled with improving reproductive performance, will require that a greater proportion of slaughtered cattle originate from dairy herds. The new Teagasc dairy-beef index (DBI) ranks beef bulls for use on dairy females based on their estimated genetic potential to produce high quality profitable cattle, with minimal impact on dairy cow performance. Traits included in the DBI relate to: 1) calving performance, 2) carcass traits, 3) feed intake, 4) docility, and 5) polledness. Research is on-going on the inclusion of additional traits such as calf health, meat quality and environmental traits.

In January 2019, Minister Andrew Doyle T.D. launched a new seven-year strategy for the development of the Irish organic food sector.

Teagasc has a lead role in the delivery of 24 actions in the strategy plan across the horticulture, cereals, dairy, meat and poultry sectors.

The Teagasc Marginal Abatement Cost Curve forms the basis of many of the actions in the Government's Climate Action Plan. A total of 14 cost-beneficial, cost-neutral and cost-effective mitigation measures were identified in the Teagasc MACC to reduce agricultural emissions (methane and nitrous oxide). These measures were estimated to reduce emissions by 1.85 Mt of carbon dioxide equivalents per year between 2021 and 2030. The largest contributors to the abatement are using protected urea, improving dairy EBI and using low emission slurry spreading.

Teagasc research has shown that the actions which improve production efficiency need not be in conflict with environmental progress. With a strong research base behind them, our highly educated Teagasc advisors are very well positioned to meet the challenges ahead.

The ASSAP programme which is a collaboration between Teagasc, The Department of Agriculture Food and the Marine as well as the Department of Housing, Planning and Local Government, together with dairy processors through Dairy Sustainability Ireland is demonstrating how advisors can influence and encourage farmers to protect the environment.

Looking forward to 2020, and beyond, I believe the new Signpost Farms Programme will further demonstrate how climate mitigation actions can be implemented in practical ways on Irish farms across a range of enterprise types, local soil and climatic conditions and different stages of business development.

I would like to offer my congratulations to Martina Donnelly on her appointment to the Teagasc Authority as the staff representative and thank Joe Larkin for his great service to the Authority in that role.

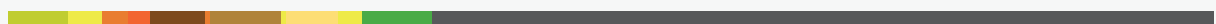
I would also like to congratulate Teagasc Director, Professor Gerry Boyle, who was conferred with a Degree of Doctor of Science by University college Cork in 2019. The citation states that 'Professor Boyle has overseen the integration of advisory, education and research functions in Teagasc, into a unique integrated model of research and knowledge transfer.'

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.

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 in 2019.



A new €10 million investment in Teagasc, Fermoy, Co. Cork was officially opened by the Minister for Agriculture, Food and the Marine, Michael Creed T.D. in December. John Hunter CEO of Moorepark Technology Limited (MTL) is pictured with Teagasc Director Professor Gerry Boyle and Teagasc Chairman Liam Herlihy.



REPORT OF THE DIRECTOR



A novel (new) coronavirus that has not previously been seen in humans was identified in December 2019. The disease that it causes, Coronavirus Disease 2019 (COVID-19), was not part of our vocabulary until the first months of 2020.

While the impact of COVID-19 on farming in the short term was more limited than for other key industries, the disease has had a huge impact on market demand for key products. The disease had a major disruptive effect on Teagasc activities in our offices, research centres and colleges but also by preventing interpersonal contact between Teagasc staff and their clients be they farmers, students, food industry colleagues etc.

The response of Teagasc staff to this challenge has been truly impressive. Very rapidly a suite of digital communication tools including webinars, farminars, virtual discussion groups, Lync and Zoom meetings was employed to continue service delivery under challenging circumstances. Thanks to excellent support by the Teagasc ICT department staff were able to work from home.

As the initial wave of COVID-19 abates, the implications for Teagasc in 2020 will be immense. The whole organisation has demonstrated a resolute determination to continue to serve our stakeholders which I believe will stand to us as we navigate the challenging period that lies ahead.

Over the period 2014 to 2019 Teagasc experienced an exceptional level of demand and enrolments across key education programmes. In 2014, total QQI certifications for Teagasc programmes stood at 2,165. In 2019, total certifications amounted to 4,078. This increase has been driven by a surge in demand for Teagasc adult Green Cert courses from those seeking a recognised trained farmer

qualification to meet young farmer focussed schemes under the national RDP programme.

The figures for our advisory services are also impressive. In 2019 our twelve advisory regions served just served under 42,000 clients with consultations, farm visits and scheme applications. A total of 11,300 of those clients participate in enterprise-based Discussion Groups: 424 drystock, 286 in dairying, and 37 for tillage. Advisory support is also provided in farm business management, succession and inheritance, diversification. Specialist colleagues deliver support in horticulture, forestry, pig and poultry production, equine husbandry and organic farming

Lowering greenhouse gas emissions, maintaining and improving water quality and protecting biodiversity are the three main environmental challenges facing Irish agriculture and Teagasc is well positioned to assist the sector in meeting these challenges. The new Agricultural Sustainability Support and Advisory Programme (ASSAP), with 20 dedicated advisors in Teagasc, complemented with a further 10 advisors in the dairy processors, has been rolled out.

In 2019 the VistaMilk SFI Research Centre and part funded by DAFM invested in the first systems in Ireland to measure methane production at grass. Methane, a potent greenhouse gas, is produced by micro-organisms in the gut of ruminants such as cattle and sheep. While the altering of farm management practices has considerable mitigation potential, there is also a significant potential at the level of the individual animal to improve both economic and environmental sustainability. According to Professor Donagh Berry of Teagasc who is Director of the centre, Ireland now possesses equipment to measure methane emissions on sheep, cattle and grazing dairy cows. The equipment can be used to evaluate breeding and management strategies to reduce animal-level methane emissions.

In terms of biodiversity, Teagasc has rolled out initiatives on its own farms in the research centres and colleges to create the opportunity for more diversity of plants, pollinators and wildlife. Lowering greenhouse gases and ammonia from agriculture will be particularly challenging and will require a concerted effort by all of our advisors, educators and researchers across the organisation to assist farmers and the agriculture sector to make the necessary changes.

Thousands of farmers attended the Teagasc Dairy Open Day, Moorepark 2019, in July. As part of a comprehensive array of dairy research and



A major scientific conference, ONE HEALTH - Awareness to Action, Antimicrobial and Anthelmintic Resistance Conference, took place to address this issue in November. The conference programme was launched by Michael Creed T.D., Minister for Agriculture, Food and the Marine. Pictured are: Professor Gerry Boyle, Geraldine Duffy, Teagasc (Chair) and Dearbháile Morris, National University of Ireland Galway.

advice at the event they heard how the Irish dairy industry has been transformed, with exports of Irish dairy products and ingredients increasing from an average of €1.84 billion from 2007 to 2009, to over €4 billion in 2018. Milk production in Ireland increased to 7.57 billion litres in 2018, and reached just under eight billion litres in 2019.

The challenge is to grow the business sustainably, Teagasc has produced guidelines for the dairy sector, identifying key actions that need to be undertaken to reduce the industry's environmental footprint and to ensure the highest standards in animal welfare.

The overall aim of the €11 million MASTER project is the development of concrete microbiome products, foods/feeds, services, or processes with high commercial potential which will benefit society through improving the quantity, quality and safety of food. This ambitious research project involves 31 leading European and international academic and industry teams with participants from 13 EU Member States, two Associated Countries and one international partner.

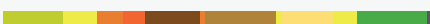
Anti-microbial resistance or AMR is one of the major current challenges facing the human population. It is estimated that by 2050, 10 million

people will die annually due to antimicrobial resistance unless major steps are immediately taken to reduce antimicrobial usage. A major scientific conference, ONE HEALTH - Awareness to Action, Antimicrobial and Anthelmintic Resistance Conference, took place to address this issue in November. Researchers at Teagasc Ashtown and elsewhere are applying social and behavioural sciences to antimicrobial resistance, specifically to help the move towards a more responsible use of antibiotics on farms.

Teagasc has a significant role in overseas assistance in developing countries in collaboration with Irish Aid. Teagasc dairy experts started work in 2019 with their Kenyan counterparts. Granted €1m in funding by the Irish Government via its Embassy in Kenya, an Irish-Kenyan consortium will begin a unique proof-of-concept project focusing on the roles of genetics and fodder in sustainable dairy farming.

The Agricultural Economics and Farm Surveys Department is currently working on a development project in Ethiopia in conjunction with University College Cork and supported by Irish Aid.

Teagasc economists with the support of a grant from Irish Aid are working with colleagues from



Vietnam's Institute for Policy and Strategy for Agriculture and Rural Development (IPSARD) on developing the capacity of Vietnamese researchers in the use quantitative models of agricultural commodity markets in the analysis of agricultural policy interventions.

In 2019 Teagasc granted possession of Johnstown Castle to the Irish Heritage Trust. Teagasc will still own the entire estate, with the castle and gardens being leased to the Irish Heritage Trust for 10 years who will operate the attraction. Funding for

the castle renovation and the other new facilities was provided by the Department of Agriculture, Food and the Marine and Fáilte Ireland.

I would like to thank Joe Larkin for his contribution over five years on the Authority and as Joint Chair of Partnership and best wishes to Martina Donnelly in her new role on the Teagasc Authority.

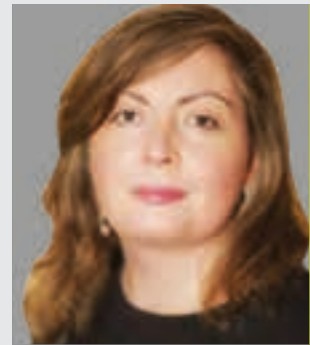
AUTHORITY MEMBERS



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



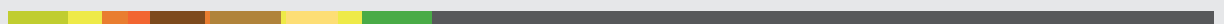
Ms. Cliona Murphy



Ms. Eilís O'Connell



Mr. Liam Woulfe



SENIOR MANAGEMENT



Professor Gerry Boyle
Director



Professor Frank O'Mara
Director of Research

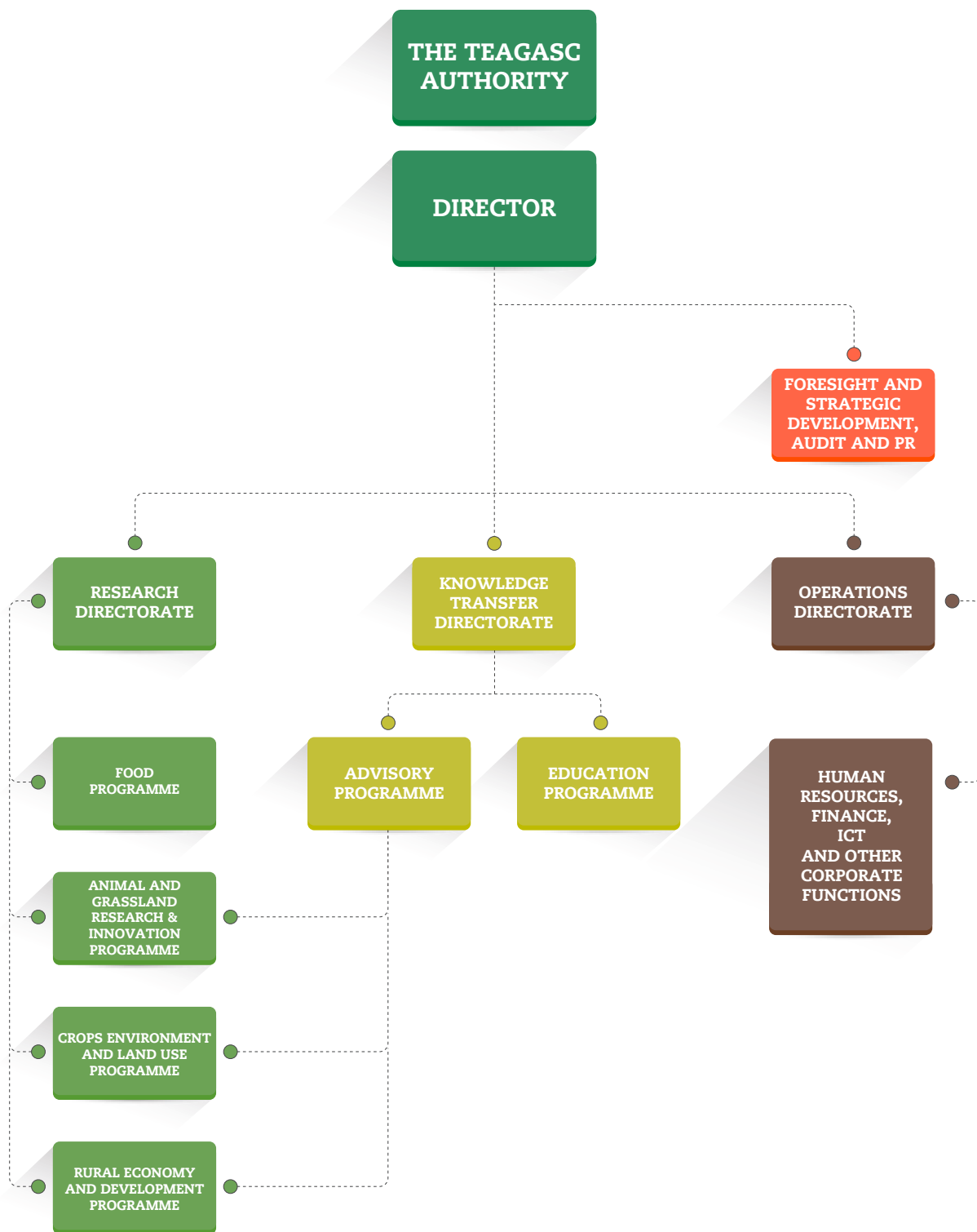


Mr. Tom Doherty
Chief Operating Officer



Professor Tom Kelly
Director of Knowledge Transfer

ORGANISATIONAL CHART



TEAGASC OFFICES & CENTRES

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



Special Article

FROM FARM ADVICE TO INNOVATION SUPPORT SERVICES



Author:
Professor Tom Kelly,
Director of Knowledge
Transfer, Teagasc.

Summary

The world we live in is in continuous change, evolution in technology is everywhere to be seen. In farm advisory services the role of advisors has also changed, I have been fortunate to work in Teagasc for the last 40 years and have seen lots of change. There are three approaches which underpin knowledge exchange and proactive support for innovation in professional farm advisory services that guide the type of support advisors provide to farmers.

1. Knowledge exchange is a human contact game. It is based on the interactivity, relationships, trust and motivations of the people involved. Advisors in their professional roles use their own, as well as farmers', peer to peer influence, digital technologies and practical demonstration, grounded in the needs of users and the language of the user. They must show empathy with the challenges and generate the interest of actors.
2. Multiple channels of communications are needed. There is no one system that does it all for everyone. For any one individual, the knowledge exchange process benefits from exposure to a range of communication channels, creating awareness, interest and a demand for more support.
3. Multi-actor approaches are better for complex innovations; they address real issues, deliver clearer messages, more consistently, with less risk of contradiction and loss of relevance to targeted users.

Farm advisors are service providers who go far beyond the role of service provider in helping farmers and their families. This developmental work extends beyond the linear knowledge transfer of technologies from science to practice. They may even go beyond the role of knowledge

exchange into roles which challenge their abilities to support networks of multi-disciplined actors to resolve issues in groups or networks.

For most advisors the immediate need is to deliver a valued service to a client base of farmers who demand these services. There is a clear value in having strong institutional support from advisors organisations or associations and the backup of applied research and industry partners working in harmony towards common farm and rural development objectives.

Introduction

This paper reflects on three basic approaches that are important in the delivery of successful innovation and entrepreneurial supports to farmers. This reflection is drawn from the experience of the author from his role as Director of Knowledge Transfer in Teagasc (Ireland) and in EUFRAS (European Forum for Farm and Rural Advisors). This experience was framed in the context of diverse grass-based family farm production systems.

The three important approaches are:

1. Human interactivity and direct contact is valuable
2. Multiple channels are needed for the diversity of messages, needs, wants of people
3. Multi-actor approaches are better for complex challenges, they support interactive innovation.

1. The value of interactivity and human contact

Human contact is basic to learning in an interactive way and to the adoption of new practices. It is fundamental to satisfying a need or want, with the possibility that knowledge and information may be exchanged and questioned, increasing the probability that it will be used to support innovation on farms.

Agriculture extension organisations like Teagasc provide innovation support through people



who have roles as farm and forestry advisors, agricultural instructors, extension agents, agricultural consultants, innovation brokers, facilitators or intermediaries. The latter three use interactive approaches which are often called, bottom up, Multi- actor or Living Lab approaches. In fact we see that this interactivity is now encouraged in formal education and society in general, for example; see how class rooms are laid out in modern schools. In theory this fits better with adult learning and support services.

Within agricultural extension there is still a strong component of linear information and knowledge transfer from applied research. The many publications, books or best practice manuals have increased the availability of information and helped wider adoption on farms. The linear extension methods have been and still are predominant and have been extremely successful in leading and assisting change in agriculture and rural development for over 100 years of formal and informal farm advisory programmes.

The objective of these programmes in helping farmers and rural communities survive, develop and prosper by providing food, environmental and other services for our increasingly urban world and its growing population is still valid. 'One to One' exchange of information and advice, whether from farmer to farmer or from professional adviser to farmer (and vice versa), will continue to be important" (Black, 2000) who also stated that "There is a need to provide for active participation by farmers in research and development processes.

Knowledge transfer has been central to a continuous learning process ranging from soils to consumer and society issues, within the framework of an agriculture and knowledge innovation system (AKIS). This system is made up of organisations, individuals and groups who

facilitate the flow of information, the generation of new knowledge and the interactions necessary to motivate and empower all the actors involved. Fundamental to all learning processes is the transfer or exchange of knowledge and support for action in applying that knowledge.

How we teach others, and learn ourselves, has been continuously challenged and while professional advisors may be comfortable with, classroom, lecture, workshop, practical demonstration and job work placement, not all adults are. There is a realisation now that learner centred approaches are more important. Are all people eager to learn? Do we learn in the same way? How do interactive tools improve engagement, dialogue and the interaction/ participation of learners? How do we facilitate adult learning?

These questions are now more important in the rush towards more online training platforms, distance learning, blended learning etc. The recent Teagasc Education Vision (2018) and the EU SCAR AKIS (2019) report support a move towards a more inquiry based learning including Problem Based Learning (PBL). PBL is a student centred learning approach where teachers become facilitators of group work as students work their way through a presented problem. (Barrett, 2017)

We have a well-educated population of farmers and farm families. They have a huge appetite for knowledge, but increasingly want information on a 'just in time' basis. Their retention span is short and they need constant reminders and routines. The role of extension is to ensure that the flow of information is constant and relevant to the time of year and issues on that farm. A good education is the platform for life-long learning.

An analysis of economic returns to formal agricultural education (Heanue & O'Donoghue 2014) confirmed a positive and significant return

both in terms of the internal rate of return from a human capital perspective as well as the internal returns from agricultural education to farm level yields, intensity and income when viewed from a production function perspective. The analysis confirms patterns in the international literature on returns to education. It also supports the contribution of learning to the enabling environment for innovation and an effective and resilient AKIS.

'One to One' is the traditional model of advisory and consultancy. It is now delivered through different means; in the office, through social media, on the phone, on the farm etc. The advisor can be both reactive (answering questions, giving information and opinions) and proactive asking questions, showing interest, challenging and encouraging. Personal contact is important in building relationships, all actions, words, tone and visual appearance affects the person we are communicating with and the message we are giving.

We must look at this from the perspective of the farmer who will form an independent opinion of the message given very quickly. Their opinions are influenced by the interest shown in them, their farm, their family and the story of the person they meet. The interest in the farm is a key factor and needs to be genuine and deliberate; it should appreciate the farmer's emotional attachment to the land, the livestock, crops, environment and history of the farmer and farm.

Advisor-client relationship and trust was recently studied by Grogan (2017) who identified the value of personal and organisational trust relations around the flow of credible and reliable information supporting changed and improved



practices and new technologies. In this study, trust in the relationship was seen to be gained quickly where there was trust in the advisors organisation (Teagasc) because of its reputation, agency status, independence and resources. This was influenced by the standards set and the support provided in the selection and appointment of advisory staff.

Apart from this, the relationship was hugely influenced by the individual characteristics and behaviour of the advisor. First impressions were important and client preferences for younger, more proactive, honest and interested advisors who had up-to-date technical knowledge were apparent in this study. Experience in the advisor role or in farming made it easier to build a relationship quickly. The study also showed the value of availability and responsiveness with higher value put on face to face meetings where possible.

The increased focus on interactivity is key to better innovation support and calls for more participatory programmes combining critical factors such as experiential learning, integrating local information, effective facilitation, group autonomy and ongoing relationships (Millar & Curtis, 1997). The change in role of extension personnel from expert to facilitator (Barman & Kumar, 2011) has opened up the potential for advisors to harness the power of peer to peer learning and to exploit the shared motivation, experience and energy for learning and improvement in practices, outcome and impacts.

Among Irish dairy farmers, studies by Hennessy & Heanue, (2012) have shown increased rates of good practice adoption and increased profitability among active participants in advisor facilitated dairy discussion groups. How we engage and build relationships in society also extends to working with groups of farmers. These groups take many forms, including, peer to peer informal discussions, e-messaging platforms, listening groups, benchmarking groups and facilitated discussion groups.

An analysis of agricultural knowledge spillovers and the degree to which these have driven innovation in agriculture in Ireland, showed a significant special relationship with research, education and advisory service locations and centres. Läpple, et al. (2016) reinforces the point that the diffusion of technology and innovation is related to the level of contact, interaction and ownership of the process. It follows that farmers' knowledge and trust of the advisor and their organisation is also important; 'Local and personal contacts generally have more influence on farmers' intentions than more distant and impersonal sources. In particular, many farmers are not disposed to follow advice from institutions that they feel do not fully understand their situation.' (Garforth et al, 2004).



2. Multiple communication channels and extension methods

People are different; they have different personalities, communication preferences and habits. The knowledge transfer challenge is to use the available channels effectively and with a view to effective knowledge sharing, learning and adoption. We should not assume that all farmers are actively seeking knowledge and many need to be engaged proactively. This leads to a potential for a miss-match or divergence of purpose and communication preferences and even cultural divide that can frustrate the advisor and the farmer.

One of Vanclays' social principles of extension (Vanclay, 2004) is that 'Farmers construct their own knowledge.; they create their own knowledge through experimentation, trial and through their own theorising'. From their own view the very act of adoption is, in itself, a form of scientific enquiry that contributed to the knowledge resource of the farmer and those who communicated with that individual. This may vary from looking over the fence, to 'one to one' communication or group work.

The value of using multiple communications and extension methods is acknowledged by Vanclay (2004). It creates a knowledge platform which is flexible and supports the varied needs, habits and preferences of individuals. The approach in organisations like Teagasc is to employ a menu of communications and extension methods both directly and indirectly which exploit the

full potential of the AKIS and are justified by the feedback received.

The value of old fashioned paper; paper-based information sources including published science, farming press, company magazines, newsletters, posters and infographics are widely used and have strong readership. Despite the fact that over 95% of Irish farmers have mobile-phone access to information, they generally value a variety of printed information, photographs and infographics. In a Teagasc digital use survey 2019 over 89% of a sample of 200 Irish advisors agreed or strongly agreed that digital media and print media would co-exist for the next five years (Moore, 2019). Teagasc, for now, continues to produce printed publications for monthly newsletters, bimonthly farmer magazine, booklets for events and conferences as well as supporting the weekly farming press with relevant articles and advertising even though these are published online.

Digitisation; new forms of communication are being increasingly used and enabled by a growing array of digital tools– e-mail, text, websites, YouTube, podcasts, webinars, messaging and social media networks. These make possible broad delivery and exchange of information in easy to access forms with a strong tendency towards mobile devices and cloud support. However the real added value from digitisation is the degree to which it expands and speeds up the flow of knowledge in the AKIS and empowers advisors and farmers to work at a higher level of interaction. For example, in the spring 2020 Covid 19 crisis advisors were quick to use digital tools to overcome movement restrictions to record and edit video and audio publications and upload these to easily accessible platforms and local

radio stations from their own homes. They also rapidly adopted the use of virtual meeting rooms to replace face to face discussion groups.



In terms of 'big data' farmers are currently gathering and processing huge amounts of information which needs to be interpreted and used more in decision making. The motivation and the means of making this change to greater digital application needs to be led by impartial intermediaries; this is a new role for advisors and will be enabled by a vastly expanded inventory of tools and services. (FAIRshare, 2020)

Public Events; The bringing together of people to listen, see, share, discuss, question, experience and evaluate information is well organised in conferences, demonstrations/open days, seminars, workshops, meetings, training days, shows etc. These have added value in that they are shop windows for the target audience and the knowledge gaps identified. A farmer or member of the public will assess if the topics are relevant to them. They can also be influenced by the skill, leadership and attitude of the presenter or the value of the message to their personal situation. The experience gained in Ireland from the BETTER Beef Programme (Kelly, 2011) and other demonstration farm programmes is that there is a need to brand and market events over a period of 4-5 years, supporting them through other channels. This includes using all farming media, advertising and promotional channels. The EU project Agri Demo and its successor Nefertiti have provided us with learnings and insights on how to organise, and achieve more effective impact from demonstration farms.

Communication and extension channels serve two main purposes, firstly they disseminate information and messages which someone has decided are important they carry new information or reminders of seasonal routines to be followed. The second purpose is that they create a public profile, they stimulate interest and the receiver will pick-up on not just the information but also the prominence given to, and importance of, the source, topic, specific action or decision to be influenced.

While we often hear of demand-led services, pull rather than push approaches, even though many of these media channels rely on push rather than

pull approaches the structure within the various communication channels is important. The source, relevance, quality and consistency of the methodology used feed the habits of the receiver and create a dependency and therefore a demand. The debate is open as to whether this dependency is good or bad. Good in that it allows the user / innovator make simple decisions based on the experience of others or the scientific expertise. Bad, because it does not stimulate the user's own rational decision-making processes and therefore it may be harder to make other decisions where support is not readily available and therefore to be creative or innovative.

The reality is that it allows both to exist in equilibrium, this equilibrium shifts for one decision to the next depending on the knowledge, complexity and importance of the action. The role of the advisor is to support the decision making and this is helped if there is lots of information available to inform both the advisor and the farmer. However the advisor must accept that human diversity exists and that opinion is formed over a lifetime and embedded in habits and experiences of the past.

The shift from top down linear knowledge transfer (KT) to more participatory knowledge exchange (KE) and co-creation has been enabled largely by the much easier access to ever increased knowledge and amounts of information. There also has been increased specialisation of farming activity, isolation of farmers and a need for reassurance through other like-minded individuals. This, however, leads to the advisors dilemma; which is that as they want to enable the client to find the best decision and implement it, like it was their own solution, but in order to be paid for a service they need to impress that they found the solution and that there was a real added value from their services.

Despite all the information and knowledge, the challenge of constantly updating and reminding farmers will continue, advisors will need to create awareness, even urgency, using all the channels available. However, to better support decisions and actions more effort is needed to persuade farmers and encourage the implementation of these decisions. The channels of communication used by advisors must always answer the 'why?' as well as the 'what?' and 'when?'

Targeting extended family, wider rural community or customer base, in order to influence farmers' decisions also exploits the wider informal networks and their relationship/influence on farmer decisions. This approach is used extensively in targeting issues like farmer health and safety, environmental and market awareness and diversification opportunities for farm businesses. This strategy is good at generating awareness, expensive if using advertising, and has been aided considerably by the advent of social media messaging platforms.



3. Multi-actor approaches

In addition to multiple channels the influence of multiple actors who interact with farmers in their day to day life are valuable resources in facilitating innovation support and better decision making. Their influence is directly proportional to their status in the farmer's mind and the degree to which their opinion and advice is localised, contextual and timed. The co-creation of innovative solutions through multi-actor interactions in formal and informal networks including groups, partnerships and related actor groupings (Faure, et al. 2019).

One actor supporting innovative decision making cannot be as effective as a range of different actors who are consistent in their advice, opinion or encouragement. It is even better if these actors have, something to gain, or have implemented these decisions on their own and gone through a similar decision making process.

Multi actor approaches allow farmers and other actors in the AKIS to cooperate or work in partnership with each other to achieve common objectives. A simple example from Ireland is where Teagasc has worked with industry partners in multi-annual joint development programmes. These have advanced the level of support to farmers and fostered innovation in improved demonstration farm and discussion group facilitation activities by advisors leading to synergies and teamwork which has endured for almost 30 years (Kelly, et al. 2004).

The value of industry collaboration is evident in the continued financial support by industry for interdisciplinary applied research and knowledge transfer programmes. These programmes are grounded by the common objectives and the desire to collaborate and solve problems or issues

through common language and coordinated engagement and messaging of the target audience.

The degree to which these multi actors are a co-ordinated group or network who have different skills, backgrounds and services but who work together to solve a problem is important and brings knowledge exchange to an even higher level. In these groups there is a cross fertilisation of ideas, inspiration and planned action which require a friendly or warm relationship. The social capital created in these networks is valuable not just in terms of interaction but in generating trust. Fisher (2013) showed that simply providing access to information is insufficient; instead, trust between the informant and recipient is essential as without it any information transfer activity will be futile.

The innovation spiral which was used in the H2020 Agrispin project to analyse a large number of diverse innovation case studies proved useful in looking at the stages of the innovation from idea generation to embedding in practice and actors involved and their interaction. The role of intermediaries at different stages and value of the range of multidisciplinary support actors was apparent but unpredictable due to the different AKIS contexts and diverse nature of each case study (Faure, et al. 2019).

The project findings supported a broader innovation broker role for farm advisors and roles in innovation network support also. The European innovation partnership for agricultural productivity and sustainability (EIP-Agri) supports the goals of rural development by encouraging innovation in agriculture and rural communities. The EIP-Agri was created to bridge the gap between the innovative solutions created and the use of new technologies by those living and working in rural areas.

By creating partnerships between those who will eventually use new technology and those that create them, EIP-Agri aims to accelerate the uptake of change. In measure 16 of the EU CAP 2014-2020 Rural Development Programme, the option of financial support for bottom up, farmer led groups was provided and adopted widely with over 1,000 EIP Operational Groups established, funded and working around Europe by 2019.

In a previous study of the needs for innovation support Klerkx & Leeuwis (2008) concluded that the innovation support roles of intermediaries in farmer networks and groups was important in the context of reduced public funding of research and advisory services and the absence of measures which articulate demand for these services in the supply chain. Wielinga (2014) identifies three useful components for creative interactive innovation processes within networks. These are: vital space, free actors and responsive capacity as these underpin the co-creation process and allow individuals to pool resources and share their ambitions effectively.

There is a clear commitment from the EU through the European Innovation Partnership (EIP) to speed up the innovation process in Agriculture and Forestry (EU SCAR AKIS, 2019). Currently a number of EU H2020 projects are evaluating interactive innovation in Agriculture and Forestry, the LIAISON project is looking at a range of projects and cases to establish good practice and measure impact, two other projects EURAKNOS and EUREKA are looking how EU H2020 Thematic Networks and EIP Operational Groups are working and to share the learning from these initiatives.

Specifically, in innovation support the AGRILINK, FAIRshare and i2connect projects aim to equip farm advisors in their roles to support interactive innovation in decision support, digital technologies and skills development. H2020 Thematic Networks and EIP Operational groups provide financial support for specific actions in areas of need identified by the beneficiaries. They empower people to help themselves through bottom up innovation processes rather than top down. These offer huge hope for faster adoption of new technologies and better innovation. They also will ensure that the lessons learned from this huge investment in speeding up innovation and the adoption of new technologies will have positive and lasting impacts for farmers and society.

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Goal 1

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

BEEF

Dairy Calf to Beef Programme

The second phase of the Teagasc Green Acres Dairy Calf to Beef Programme was launched in April 2019. The programme will follow, and share, the progress made over the next three years by 14 beef farmers who are all buying dairy bred calves. The very successful first phase of the programme ended in 2018.

Two full-time programme advisors work closely with each of the farmers where they focus on improving overall farm profitability through better grassland management, calf rearing skills, animal health, financial management and farm planning.



Pictured at the launch were: Professor Gerry Boyle, Teagasc Director; Cormac Farrelly, Agriland (Media Partner); Programme Advisors Alan Dillon, David Argue and Sean Cummins along with the participating farmers, industry sponsors (MSD Animal Health; Volac; TP Whelehan/Corteva Agriscience; Liffey Mills; Munster Bovine; Drummonds).

Teagasc DairyBEEF2019 Open Day

There are approximately one million dairy male calves and dairy-beef cross calves available for beef production each year. A key message of the Dairy BEEF 2019 open day event that took place at Teagasc Johnstown Castle Environment Research Centre was maximising production and farm efficiency from grass while reducing the effect of production on the environment. The event included comprehensive comparisons of different dairy beef production systems and finishing regimes, and profitability analysis. The event also displayed the latest research from Teagasc on environmentally sustainable farming.



The organising group included: Dr. Padraig French, Ruth Dunne, Wayne Hayes, Sean Cummins (Green Acres Advisor), John Watchorn (Grass10 Grassland Farmer of the year 2018), Ger Shortle (Wicklow/Carlow/Wexford Regional Manager), Donall Fahy & Dr. Nicky Byrne (Teagasc Grange Dairy Calf to beef programme), Dr. John Finn, Rioch Fox

“Irish livestock systems will need to meet stringent environment targets which will require increased knowledge and technology,” explained Dr. John Finn, Teagasc Johnstown Castle Enterprise Leader. “This includes effective nutrient management, low emissions slurry spreading, and use of protected urea that contributes to soil fertility, protection of water quality and lower greenhouse gas emissions.”

Balanced breeding – the dairy-beef index

The expanding dairy herd, coupled with improving reproductive performance, will require that a greater proportion of slaughtered cattle originate from dairy herds. A tool that ranks beef bulls for use on dairy females, balancing the desires of the dairy and beef farmers, is needed.

The new Teagasc-ICBF dairy-beef index (DBI) ranks beef bulls for use on dairy females based on their estimated genetic potential to produce high quality profitable cattle, with minimal impact on dairy cow performance. Traits included in the DBI relate to: 1) calving performance, 2) carcass traits, 3) feed intake, 4) docility, and 5) polledness. Research is on-going on the inclusion of additional traits such as calf health, meat quality and environmental traits.

Reproductive Management Model

The Grange Reproductive Management Model is a decision support tool developed by Teagasc to aid in reproductive management of suckler herds. A user interface allows farmers to enter current herd size, breeding season length, calving profile, replacement rate and pre-weaning mortality rate for their farm.

Energy availability around calving is predicated on the level of concentrates fed, the silage quality, and date of turn out to pasture as indicated by the user. Management options are selected prior to the next breeding season by farmers who wish to improve herd reproductive performance. These include alternative sire selection, increasing the energy density of the diet post calving, biostimulation of the cow through the use of a vasectomised bull, and temporarily restricting the suckling time of the calf.

Vitamin D for cattle

Teagasc researchers are investigating whether recommendations on vitamin D supplementation for cattle need to change in light of new information on its role in immune function. Teagasc research shows that the levels of vitamin D increase when calves are at pasture but reduce significantly once daylight hours lessen and cattle are housed, particularly under our low concentrate supplementation systems. The current focus of this work, in collaboration with other research institutes, is the investigation of how this level of vitamin D affects disease susceptibility and whether supplementation can alter disease outcomes.

SHEEP

Ewe productivity

SheepNet is an EU funded project focusing on ewe productivity. Ewe productivity (number of lambs reared per ewe joined) is a combination of reproduction success, embryonic and lamb survival and litter size. SheepNet is designed to stimulate knowledge exchange between research and stakeholders to widely disseminate the best practices and innovations, with the objective of increasing ewe productivity. SheepNet involves the six main EU sheep producing countries (Ireland, France, United Kingdom (EU member in 2019), Romania, Spain and Italy) and Turkey.

Sheep and clover

Current grazing systems research projects in Teagasc Athenry are focusing on the impact of incorporating white clover and other companion forages into sheep grazed swards on the productivity of pasture based lamb production systems with special focus on the animal, environmental and economic impacts.

Key findings to date show that the inclusion of white clover in the sward relative to perennial ryegrass alone resulted in lambs reaching slaughter weight nine days faster. In terms of sward DM production the grass-only swards grew 13,483kg DM/ha, grass clover swards at 145kg N/ha grew 13,926kg DM/ha and the grass clover swards at 90kg N/ha grew 13,590kg DM/ha. While only a small difference is evident between treatments, a positive aspect is that the low N treatment (90kg N/ha) is growing just as much grass or slightly more than the other high N treatments (145kg N/ha) with or without white clover.



Farmers visiting Teagasc Athenry learn about grazing systems research.



DAIRYING

Joint programmes/ collaborations

Kerry Agribusiness and Teagasc celebrated 25 years of working collaboratively on the Joint Programme which commenced in 1994 and was an innovative concept of peer-led learning and knowledge transfer. Over the 25 year period, the Joint Programme was implemented across counties Kerry, North Cork, Limerick and Clare.



Back row left to right Dr. Sean McCarthy Kerry Agribusiness, service Manager, Edward McCarthy Monitor farmer, John Collins Operations Manager Kerry Agribusiness
Front row: Teagasc Regional Manager Majella Maloney, Teagasc Director Professor Gerry Boyle, Padraig McCarthy Monitor Farmer, Nora O'Donovan Teagasc dairy advisor Tralee, Ger Courtney, Teagasc Joint Programme Coordinator.

Glanbia Ireland and Teagasc launched the next generation of a joint programme that aims to provide family farms with the skills and technologies to operate efficient and sustainable dairy farming systems.

Calfcare events

A series of fourteen CalfCare events took place in winter 2019. Teagasc and Animal Health Ireland teamed up to organise these on-farm events, with the dairy milk processors Arrabawn, Aurivo, Carbery, Centenary Thurles, Dairygold, Glanbia, Kerry Agribusiness, Lakeland Dairies, North Cork Creameries, Tipperary Co-op and supported by Volac.

Teagasc Moorepark Open Day 2019

Thousands of farmers attended the Teagasc Dairy Open Day, Moorepark 2019, in July. As part of a comprehensive array of dairy research and advice at the event they heard how the Irish dairy industry has been transformed, with exports of Irish dairy products and ingredients increasing from an average of €1.84 billion from 2007 to 2009, to over €4 billion in 2018. Milk production in Ireland increased to 7.57 billion litres in 2018, and reached just under eight billion litres in 2019.

Director of Teagasc, Professor Gerry Boyle, warned dairy farmers that the Irish dairy industry is currently facing a number of key challenges: climate change; water quality; remaining competitive; access to markets; and, availability of skilled labour: “The challenge is to grow the business sustainably,” he said. “In relation to climate change, Teagasc has produced guidelines for the dairy sector, identifying key actions that need to be undertaken to reduce the industry’s environmental footprint.”



Pictured discussing the plans for the Teagasc Moorepark '19 Dairy Open Day: Dr. Tom O'Dwyer (Teagasc), Dr. Ann Marie Butler (Ulster Bank), Dr. Pat Dillon (Teagasc), Philip Cocoman (Ornua), Liam Herlihy (Teagasc Chairman), Ailish Byrne (Ulster Bank), Michael Berkery (FBD) and Prof. Frank O'Mara (Teagasc).



Dr. Mike Egan addresses some of the huge attendance at the Teagasc Moorepark Open Day.

Sexed semen trial

Teagasc researcher Stephen Butler outlined the results of a recent sexed semen trial at the Teagasc Moorepark Open Day. The levels of fertility performance obtained in the study makes sexed semen a viable strategy for generating

replacement heifers on commercial farms, but more work is needed to identify the reasons for poor performance with sexed semen in a subset of herds that can achieve excellent performance with conventional semen.

The rumen microbiome

Teagasc researchers, along with colleagues in UCD and the ICBF, are participating in European-wide research into the rumen microbiome and its links to both productivity and GHG

emissions. RumenPredict, an international research consortium, aims to further advance our understanding of the association between the feed efficiency capacity of the host animal and GHG emissions, with particular focus on how the host shapes its constituent rumen microbiome.



Pictured at the 9th European Conference on Precision Livestock Farming (ECPLF) which gave delegates a first-hand opportunity to consider precision technologies in dairy, beef, sheep, poultry and pig production are Peter Hynes, Aherla, Dr. Bernadette O'Brien, Teagasc (Chair of the Organising Committee), Fergal Dennehy, Deputy Lord Mayor of Cork & Professor Frank O'Mara, Teagasc Director of Research. Teagasc were the main organisers of ECPLF 2019 which took place at University College Cork in August.

GRASS

Feed value

A TEAGASC collaborative project with Cornell University in the United States is examining the true nutritive value of grazed pasture and its role in dairy cow diets. The project will provide a greater understanding of the nutrition of grazing dairy cows. Through precise quantification of the nutritional interactions involved, strategic supplementation or diet optimisation can be implemented to increase the efficiency of pasture-based systems.

PastureBase Ireland

There was a large increase in the use of PastureBase Ireland in 2019. PastureBase Ireland (PBI), Ireland's national grassland database and grassland decision support tool, has approximately 450,000 dairy cows being managed through the system. Teagasc Director, Professor Gerry Boyle said: "This is a phenomenal figure given that PBI only started in 2013. We have recorded a 60% increase in farmers completing more than 20 farm grass covers annually. At peak this year, there were 1,600 farm covers being completed weekly in PastureBase Ireland. We expect this figure to continue to increase."

Teagasc dairy advisor Joe Kelleher presenting at a PastureBase Ireland walk on Niall Moloney's farm in Crecora, Co. Limerick. Niall was the 2018 Young grassland farmer of the year.



PIGS

LEAN Principles

The Teagasc Pilot Pig Supply Chain Lean Initiative in 2018 proved that applying Lean Principles to the pig production process could deliver improvements in competitiveness, cost effectiveness, energy use and feed conversion efficiencies. In 2019 the Pig Development Department introduced a new Lean Initiative in collaboration with Bord Bia and DAFM. The objective was to support the adoption of Lean manufacturing principles to achieve operational and efficiency improvements on pig farms.

Participants worked with a panel of Lean consultants established by Teagasc and Bord Bia. Teagasc led the operational and technical management of the initiative, which delivered a mix of Lean Start and Lean Plus projects. This programme delivers on one of the key recommendations of the report of the DAFM Pig Industry Stakeholder Group.

Teagasc Pig Production Economic Model (TPPM)

With the launch of the new pig economic model in 2019, Teagasc now has economic models for cattle, sheep and pigs. The model simulates biological and economic performance of pig farms and can be used to study scenarios that cannot be tested on real farms because they are too expensive or not feasible.

Simulated results will support decision making on Irish pig farms. Future uses of the TPPM will include assessing the economic impact of changes in diet specifications, of diseases, or cost of new legal requirements in the areas of antimicrobial reduction, environment or welfare.



Farm management course

Following on from the success of the part-time Certificate in Agriculture in Pig Production (Level 5) and in response to stakeholder demand Teagasc introduced a Pig Farm Managers' Course (Level 6) specifically designed for students currently managing, or aiming to manage, a pig farm.

The course is a component award comprising four Level 6 modules (Pig Husbandry Management, Managing Pig Nutrition, Pig Equipment Management, Applied Pig Reproduction) relating to pig farm management that are accredited by QQI. It consists of a combination of lectures delivered by the Pig Development Department and external guest speakers as well as group discussions, day trips and team work activities. In September 2019, 21 students completed the inaugural course.

EU PiG best practice

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.

There are four key project themes identified: 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 practice.

Ireland had a winner in the inaugural year (2017) in Health Management and was successful again in 2019 in the 'Meat Quality – Opening Farms to Engage with the Public' challenge.

Teagasc National Pig Conference

The theme of the 2019 Teagasc National Pig Conference was "Focusing on the Future", with all presentations incorporating this theme. The October conference was held at venues in Tipperary and Cavan.

Pictured at the Teagasc National Pig Conference in Cavan are Wellington Osawe, NUIG, Mark Hawe, DAERA-NI, Ciarán Carroll, Teagasc and Liz Donnelly, DAERA-NI.



TILLAGE

Open Day

The 2019 Teagasc Crops Open Day provided 3,000 visitors with an excellent opportunity to witness first-hand demonstrations from the Teagasc applied and strategic crops research programme. Entitled ‘Crops & Spreaders’, in partnership with the Irish Farmers Journal the event was focussed on the importance of accurate fertiliser spreading to support sustainable productivity, with live fertiliser spreader demonstrations throughout the day. The event, hosted by Teagasc Walsh Scholars and staff, highlighted active research across 30 stands.



Teagasc tillage specialist Ciaran Collins presenting at the Crops and Spreaders Open Day which took place in Teagasc crops research centre in Oak Park .

Tillage Forum

The Teagasc National Crops Forum took place in September 2019. The forum addressed a number of agronomic topics, and also CAP changes expected post 2020. The forum also covered the plant virus BYDV in detail with a talk from Steve Foster, Research Entomologist from Rothamsted Research, UK.

Pictured at the Teagasc National Crops Forum (from left: Andy Doyle (Irish Farmers Journal), Steve Foster, JohnJoe Byrne (DAFM), Fran Morrin (DAFM), from Teagasc Michael Hennessy, John Spink, Ciaran Collins.



Ryegrass

A new late diploid perennial ryegrass variety with a Pasture Profit Index of €118, has been added to the 2019 Recommended Grass Variety List in Ireland for the first time. This is the first variety to be commercialised from the marketing agreement signed between Teagasc and Goldcrop in 2013. The Teagasc Oak Park produced grass variety has a very good balance for spring, summer and autumn growth and high silage values. It rates as the second highest late diploid variety in the recommended list.



Prof. Frank O'Mara (Teagasc, Director of Research), Dr. Michael O'Donovan (Teagasc, Head of Grassland Science) Mr. Dave Barry (Goldcrop) Dr. Pat Conaghan (Teagasc, Grass Breeder) Mr. Liam Herhily (Teagasc, Chairman) Mr. John Murphy (Goldcrop) Prof. Gerry Boyle (Teagasc, Director) Dr. Pat Cashman (Goldcrop) Mr. Donal Fitzgerald (Goldcrop) Dr. Pat Dillon (Teagasc, Head of Agrip).

VICCI

The Teagasc Virtual Irish Centre for Crop Improvement (VICCI) project, which is supported by the Department of Agriculture, Food and the Marine has enabled Teagasc to build capacity with national and international partners to develop improved crop varieties with increased resource use efficiency.



In 2019 IPM Potato Group Ltd and Teagasc signed a new fifteen year agreement in Oak Park, Carlow. Pictured (Front Row) were: Dr. Marcel De Sousa, IPM Director; Ian Ireland; Managing Director, Donegal Investment Group; Professor Gerry Boyle, Teagasc Director; Liam Herhily, Teagasc Chairman; (Back Row) were: Dr. Colm McDonnell, R&D Manager, IPM; Dr. Denis Griffin, Potato Breeder, Crops Science Department, Teagasc; Sean Mulvany, Head of Technology Transfer, Teagasc and John Spink, Head of Crops Environment and Land Use, Teagasc.

For example, in the absence of adequate control measures, Septoria tritici blotch (STB) can cause yield losses of up to 50% when susceptible wheat varieties are grown under our weather conditions which are conducive to STB development. Coupled with this is the loss of several chemistries due to the ability of STB to evolve resistance/tolerance to fungicides. In collaboration with the John Innes Centre in the UK, Teagasc researchers have identified two wheat lines with enhanced STB resistance and we are working with industry to map this resistance and introgress it into pre-breeding material.

Protein Stakeholder Group

A National Crop Protein Stakeholder Group was formed in 2019. It aims to help guide and develop the production of plant proteins in Ireland to provide new options for growers and achieve import substitution.

Precise application of fertilisers

A national series of workshops was delivered, in association with the Fertiliser Association of Ireland, to enhance agricultural contractors' knowledge and skills in applying fertiliser to grassland and tillage crops. The workshops included practical demonstrations on achieving the correct fertiliser spreader settings to minimise overspill.

FORESTRY

In 2019 forestry advisors carried out 500 advisory visits, 4,200 advisory sessions by email, phone and office consultation and sent out 600 tailored information packs. This was in addition to 39 one-to-one advisory clinics (360 attended) and a series of 15 forest management walks nationwide.

Pest risk analysis

Pest risk analysis carried out by TEAGASC researchers is helping to ensure the future of forestry in Ireland and further afield. A Pest Risk Analysis is a technical document that analyses the likelihood of pests entering and establishing in a defined area, e.g., the island of Ireland. It then estimates the potential magnitude of economic, environmental and social impacts to that area. Finally, PRA will identify measures that can be taken to reduce the risk of the pest via regulation.

EARTH

EARTH project (Exploitation and Realisation of Thinnings from Hardwoods) concluded that small diameter thinnings of alder, ash, birch and sycamore have the potential for conversion to inside-out beams for internal construction uses, such as window and door lintels. Due to its mechanical properties and treatability with preservative, ash is the most suited of the species that were tested for structural purposes such as small recreational constructions, playgrounds and fencing.

Ash dieback

The genebank of 208 ash-dieback tolerant ash was completed by Dr. Miguel Gorriz and 1,000 Irish ash genotypes were sent abroad for screening under significant disease pressure conditions. The research objectives of Teagasc work on the disease are to identify tolerant ash genotypes in Irish forests, to study the molecular mechanisms conferring tolerance to individual ash genotypes and to develop efficient propagation methods for tolerant ash material.

Short rotation forestry

Teagasc research on the potential for short rotation forestry (SRF) provided early indications that Italian alder and Eucalyptus nitens have significant potential for SRF in Ireland, depending on site conditions.

Successfully integrating forestry and farming reaps rich sustainability dividends – but it can be challenging.



HORTICULTURE

Integrated Pest Management (IPM)

In 2019, several national and European projects aimed to improve IPM systems in key horticultural pests. Through industry funding, monitoring of the invasive species Spotted Wing Drosophila, has continued and this work has been supported by a Teagasc funded Walsh Scholar who is investigating the comparative efficacy of crop covers against traditional pesticide applications to manage this pest.

Improving soil health

Maintaining soil health and reducing the carry-over of soil borne disease and plant pathogenic nematodes was a focus of the EU H2020 funded Best4Soil project. Teagasc collaborated with eight European institutes to create a new decision support tool to visualise the potential disease carryover in a grower's rotation. Teagasc were responsible for compiling disease x crop interactions for 32 horticultural crops and over 80 disease causing organisms. This database was used to create an online decision-support tool.

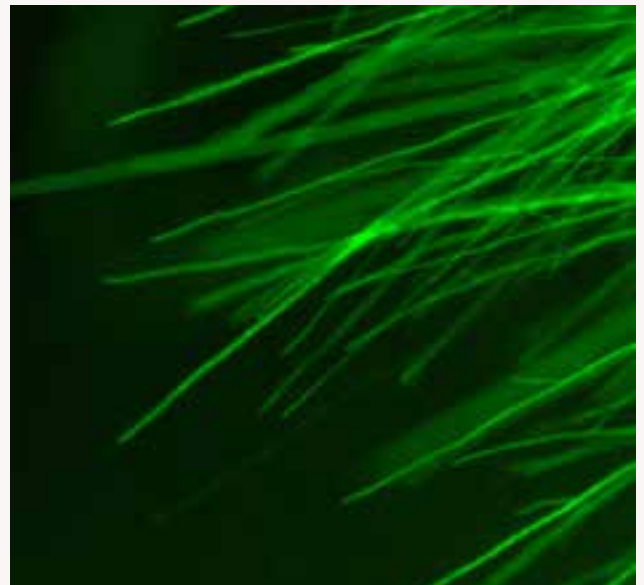
Assurance in horticultural production

The Horticultural Development Department in collaboration with the Teagasc Food Safety Department, Technological University Dublin and University College Dublin were awarded funding through DAFM to conduct a four year research project on optimising agronomic approaches to reduce the risks from irrigation water and treated surfaces to field crops. This project will assess current procedures for water management and microbial control in commercial horticultural production.

Mushroom research

Mushrooms are a major horticultural export. Mushroom viruses can reduce the quality and value of the crop and a virus-resistant strain is highly desirable. A major piece of Teagasc research on mushroom viruses was completed in 2019 which showed that viruses can be transmitted between strains that are considered 'incompatible', making the breeding of a virus-resistant strain quite a challenge.

One of the most interesting outputs was successfully visualising viruses in living tissue using a 'Fluorescence In Situ Hybridisation' (FISH) method (pictured right). Different viruses were found to be located in different regions of the mycelial network, which has implications for how viruses are transmitted to non-infected cultures but also on how they interact with each other within the host.



Cut foliage

Cut foliage production is ideally suited to Ireland's temperate climate and the sector is steadily growing, targeting the lucrative €2.5 billion European cut-flower market. Eucalyptus and Laurel are widely planted and commercial output has doubled in the past five years.

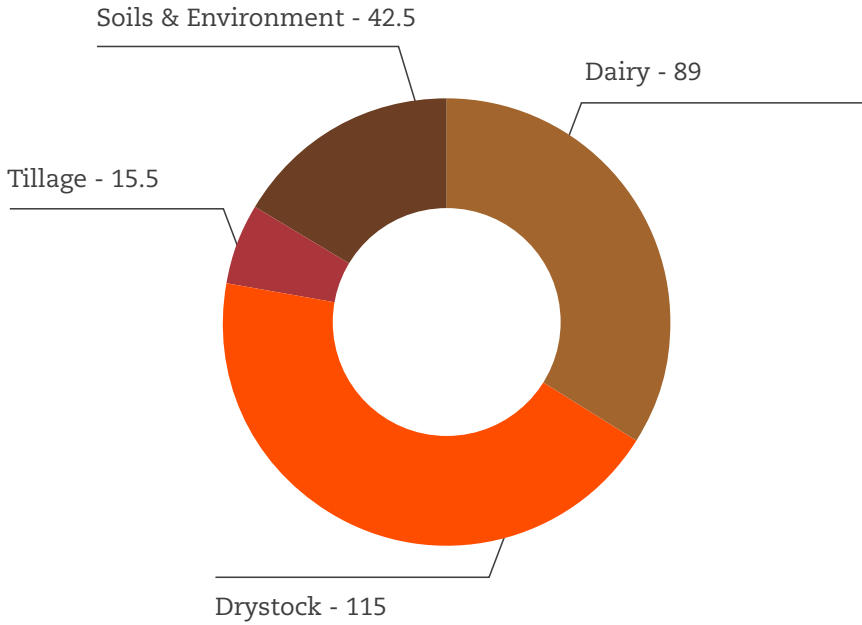
Teagasc, in collaboration, with the industry supported by DAFM-funding, is researching traditional and micro propagation technologies for key species to increase the commercial availability of high value 'mother' plants for commercial propagation.



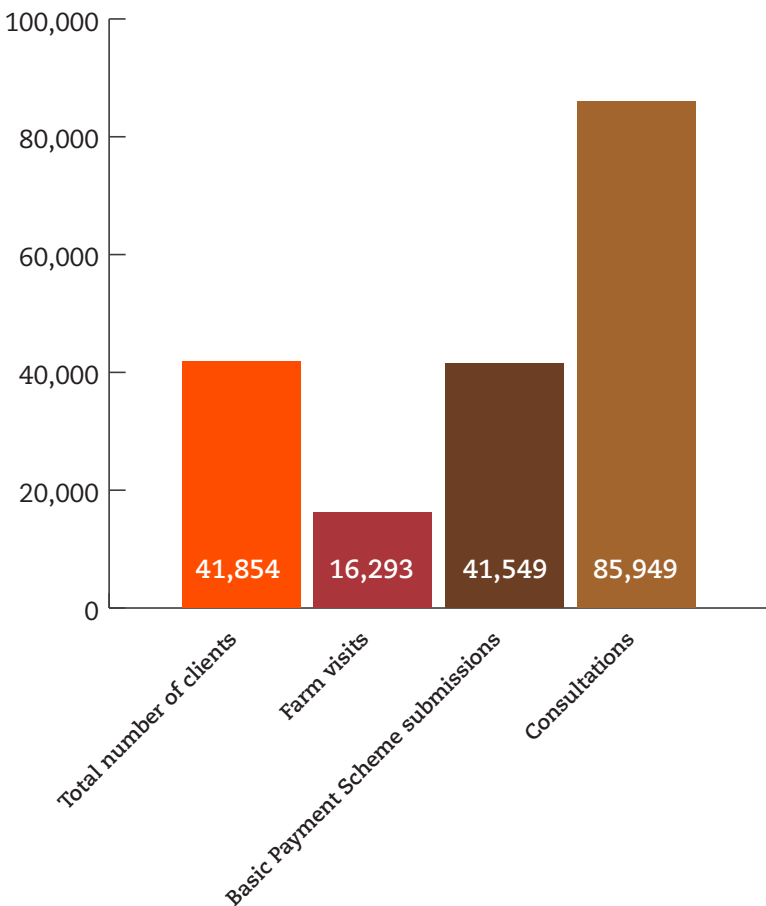
ADVISORY SERVICES

At end Dec 2019

Advisors



Client Interaction



Staff Profiles



Mark Coyne, a native of Co. Westmeath, is a Business and Technology drystock advisor based at the Teagasc office in Tullamore which is the headquarters of the Westmeath/Offaly/Cavan/Monaghan advisory region. He qualified from University College Dublin with a B.Agr.Sc. and has previously worked at Teagasc offices in counties Kerry and Laois.

Mark has over 250 clients who operate a range of beef systems including suckler calf-to-beef; dairy calf-to-beef; store-to-beef; suckler to weaning etc. As part of the drystock team in the region Mark has helped establish 'Grass on the by-pass' which is a demonstration of grassland best-practice located on a client's farm visible from the Tullamore by-pass.

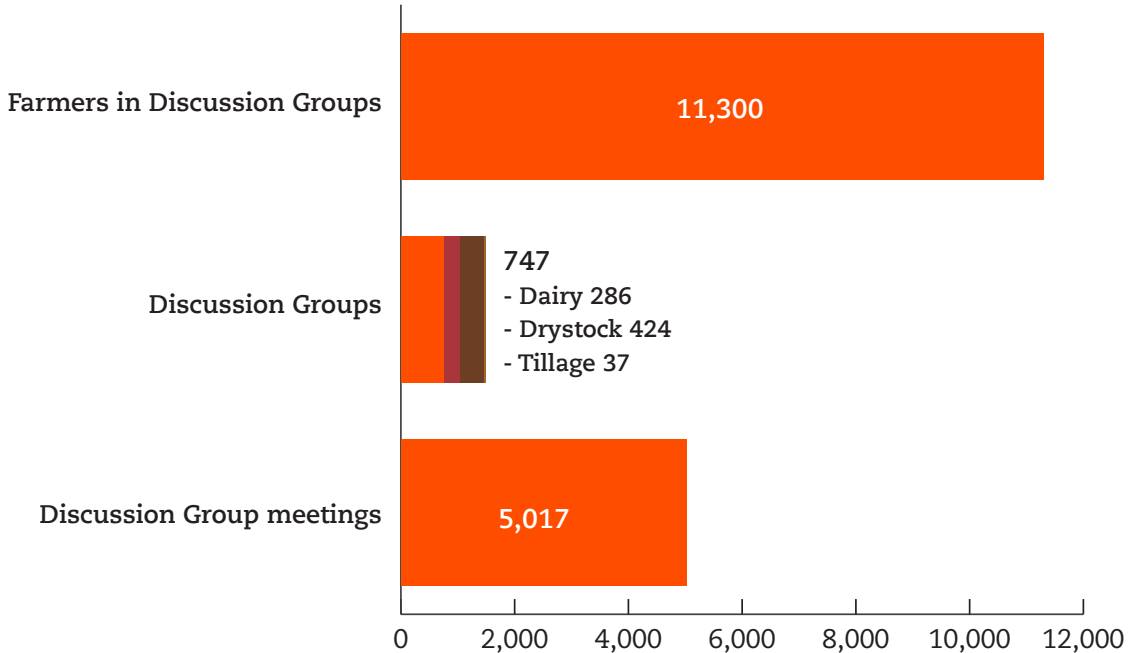
Who are my customers?

"Our aim is to support sustainable beef and lamb systems which means farmers protecting the environment and focusing on profitability by maximising the amount of grazed grass in their animals' diet," says Mark.

Since dairy quotas were removed in 2015 Mark, working with the Teagasc Dairy Expansion Service, has supported over 30 of his clients to become dairy farmers. Regardless of enterprise, Mark says his clients are increasingly interested in environmental initiatives. "A large number of my clients are in the GLAS scheme," he concludes. "I believe farmers in the area will be ready to embrace new environmental initiatives as they emerge."

Picture: Mark Coyne and client Sean Bracken who farms near Kilcormac in county Offaly inspect cover for partridge sown on Sean's field headlands.

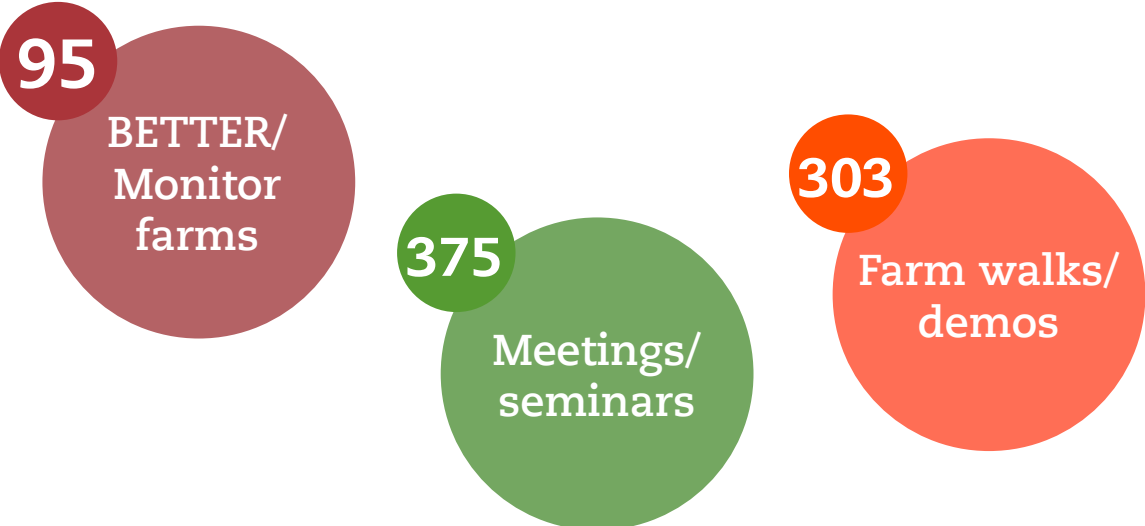
Discussion Groups



Farm planning activities:

1,116 TAMS plans
7,936 Profit Monitors
8,100 KT Farm Improvement plans

Other activities:



Teagasc ConnectEd

The Teagasc ConnectEd Programme continues to deliver high quality knowledge transfer programmes to the agri-food sector. 2019 was another busy year for the programme where 28 training courses were delivered to industry with 1,133 training places occupied. Teagasc ConnectEd launched a successful Spring Webinar series which attracted a wide audience across the agri-food sector. A new Master Class series was launched in the autumn which included topics such as Farm Building Infrastructure for the Financial Sector and Soil Quality and Health. Members of Teagasc ConnectEd receive monthly publications and invitations to Teagasc events. Teagasc ConnectEd also supported access to Teagasc Online systems such as NMP Online and Profit Monitor to 290 agri-professionals across Ireland.

CECRA

The Teagasc CECRA Advisory Skills training is part of an EU wide training framework focusing on methodological training for farm advisors and consultants. Courses include Group Facilitation Training, Marketing and Public Relations, Team Leadership etc. The programme delivered 206 training places over 15 modules (two days in duration). In order to achieve CECRA certification participants are required to attend five modules, visit an advisory service outside of Ireland, attend seminars and reflect on a case study.

EDUCATION

Demand for courses

Over the period 2014 to 2019 Teagasc experienced an exceptional level of demand and enrolments across key education programmes. This has been reflected in total annual Quality Qualifications Ireland (QQI) learner certification trends for Teagasc courses. In 2014, total QQI certifications for Teagasc programmes stood at 2,165. In 2019, total certifications amounted to 4,078. This increase has been driven by a surge in demand for Teagasc adult Green Cert courses from those seeking a recognised farmer qualification to meet young farmer focussed schemes under the national RDP programme.

A peak level of enrolment for Teagasc courses occurred over the 2015/2016 period leading to a peak QQI certification total of 6,253 in 2018. This exceptional enrolment intake 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 period 2014 to 2018.

While certification totals for 2019 were almost double those of 2014 they are lower than the 2018 total. Two factors account for this trend. The number of temporary education officer contracts posts peaked in the period 2016/17 and the substantial majority of these contracts have now expired. This directly impacted on enrolment capacity. In addition there has been some easing back on the exceptional demand level for Teagasc courses. Nevertheless demand remains very high relative to pre-2014 levels and the introduction of a post 2020 CAP programme is likely to see continuing demand for Teagasc courses.

New degree

A new Agricultural Science Degree delivered in collaboration with Teagasc at University College Cork was launched at the Animal & Grassland, Research and Innovation Centre, Moorepark, Cork.



Tom Curran, second from right, spoke on succession and inheritance at this Alumni Event in Teagasc Clonakilty Agricultural College.



Ciara O'Donovan (right), who teaches in Clonakilty Agricultural College, with prospective students.

FOOD

Simulating food digestion

Teagasc researchers have been involved in a large-scale EU-funded network to improve and standardise the scientific protocol for simulating food digestion. The protocol is a result of a long-term collaboration between more than 27 academic institutes from 18 different countries. A paper detailing the protocol has just been published in the prestigious journal *Nature Protocols*.

Prepared consumer foods

The National Prepared Consumer Food Centre (NPCFC) at Teagasc Ashtown is now fully operational with the appointment of Shay Hannon as NPCFC manager. Promotion of the NPCFC and its capabilities is on-going and over 60 food businesses have availed of the centres services to date. One of the flagship pieces of equipment, the Clextral Twin Screw Extruder, was installed and commissioned in 2019. Teagasc researchers are currently examining processes for new types of bio-sourced plastics.

Baked products

Researchers at Teagasc Ashtown and Teagasc Moorepark are investigating the impact of reduced sugar on the baking properties and sensory qualities of baked products. They have shown how the aromatic compounds from ingredients and those generated during baking are influenced by sugar reduction in sponge cakes. Careful choice of ingredients and the use of natural sucrose replacers can mitigate negative baking results and loss of consumer appeal in reduced sugar baked confectionary products.

Pictured at the Teagasc Gateways event on “Food Biotransformation – Biological Processes for Sustainable & Novel Food Development” in Teagasc Moorepark, Fermoy, Co Cork are Drs. André Brodkorb, Linda Giblin, Sheila Morgan, Teagasc and Associate Professor Kostas Gkatzionis, University of Aegean, Greece. (see Foodworks overleaf)



Foodworks

FoodWorks, an accelerator programme run by Teagasc, Enterprise Ireland and Bord Bia, has supported 76 Irish food start-ups to develop scalable and export focussed business ideas. To date, one in three Food Works companies has already achieved export success and the global markets reached span four continents: Europe, Africa, Asia and North America.

Following a rigorous selection process, six ambitious Irish food and drink companies were selected to take part in Food Works 2019. The companies ranged from early start-up T4 Adventure's trekking meals to more established brands such as Silk Tree Botanics' alcohol-free spirit and Clintons Crisps. Ireland's first snail farm, Gaelic Escargot, also participating in this year's programme, along with a two novel snack based start-up companies.

A2 milk

The conclusion from a Teagasc A2 MasterClass was that there is limited robust scientific evidence to support any claims related to the consumption of A2 milk. Such claims in the past have been paramount in the innovation and formulation of new dairy products.

Blending dairy and cereals

Fermented dairy-cereal blends present new export potential for Irish ingredients and TEAGASC and UCC researchers have been researching the development and characteristics of different blends. The addition of milk solids to

cereal-based products enhances the content of important nutrients, including essential amino acids, linoleic acid, fat-soluble vitamins, calcium and phosphorous.

Microalgae

Teagasc researchers are examining types of microalgae, which are among the richest and most sustainable sources of nutrients. They have shown that the application of novel extraction techniques such as ultrasound, enzymes and microwave-assisted extraction techniques can enhance the extraction of proteins and other bioactives from microalgae.

EnhanceMicroAlgae (High added-value industrial opportunities for microalgae in the Atlantic Area – Enhance Microalgae) is an ongoing project with a budget of €2.45 million, aiming to make the most of microalgae in the Atlantic Area, with several partners based in Spain, Portugal, France, the UK and Ireland.

MASTER project

The MASTER research project, a Horizon 2020 Innovation Action, was launched at the Teagasc food research centre, Ashtown, Dublin in January. Pictured below at the launch of the €11 million project were Professor Frank O Mara, Dr. Sinead Waters, Dr. Paul Cotter and Dr. Fiona Brennan, Teagasc. This ambitious research project involves 31 leading European and international academic and industry teams with participants from 13 EU Member States, two Associated Countries and one international partner.



BIA Innovator

Teagasc, Galway County Council, Athenry Community Council, Galway Roscommon Education and Training Board, Western Development Commission and SCCUL are the founding partners of BIA Innovator Campus CLG, a step change project that will transform the food entrepreneurship landscape in the West of Ireland. Co-funded by Enterprise Ireland under the Regional Enterprise Development Fund, it addresses a need for regional food workspace infrastructure by realising a dynamic food and drink innovation and incubation centre of scale, 2301 square metres (23,767 sq. ft.), with the creation of 360 jobs within three years over 40+ businesses and which will see 2,400 individuals receive training, development and support from the founding partners and wider stakeholders. It is a unique infrastructure enabler with far reaching innovation ecosystem benefits in its location at Teagasc, Athenry, Co. Galway.

BIA Obair will have 12 food-grade production units allowing a continuum of growth from:

- Specialist co-working food incubators (dairy, meat, seafood and multi product)
- Starter units,
- HPSU growth units

BIA Accelerate will provide a much-needed continuum pathway structure to support food businesses to grow and scale. It will comprise a Business Engagement Zone – for entrepreneurship peer learning and mentor coaching, a Business Information Centre and a Demonstration & Training Area for use as a Taste Panel lab for peer review of new product development.

BIA Eolas – A dedicated learning environment that will encourage exchange and innovation, integrate key culinary offerings: accredited career training programmes, continuing education for food entrepreneurs, industry professionals, chefs, master classes for home cooks and special events. It will comprise a large demo kitchen/auditorium, a Culinary Training Centre and hot desking.

BIA Blas will be a dual function showcase and training/events facility that will provide a 'Fast' network to trade buyers; service suppliers and investors. It will provide a permanent showcase of new product development emanating from across the BIA Innovator Campus and act as a central point for group activities.





Goal 2

Support sustainable farming
and the environment

SUSTAINABILITY REPORT

This report, published in 2019, describes the economic, social, environmental, and innovation dimensions of sustainability at farm level using the Teagasc National Farm Survey. Economic (economic return and profitability of land, market orientation, productivity of labour and viability), social (household vulnerability, isolation risk, age profile, education and work-life balance), environmental (greenhouse gases, ammonia, nitrogen and phosphorus loss risk) and innovation (various practices) results are reported in detail over the 2012 to 2017 period across dairy, cattle, sheep and tillage farms.

The report illustrates the income gap between dairy farms and other farm types in Ireland, which has accelerated with the growth in Irish milk production in recent years. The report also highlights that within each farm type there is a wide range in income levels across the farm population. While the mainstay of the National Farm Survey is the measurement of the economic performance, in recent years the scope of the survey has been expanded to include a growing range of environmental metrics, including farm level greenhouse gas emissions. This year's edition of the report also includes metrics for farm level ammonia emissions for the first time.

Author of the report Teagasc economist, Dr. Cathal Buckley, noted that farm level emissions efficiency is improving, with a trend towards fewer emissions of greenhouse gases and ammonia per unit of product produced. However, the report also shows that emissions of greenhouse gases and ammonia over time are increasing on farms that are growing in size. Data compiled through the report will be valuable for policy makers and the agri-food industry in understanding how best to focus continuing efforts to address farm emissions and contribute to national targets for gaseous emissions reductions.

The report demonstrates the positive relationship between economic profitability and emissions efficiency, with the highest levels of emissions efficiency tending to be found on the most profitable farms. This suggests that improvement in economic sustainability can be achieved side by side with improvements in emissions efficiency.

The report is representative of about 90,000 farms in Ireland, but does not cover the smallest farms in the country in terms of economic size. However, these small farms will be tracked in a separate survey using the same methodology, which is set to take place in 2020.



Pictured at the launch of the Teagasc Sustainability Report: (L-R) Dr. Kevin Hanrahan, Dr. Emma Dillon, Teagasc Director Professor Gerry Boyle, Dr. Mary Ryan and Brian Moran.

Teagasc/SRUC

Teagasc and Scotland's Rural College (SRUC) have long collaborated on issues of mutual interest. This process culminated in 2018, in Edinburgh, with the first of a series of annual conferences aimed at identifying solutions and helping create new opportunities for rural economies. The 2019 conference, at Teagasc Ashtown, addressed the major environmental, consumer and economic challenges facing pasture-based livestock systems in both countries.

Particular emphasis was placed on options for creating sustainable and resilient pasture-based livestock production systems that can help mitigate Greenhouse Gas (GHG) emissions and adapt to a changing climate, while continuing to provide food and nutrition security. Specifically, the conference explored how to strengthen the role of sustainable livestock in a circular bio-economy.



Pictured in November 2019 at the One Health- Awareness to Action, Antimicrobial and Anthelmintic resistance conference in Tullamore were: (L to R) Dr. Lisa O Connor, Food Safety Authority of Ireland; Dr. David Graham, CEO Animal Health Ireland; Michael Creed T.D., Minister for Agriculture, Food and the Marine; Professor Gerry Boyle, Teagasc Director; Professor Michael Diskin, Teagasc.



Pictured at the joint Teagasc/SRUC Conference at Teagasc, Ashtown were (L to R): Professor Gerry Boyle, Director Teagasc; Liam Herlihy, Chairman, Teagasc; Professor Wayne Powell, CEO, SRUC, and Sandy Cumming CBE, Chairman SRUC.

Antimicrobial Resistance

This is one of the major current challenges facing the human population. It is estimated that by 2050, 10 million people will die annually due to antimicrobial resistance (AMR) unless major steps are immediately taken to reduce antimicrobial usage. Researchers at Teagasc Ashtown and elsewhere are applying social and behavioural sciences to antimicrobial resistance, specifically to help the move towards more responsible antibiotic use on farms. They are working with farmers, vets, and consumers to develop farm-level and market-level interventions to support behaviour change.

One component of this programme has included working with the Animal Health Ireland (AHI) CellCheck Implementation Group to employ a behavioural science approach to support greater engagement with selective dry cow therapy in the dairy sector in advance of legislative changes in 2022. Activities in 2019 included a farmer survey and CellCheck Implementation Group Workshop and an evaluation of an AHI initiative.

Soil improvement

The 2018 annual review of soil sample results prepared by Teagasc showed some improvement in soil fertility after years of decline or stagnation. The review tracked trends in soil fertility between 2007 and 2018. The analysis showed significant improvements in soil pH over the last few years and a halting of the decline in soil phosphorous (P) and potassium (K) levels, with some indication of improvements in 2018.

Sustainability at the National Ploughing Championships

'Driving sustainable growth' was the theme for the Teagasc stand at the National Ploughing Championships in Carlow, and all three pillars of sustainability economic, social, and environmental were addressed by Teagasc researchers, specialists, and advisors over the three day event. Enterprise specialists, environmental specialists and frontline advisors outlined the technologies to optimise farm productivity and enhance the environment.

Head of Environment Knowledge Transfer, Pat Murphy said; "low emission slurry spreading and protected urea are two technologies that farmers must adopt if we are to seriously address the levels of ammonia and greenhouse gases coming from agriculture. Enhancing biodiversity on farms, particularly through hedges and field margins, will be critical to the future, and looking at indicator species like bees is a great way to check that our farming activities are in tune with nature."

Dr. David Wall, Teagasc environment researcher said: “Soils underpin Irish agriculture and how we manage them to maintain soil quality is critical to the future productivity of Irish agriculture. Addressing issues like soil compaction and nutrient loss are steps that the individual farmer can take to improve their farming enterprises. The new team of water quality advisors (ASSAP) are working with farmers across the country to maintain and improve water quality.”

The outdoor exhibition at the Teagasc stand at the National Ploughing Championships showcased many good farming practices for the environment:

- The first paddock exhibited the soil profile, demonstrating rooting depth by grass and mustard crops and issues related to the management of soil compaction.
- The second paddock demonstrated how trailing shoe slurry application compares with splash plate application and outlined the benefits of protected urea fertiliser.
- The third paddock exhibited varying grass covers and how grass production and management can help optimise profitability sustainably.
- The final paddock showcased Integrated Pest Management (IPM). Measures to promote plant biodiversity and support bee populations were highlighted. Integrating forestry into sustainable production systems was also demonstrated.



The Teagasc exhibit at the National Ploughing Championships in 2019 included a marquee covering the wide range of Teagasc activities in research, advice and education. In addition there were number of outdoor demonstration areas covering production, soil management, enhancing biodiversity, and forestry. A highlight was when President Michael D. Higgins and his wife Sabena visited the Teagasc exhibit.



Supporting international food security

Kenya

Teagasc dairy experts started work in 2019 with their Kenyan counterparts on key issues of importance to the dairy sector in Kenya. Granted €1m in funding by the Irish Government via its Embassy in Kenya, an Irish-Kenyan consortium will begin a unique proof-of-concept project focusing on the roles of genetics and fodder in sustainable dairy farming.

Ethiopia

The Teagasc Agricultural Economics and Farm Surveys Department is currently working on a development project in Ethiopia in conjunction with University College Cork and supported by Irish Aid. The project aims to continue the long established Irish Aid funded development work taking place in Ethiopia's northern province of Tigray.

Vietnam

Teagasc economists with the support of a grant from Irish Aid are working with colleagues from Vietnam's Institute for Policy and Strategy for Agriculture and Rural Development (IPSARD) on developing capacity of Vietnamese researchers in the use quantitative models of agricultural commodity markets in the analysis of agricultural policy interventions in agricultural commodity markets.

ERITREA

The EU has formally approved a proposal for a dairy value chain project in Eritrea, led by Teagasc, and involving UCD, UCC, LUKE (Finland), Vita, Self Help Africa and a number of Eritrean institutions. The project will commence on 3rd February 2020 and will be funded for a 50-month period to the value of €4 million. The new proposal . The focus will be on three key objectives: (i) new innovations on smallholder farms and along the value chain with a focus on the contribution of dairy livestock; (ii) strengthening of research, education and innovation support capacity in Eritrea; (iii) new initiatives in relation to youth employment.

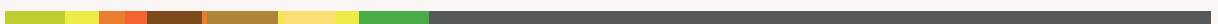


Pictured are Dr. Tom Beresford, Prof. Gerry Boyle, Mr Nguyễn Văn Hiếu - Vice Minister of Ministry of Planning and Investment, Dr. Lance O'Brien, Dr. Pat Dillon.

ENVIRONMENTAL SUSTAINABILITY

In 2019 the VistaMilk SFI Research Centre invested in the first systems in Ireland to measure methane production at grass. Methane, a potent greenhouse gas, is produced by micro-organisms in the gut of ruminants such as cattle and sheep. While altering farm management practices has considerable mitigation potential, there is also huge potential at the level of the individual animal to improve both economic and environmental sustainability.

The lead VistaMilk technician, Katie Starsmore pictured setting up the recently purchased Greenfeed system located in Teagasc Moorepark, the first Greenfeed systems in Ireland for measuring methane outdoors.



Agricultural Catchments Programme

EU Member States are required to monitor the effectiveness of their Nitrates Regulations, under Article 5 (6) of the EU Nitrates Directive. Under the GAP Regulations, DAFM has been monitoring the effectiveness of Ireland’s measures since 2008 through its significant funding of the Agricultural Catchments Programme which has been delivered by Teagasc since its inception. In 2019 the Minister for Agriculture, Food and the Marine, Michael Creed T.D., announced the continuation of the Agricultural Catchments Programme (ACP) for a further four years to 2023.

The theme for the 2019 Catchment Science conference was “Achieving quality water in diverse and productive agricultural landscapes under a changing climate.” Andrew Doyle T.D., Minister of State at the Department of Agriculture, Food and the Marine thanked the 300 farmers in the six catchments for their contribution in demonstrating Ireland’s ability to farm efficiently, while adopting new approaches to farming which reduces agriculture’s footprint on the environment.

Minister Doyle pointed out that the ACP has delivered substantial changes in nutrient management on farms. The proportion of fields with excess soil P has declined in four of the catchments, and the fields with very low or low P have increased indicating an overall decline in soil P levels thus reducing risk of P loss to water and this reflects the national trend.

During Hedgerow Week 2019 Teagasc held events for machinery contractors and farmers, as well as engaging with other stakeholders with an interest in hedgerows, in order to highlight best practice in hedgerow maintenance which provides the ideal environment for birds and pollinators.



Pictured with Andrew Doyle, T.D., Minister of State for Food, Forestry and Horticulture today at Teagasc Kildalton College launching Teagasc National Hedgerow Week 2019 were Dr. Catherine Keena, Teagasc Countryside Management Specialist; Professor Gerry Boyle, Teagasc Director and Francis Quigley, Teagasc Farm Machinery Specialist

Pictured at the Catchment Science 2019 Conference were: (L to R) Liam Herlihy, Teagasc Chairman; Jack Nolan, Department of Agriculture, Food and the Marine, Per-Erik Mellander, Edward Burgess, Teagasc; Caroline Read, Overseer Ltd, NZ; Andrew Doyle, T.D. Minister of State for Food, Forestry & Horticulture and Claudia Olazabal, European Commission.



Teagasc Agri-Environment Conference

“The government’s Climate Action Plan sets out the challenging targets for agriculture: Reduce emissions by 10 to 15% by 2030; deliver carbon sequestration; and support diversification including bio based products and bioenergy,” said Dr. Karl Richards, Head of Environment, Soils and Land-Use Research Department in Teagasc, at the Teagasc National Agri-Environment Conference 2019:

This Climate Action Plan contains many of the measures identified in the Teagasc Marginal Abatement Cost Curve (MACC), which assess the abatement potential of a range of mitigation measures, as well as their associated costs and benefits on both greenhouse gas (GHG) and ammonia emissions for the period 2020-2030.

A total of 14 cost-beneficial, cost-neutral and cost-effective mitigation measures were identified in the Teagasc MACC for reducing agricultural emissions (methane and nitrous oxide). These measures were estimated to reduce emissions by 1.85 Mt of carbon dioxide equivalents per year (CO₂-e yr⁻¹) between 2021 and 2030. The largest contributors to the abatement are using protected urea, improving dairy EBI and using low emission slurry spreading.

In addition, the MACC identified carbon sequestration from afforestation and management of high organic soils could potentially remove another 2.97 Mt CO₂-e yr⁻¹ from 2021-2030 reaching a maximum of 3.25 Mt CO₂-e yr⁻¹ by 2030. The cultivation of biofuel / bioenergy crops and anaerobic digestion has potential to account for a further reported reduction of 1.37 Mt CO₂-e yr⁻¹ by 2030, mainly associated with the displacement of fossil fuel usage.

The key message from Karl Richards was that we know the potential for mitigation, but now we have limited time to encourage farmers to adopt the actions and deliver mitigation. Early actions results in greater greenhouse gas reductions.



Bernard Harris, Department of Agriculture, Food & the Marine (DAFM); Professor Gerry Boyle, Teagasc Director; Dr. Helen Sheridan, University College Dublin (UCD); Mary Barrett, Local Authority Waters Programme (LAWPRO) & Dr. Mary Ryan, Teagasc pictured at the Teagasc National Agri-Environment Conference which took place in Co. Offaly

Mapping floods by satellite

A 2019 large-scale analysis of rural flooding demonstrated the potential of free ESA Copernicus data to map the extent and impact of flooding in rural areas. Sentinel 1A RADAR images were used to produce detailed national flood extent maps every 12 days between November 2015 and April 2016. The maps monitored changes in the extent of flooding in response to individual storms over the period and identified areas that had the most persistent flooding. Maximum flood area during this period was estimated to be 24,356 hectares, with persistent flooding (floods on eight or more consecutive occasions) identified on about 3,000 ha.

Lead author Dr. Rob O’Hara of the Teagasc Spatial Analysis unit explains: “Rural areas provide an important ecosystem function to towns and cities by absorbing much of the impact of winter floods. Provision of this function however can have a negative impact on rural areas for a considerable period after the flood event. After the flood waters recede, the underlying soils can remain saturated for several weeks.

“The impact on farmers was significant where winter fodder stores were exhausted and replacement grass could not be grazed. Combining the Sentinel flood map with multispectral images from the NASA/U.S. Geological Survey Landsat 8 satellite the impact of persistent or late winter floods on spring grass growth was observed. Where soils were still saturated in April, the satellite images indicated significantly less growth and did not recover to expected levels until July.”



Satellite view of flooding at Shannonbridge.

Staff Profiles



**Research Officer
Animal and
Bioscience,
Teagasc Athenry,
Co. Galway**

A native of county Mayo, Dr. Fiona McGovern is a research officer based at Teagasc

Athenry, Co. Galway. Fiona studied Animal Science before completing a PhD in animal nutrition from UCD before joining Teagasc as a post-doctoral research fellow.

Who are my customers?

“As a research officer my main focus is on the genetic and non-genetic factors affecting production in sheep systems. I am part of a team validating the Sheep Ireland maternal genetic sheep index which aims to evaluate the usefulness of high genetic merit sires in commercial flocks through examining ewe performance potential, lamb performance, carcass quality and ewe longevity across elite Irish versus New Zealand animals.”

Fiona is also investigating the relationship between feed intake, methane output and genetics in sheep systems. The environmental traits considered include greenhouse gas (methane, ammonia, nitrous oxide) emissions and nitrates. Nationally these are the first research projects which will investigate the methane output from grass based sheep production systems in Ireland and ultimately examine the impact of breeding high or low genetic merit animals on the environmental ‘hoofprint’ of the production system.



Goal 3

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

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 (HSA) and farming organisations to promote farm health and safety. The Teagasc occupational health and safety (OHS) programme encompasses both research and knowledge transfer through media, education and training and advice provision.

- In 2019, 18 farmers died in work related accidents out of a total of 46 workplace deaths, with 11 being aged 65 or older. During 2019, Teagasc with HSA, updated its geo-demographic study of fatal farm accidents trends since year 2004. In the most recent three-year period, 46% of farm deaths were in the 70 years or older category, 29% aged 55-69 and 25% aged 54 years or younger. The trend of reduced fatalities for under 55 year olds and increased fatalities over this age was evident in the study data.
- ‘The Farm Safety Experience’, an event promoting family safety on farms, took place at Coevin Farm, Borrisokane, Co. Tipperary in April. This was a collaborative event involving the Moran family, Teagasc, IFA, H.S.A., ICMSA, Arrabawn Co-op, FRS Networks, An Garda Síochána, Embrace and Agri Aware.

Minister of State for Food, Forestry and Horticulture Andrew Doyle T.D. visited the Farm Safety Exhibit at the Teagasc/FBD National Dairy Open Day at Teagasc Moorepark in July 2019. A feature of the exhibit was the use of drama/actors to depict the occurrence and consequences of a farm accident in an animated manner.



Promoting farm safety through theatre, at the Teagasc/FBD Moorepark'19 Dairy open day in Fermoy, Co Cork. Pictured are Michael Somers, Teagasc, Ciaran Roche, Risk Manager FBD, Paul McManus, actor, Brian Howe, Teagasc, Andrew Doyle, T.D., Minister of State at the Department of Agriculture, Food and the Marine & Professor Gerry Boyle, Teagasc Director.

- Major Farm Safety exhibits took place both at the Teagasc National Tillage Open Day ‘Crops and Spreaders’ at Teagasc Oak Park Carlow in June and at the National Ploughing Championships, Fenagh, Co Carlow. Health and Safety exhibits and demonstrations were also held in at Teagasc regional events. Teagasc staff also participated in events for the UK and Ireland ‘Farm Safety Week’ which took place in July.

- 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. The seminars were addressed by an accident victim who described the consequences of their injury. 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’ training to farmers nationally. The half-day training session provides practical methods for working safely on farms. It was developed in partnership with the HSA and deals with the reality of farm hazards. In 2019, about 1,700 farmers attended a half-day course provided by Teagasc.
- Teagasc was awarded Department of Agriculture, Food and the Marine Stimulus Research Funding to investigate behavioural approaches to improve farm safety. The funding has facilitated the appointment of a post-Doctoral researcher and two PhD Walsh Scholars.
- A new four year project commenced in 2019 to develop, deliver and evaluate bespoke training to equip Teagasc advisors and consultants with the knowledge, skills and competencies to engage farmers on health and safety issues. The project named ‘An Feirm Ground’ is sponsored by the Department of Agriculture, Food and the Marine and the Department of Health. It will be delivered in association with the National Men’s Health Development Network.
- Teagasc actively promotes Farm Health and Safety through its publications, (Today’s Farm, TResearch, Newsletters) and through the agricultural media. Particular use is made of social media such as Twitter, Facebook and Instagram. In 2019, eight national press releases were issued, associated with major Teagasc initiatives, events and occupational health and safety study reports.
- In 2019, Teagasc appointed a second National Specialist Advisor in Farm Health and Safety to increase Teagasc capacity to deliver Health and Safety Services to farmers and to accommodate the increasing research workload.
- In 2019, the European Agency of Safety and Health at Work (EU OSHA) awarded a contract to review the future of Agriculture and Occupational Safety and Health (OSH) to Teagasc in association with Leibniz-Institut für Agrartechnik und Bioökonomie e.V. (ATB), Germany and Mediterranean Agronomic Institute of Zaragoza – International Centre for Advanced Mediterranean Agronomic Studies (IAMZ CIHEAM), Spain. The Review is intended to inform policy makers and stakeholders of key issues related to progressing OSH in Agriculture in Europe.

Positive Mental Health in Farming



AGRICULTURE AND FOOD DEVELOPMENT AUTHORITY

- Teagasc Health and Safety Specialist John McNamara was an invited Speaker at International conferences in the UK and Estonia in 2019. In follow-up to the UK event a blog 'Promoting Farmer Mental Health – A Farm Advisory Perspective' was issued while following the Estonia conference the paper 'Farm health and safety adoption through engineering and behaviour change' was published in the Estonian Agronomy Journal. John McNamara also participated in an international research group on farm safety nudge theory at New York Centre for Agricultural Medicine and Health, USA.
- The EU COST Action – Safety Culture and Risk Management in Agriculture (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 John McNamara, Teagasc Health and Safety Specialist. In 2019, the Action produced interim Policy Recommendations.



European Commissioner for Innovation, Research, Culture, Education and Youth Ms. Mariya Gabriel (centre) with L to R: Professor Risto Rautiainen (Action Chair), Finland; Mr. Kevin Keary, EU Commission; Ms. Anne Marie Heiberg, Norway; Ms. Petya Stavreva, Bulgaria; Ms. Helle Birk Domino, Denmark; Mr. José Rato Nunes, Portugal; Mr. Pat Griffin, HSA Ireland and Dr. John McNamara, Teagasc (Action Vice Chair).

RURAL DEVELOPMENT

Equine husbandry

The 2019 Teagasc National Equine Conference addressed challenges and opportunities in the sector. A strong attendance received advice and insight from distinguished Irish, British, Belgian and Dutch panellists. Teagasc equine specialist Wendy Conlon said: “A variety of topics were addressed including pre-purchase veterinary examinations, the potential role of renewables in equine enterprises, while recognising the uncertainty and potential key challenges of Brexit.”

An equally well-attended event took place at Cooley Farm in Wicklow showcasing a variety of horses considered highly marketable and the relevance of a skilled rider and quality production system. Meanwhile young breeders were offered 10 training days on quality demonstration farms around the country and showcased their learning at both national and world championship competitions.

Irish Sport Horse (ISH) Studbook Young Breeders competed at the World Championships in July. The ISH Young Breeders Programme is a joint programme between Teagasc and Horse Sport Ireland’s Irish Sport Horse Studbook aimed at those aged 14-25 years of age who are interested in assessing, exhibiting and breeding performance horses.

Organic farming

In January 2019, Minister of State for Food, Forestry and Horticulture, Andrew Doyle T.D. launched a new seven-year strategy for the development of the Irish organic food sector. The strategy includes a wide range of recommendations to take account of projected market developments for the sector. The development of the strategy involved input from a wide range of industry stakeholders together with a public consultation process.

Teagasc has a lead role in the delivery of 24 actions in the strategy plan across the horticulture, cereals, dairy, meat and poultry sectors. Subsequent to the launch of the plan, an Organic Food Strategy Implementation Group which includes representation from Teagasc was established which periodically reports on progress made in the Strategy to the FW2025 High Level Implementation Committee.



Pictured with organic cereal producers and processors Andrew and Leonie Workman are Teagasc organic farming advisor Elaine Leavy (second from left) and Teagasc tillage advisor Alan McEvoy (right).

Transferring the Family Farm

Teagasc held another successful round of the Transferring the Family Farm Succession and Inheritance Clinics in 2019. There were twenty events in seven Regional Units running from the last week of September to the first week of October with over 1,000 farm families attending. Farmers and successors availed of the opportunity to get 'One to One' advice from local solicitors, accountants, mediation specialists, citizen's information, social protection officials as well as Teagasc enterprise advisors, and Teagasc specialists in forestry, financial management and collaborative farming.

Collaborative farming

Collaborative farming is where two or more farmers working together in a formal arrangement for the mutual benefit of those involved. The main benefit of a collaborative arrangement is that it can offer farmers increased returns through the ability to achieve scale at a lower capital cost; the reduction of costs which are duplicated between farmers; and risk sharing. Joint farming ventures can also help to address the social challenge of the 'one person farm' model making farming a more attractive occupation. They also open the possibility of sharing best farming and business management practice. Teagasc appointed a collaborative farming specialist in 2019.

Succession and inheritance

In June, in conjunction with the RDS, Teagasc held a Succession and Inheritance Conference with national and international speakers delivering papers that improved the understanding of factors which influence farmers and successors around the area of succession. Brian Leonard, RDS-Teagasc Walsh Scholar presented a paper "Lessons and Findings from his PhD Research – Irish Perspective on Land Mobility".

Profit Monitor

Over 16,500 Teagasc Profit Monitors were completed in total in 2019 – ca. 8,500 by Teagasc clients, 6,800 were completed for non-Teagasc clients by private consultants and almost 1,000 by Young Farmer and adult education students.

You can farm

The purpose of this interactive event held in Kerry (see picture below) was to promote dairy farming as a positive career, demonstrate different pathways to becoming a dairy farmer and to increase overall knowledge of dairy farming. This event was organised as part of the demonstration campaign for the NEFERTITI project. The event was organized under **Horizon 2020 NEFERTITI project** within Network 10 "Farm Attractiveness: You Can Farm".



Teagasc, in association with IASTA (Irish Agricultural Science Teachers' Association), hosted a 'You Can Farm' event with over 130 fifth year Agricultural Science students attending.

ECONOMICS

Teagasc National Farm Survey

The Teagasc National Farm Survey (NFS) continues to provide the official annual estimate of incomes earned from the main farming enterprises in Ireland. With the cooperation of participating farmers Teagasc's Agricultural Economics and Farm Survey Department annually collects detailed microeconomic and farm data from a representative sample of Ireland's farms.

The detailed data collected by the NFS forms the basis of much of the economic analysis published by Teagasc at its annual Review and Outlook conference where the economic performance and prospects for the main systems for Irish farming are presented each year. At the Review and Outlook conference held in November 2019 forecasts for all of the main farm systems in Irish agriculture were presented together with an update on Teagasc's economic analysis of the potential impact of Brexit on Irish agriculture and farm incomes.

By May of each year, the Agricultural Economics and Farm Survey Department would normally have official estimates from the Teagasc National Farm Survey on the outturn for agricultural incomes for the previous year. However, the COVID-19 emergency and related public health measures had an impact on the data collection activity of the National Farm Survey and delayed production of the results for 2019. Therefore, the incomes values provided for this report represent an approximation and will be subject to some revision when the National Farm Survey is published later in the summer of 2020.

Given the constraints outlined, best estimates suggest that the average family farm income in 2019 increased by about 4%, to a little over €24,200. However, the average income on different farm systems continues to vary greatly.

Average family farm income on Cattle Rearing farms increased to an estimated €9,600 in 2019, an increase of 15% on the 2018 figure, with a fall in production costs and additional support for the sector representing the main drivers. Cattle Other farms, which comprise a range of cattle production systems (e.g. cattle finishers) experienced an income decrease, despite having lower input costs and higher direct payments. Average Cattle Other farm income in 2019 was about €14,000, a decrease of 4% on the 2018 figure.

Dairy farms incurred the largest rise in incomes in 2019, with average dairy farm income reaching close to €68,000, representing an increase of 11% on the 2018 income. Concentrate feed use decreased substantially in 2019, due to a return to normal growing conditions following the drought of 2018.

Sheep farms also experienced an increase in income in 2019. Average Sheep farm income increased to about €14,600 an increase of 10% on the 2018 level.

While crop yields on tillage farms in 2019 rebounded from the low levels observed in 2018, there was a substantial reversal in cereal and straw prices, which completely eroded the benefit of improved yields. The average tillage farm income in 2019, is estimated to have been about €35,500, a decrease of 13% on the 2018 figure.



Dr. Kevin Hanrahan, Dr. Jason Loughrey, Mr. Tom Houlihan, Dr. Emma Dillon, Professor Gerry Boyle, Dr. Trevor Donnellan, Dr. Fiona Thorne, Mr. Michael McKeon, Dr. Anne Kinsella.

Brexit

The UK formally left the European Union on January 31st 2020, and is currently in a transition period that will come to an end on December 31st 2020. Throughout 2019 Teagasc economists undertook economic research on the potential impact of Brexit. This research has been provided to government and disseminated to industry stakeholders.

Presentations on the impact of different Brexit scenarios on Irish agriculture and farm incomes have been presented at Teagasc ConnectEd briefings, academic seminars in Ireland and the UK and a conference organised by PwC and the Central Bank of Ireland “On the Brink of Brexit”. The Teagasc economic research highlighted the large negative impact that Brexit could have on the value of Irish agri-food exports, agricultural sector income and farm level incomes.

Design thinking

Teagasc researchers are supporting user-centred technology design to ensure appropriate governance in relation to the digital transformation of agriculture. Initiatives have included working with the Department of Agriculture, Food and the Marine (as a Paying Agency), Telecommunications Software and Systems Group (TSSG), Waterford Institute of Technology, to employ a ‘design thinking’ approach to the development of a geo-tagged smart device app to support farmer compliance with various schemes; exploring the use of social media for knowledge exchange and informing good data governance practices regarding data ownership, use and sharing through a series of multi-actor ‘data & ethics’ national workshops with the farming, scientific and agtech communities.

The research programme is linking farmer behaviour to farm performance in digital agriculture with research to measure grass production and use through earth observation and the modelling of farm management response to extreme weather. One highlight from 2019 relating farm economic performance to extreme weather events was a finding that on Irish dairy farms every extra wet spring day means an extra 4.42 kg of concentrate needs to be fed per animal.

Completing the digital farming circle, the impact of farming on the environment is analysed with spatial analysis methods on farm drainage, high nature value farming and machine learning driven mapping of farm habitats feeding back information to the farmer on resilience, impacts and performance.

Grass as biomass

Is grass more than it seems? This was a question addressed by a group of specialists from New

Zealand, Denmark and Ireland during a four-day visit to three Teagasc Research Centres and the BEACON Bioeconomy Research Centre in 2019.

The impetus for this discussion is based on shared concerns regarding the need to address greenhouse gas emissions from agriculture, to address the need for improved use of our biological resources, recognition of the existence of complementary knowledge and experiences across the three countries, and a growing awareness of the opportunities presented by the sustainable circular bioeconomy.

SKIN

Teagasc is a key partner in the Short Supply Chain Knowledge and Innovation Network (SKIN), a project funded by the European Commission’s Horizon 2020 Innovation Programme (2017-2019).



Pictured at the third of three European Innovation Challenge Workshops held in Teagasc Ashtown are Bridin McIntyre, Dr. Anne Kinsella, Dr. Maeve Henchion and Dr. Aine Macken-Walsh.

Microsoft partnership

At Teagasc Ballyhaise Agricultural College, Cavan, then European Commissioner for Agriculture and Rural Development, Phil Hogan, pictured below 2nd from the right, joined Teagasc and Microsoft at the signing of a Memorandum of Understanding (MOU) which will see both organisations work together to develop agricultural-based technology that will advance Irish agriculture in support of rural development and innovation.



Picture shows from left Teagasc student, Killian Faulkner; Cathriona Hallahan, Managing Director of Microsoft Ireland; Gerry Boyle, Director of Teagasc; The then European Commissioner for Agriculture and Rural Development, Phil Hogan; and Teagasc student Noel Prunty in Ballyhaise Agricultural College in Cavan after the signing of a Memorandum of Understanding (MOU) which will see the roll out of a pilot Airband rural broadband initiative to help address rural connectivity.

RENEWABLE ENERGY

Energy and Rural Business

Run in association with Teagasc and the Irish Farmers Association (IFA), this event was held in Kilkenny in October. The Energy and Rural Business Show Ireland is the one stop shop for the latest opportunities in renewable energy and carbon management as well as practical farm diversification advice.

Biogas

The overall objective of the Small Biogas Demonstration Programme (SBDP) is to support the demonstration and deployment of on-farm small-scale anaerobic digestors. Anaerobic digestion (AD) technology is not widespread in the Republic of Ireland, despite being a commercially available technology, with many thousands of successful examples internationally and in Northern Ireland.

The main aims of the research are to establish the reduction in greenhouse gases from using AD, the improvement in farm carbon footprint and the contribution of digestate towards soil nutrient requirements for a typical dairy farm. Case studies on the demonstration and the supporting research will be disseminated through the Teagasc advisor and farm communication network, as well as through existing dissemination channels.

Teagasc hopes to commission its AD demonstration plant at Grange within the next 12 months.

Energy in Agriculture 2019

Farm-scale and community-based renewables are expected to be a central part of future energy policy in Ireland if the ambitions of Government's Climate Action Plan are to be delivered. The fourth Energy in Agriculture conference and exhibition took place at Gurteen Agricultural College in August. The major national event was launched by Minister of Agriculture Food and the Marine, Michael Creed T.D.

Energy in Agriculture is a joint initiative between Teagasc, Tipperary Co Council, IFA and Tipperary Energy Agency. The event's main sponsor was the Sustainable Energy Authority of Ireland (SEAI). Energy in Agriculture creates awareness of the benefits of renewable technologies for the farm business.

The Agri-futures arena gave attendees the opportunity to look at the latest in agri

Staff Profiles



A native of Mitchelstown, Co. Cork, Siobhán O'Farrell-Barry joined Teagasc in 1997 working in the Advisory Office in Moorepark. She moved to the position of

Staff Officer at Kildalton College in 2000, and then moved back to Moorepark in 2008, where her current role is Finance Officer in the Research Grants Finance Team.

Who are my customers?

As a member of the Research Grants Finance Team, I provide support to project leaders with the financial management of externally funded projects, from inception to final report and audit. I prepare and submit claims according to funding agency and Teagasc guidelines and monitor the collection of funding due to Teagasc. My customers are both internal and external parties.

My internal customers are project leaders and other researchers working on funded projects, as well as other teams within the Finance Department. My external customers are the various funding agencies that Teagasc deal with, along with other research institutions such as universities, both in Ireland and abroad. I ensure that queries, audit points and rejected expenses are kept to a minimum and that Teagasc claim the maximum amount of external funding available.

technology, a chance to trial the latest electric vehicles as well as a look at the fully electric Kramer loader. The expo hall had over 60 exhibitors and was a hive of activity with all areas represented; solar pv, wind, biomass, finance and consultancy.



Goal 4

Enhance organisational capability and deliver value for money

COMMUNICATIONS STRATEGY

In 2019 Teagasc finalised an internal communications and engagement strategy. It is built around a clear message to staff – ‘I’m the Difference’ – and includes five major objectives:

- ensure staff know what the organisation is trying to achieve at all times,
- encourage involvement and innovation through sharing of ideas and views,
- help staff understand the importance of the role they and their colleagues play in the wider organisation,
- acknowledge and celebrate the impact of the organisation and the achievements of individual staff as a matter of daily routine
- support and reinforce a clear statement of Teagasc People Values that we all aim practice in our working lives.



Pictured at the launch Martina Donnelly, Teagasc Authority member, Alan Phelan, Professor Gerry Boyle, Siobhan Culleton, Teagasc Chairman Liam Herlihy.



Equality and Human Rights

All public bodies in Ireland have a responsibility to promote equality, prevent discrimination and protect the human rights of their employees, customers, service users and everyone affected by their policies and plans. This is a legal obligation, called the Public Sector Equality and Human Rights Duty, and it originated in Section 42, the Irish Human Rights and Equality Act 2014. These duties have been part of Irish Law since 2014.

The duty is an on-going obligation on public bodies, which must be incorporated as part of an organisation's overall strategic planning cycle. While a number of initiatives have, and are being, progressed as part of the Gender and Diversity projects which will have a positive impact on the human rights of our staff, public bodies are also asked to 'account for their actions to address the human rights and equality impact of their work as it relates to members of the public, people who use their services, and their staff, in their annual report'.

While Teagasc has been addressing building access issues as part of the buildings projects, is supporting students with special needs and the most vulnerable of our clients, other human rights of our service users have not been formally assessed to identify if there are gaps in the services we provide. This will be progressed in 2020.

National Partnership Committee

The National Partnership Committee met five times in various Teagasc locations in 2019. During 2019 staff representatives at National Partnership had the opportunity to review policy and strategy documents for the organisation prior to the final version being published including the CCTV policy, ICT Acceptable Usage Policy, Child Safeguarding Policy and Internal Communications Strategy.

Partnership Working groups were established to assist with the embedding of the new Health & Safety system and to consider proposals around Work Life Balance. Work Life Balance proposals required further consideration and work progressed into 2020. Staff saw the introduction of the H&S system as very positive and the working group established numerous measures to assist staff embed the new ways of working and contribute to the success of the system in Teagasc. A Partnership Education Working group continued to hold two meetings in 2019 to discuss various matters in the area of Education.

Martina Donnelly was appointed the new joint chairperson of the National Partnership Committee in November 2019, following the retirement of Joseph Larkin from the role and Teagasc.

Finance

In 2019 the Finance Department supported continuous improvement in financial management in Teagasc. Budgeting capability in Teagasc is evolving and maturing with the support of the Finance Department. Financial management training was provided to research Principal Investigators and the Finance Department supported a DAFM call with 72 project budgets. Automatic distribution of regular finance reports to managers commenced. Standard processes for debt collection were agreed and implemented.

Information and Communications Technology

2019 saw Teagasc introduce the new Health & Safety system which was implemented across all locations. Phase 1 of a major upgrade to Teagasc's Wi-Fi infrastructure was completed, with Wi-Fi now available in all offices. The Student Management System replacement project brought online applications and results to all college courses. A new Customer Relationship Management and Billing system was tested and is ready for a 2020 implementation. Teagasc also continued to invest in upgrading the high speed data links to its larger campuses.

International Women's day

Over 120 staff attended the career insights workshop and networking event at Teagasc Moorepark to mark International Women's Day in March. This follows the staff conference on Gender and Diversity held on International Women's Day in 2018.

This year's Balance for Better event, attended by both male and female colleagues, focused on sharing career insights and how to better support female talent across the organisation.

Following some interesting presentations from colleagues and external speakers, Judith Spring from Kingstown College spoke about the Teagasc Leading from Within Programme and facilitated a 'What is holding us back?' workshop.

Teagasc Customer Charter

An updated Teagasc Customer Charter leaflet and new Customer Action Plan for 2019-2021 was completed in 2019.

- The Customer Charter briefly outlines the level of service we aim to provide to our external customers and describes our customer complaints procedure.
- The Customer Action Plan sets out a range of initiatives aiming to build on progress achieved in recent years. It provides a framework to measure, report on, and improve the quality of our customer service across the organisation.

Research funding

Teagasc secured €3.7 million funding for research from the European Commission's Horizon 2020 programme in 2019. In comparison with all other research organisations and universities across Europe, Teagasc is ranked 5th in terms of number of projects awarded in the agri-food stream of European funding since Horizon 2020 began in 2014.

Copies of the new Customer Charter leaflet are available to staff and clients at Teagasc reception desks.



Members of the joint Oireachtas committee on agriculture visited Teagasc Moorepark in February 2019. Pictured L to R; Dr. Mark Fenelon, Dr. Michael O Donovan, Teagasc, Mr. Jackie Cahill T.D. and Vice chairman; Senator Tim Lombard, Professor Gerry Boyle, Teagasc Director; Mr. Pat Deering, T.D. and chairman, Senator Paul Daly, Mr. Kevin O Keeffe T.D., Dr. Pat Dillon, Dr. Donagh Berry Teagasc.

Engaging People Programme

In 2019 Teagasc started a major internal awareness campaign on sustainability 'Engaging People Programme', including reductions in energy use and waste, increasing recycling, eliminating single-use plastics and conserving water. An energy awareness team has been put in place to work with Teagasc's electricity, waste, catering and other suppliers to improve sustainability.

Local Green Champions have volunteered in every Teagasc site; these are people who want to play their part by promoting sustainability initiatives in the workplace and in encouraging and engaging their colleagues to reduce their environmental impact.

New portal for online recruitment

The Teagasc Human Resources department launched a new portal for online recruitment (Teagasc Opportunities Portal - TOPjobs). To apply for future job vacancies in Teagasc, candidates must have a profile on TOPjobs and submit their application using the portal. TOPjobs is user-friendly and interactive and will ensure a more efficient service to candidates and managers.

Teagasc and TNO sign Memorandum of Understanding

Teagasc and TNO, the Dutch technological innovation centre, signed a Memorandum of Understanding (MoU) in the presence of the Dutch Ambassador, HE Mr. Adriaan Palm, in Teagasc Head Office, Oak Park, Carlow, in April.



Pictured at the signing of a memorandum of understanding (MoU) between Teagasc and the Netherlands Organisation for Applied Scientific Research (TNO) are, from left: Professor Gerry Boyle, Director of Teagasc; Ir. Berry Vetjens, Director of Markets, TNO and HE Mr. Adriaan Palm, the Dutch Ambassador to Ireland.

Science Week

During the Science Foundation Ireland Science Week in November the Teagasc 'Festival of Farming and Food' took place at venues all around the country. With almost 30 events taking place over eight counties, ranging from workshops for schools, open days, exhibitions and public lectures.

The theme of 2019's Science Week was 'Climate Action' and this theme was incorporated throughout the event programme to help people understand climate change, how science and technology can help create a positive climate future and the impact individuals can have on climate change.



Just some of the events were:

- At Teagasc Grange in Meath, Teagasc joined forces with the EU Health and Food Safety Office for the public lecture 'Antibiotics, Animal Health and Climate Action', chaired by Minister for European Affairs, Helen McEntee, T.D.
- Teagasc Ashtown held a 'Slice of Science' event at nearby Blanchardstown Library, Dublin, attendees met science Teagasc researchers in the fields of food, horticulture and spatial science.
- In Teagasc Moorepark, Fermoy, TV presenter Kathriona Devereux hosted a '60 Minute Science' event 'Feeding the Future: the Science of Sustainability and Climate Change' featuring Teagasc researchers.

Dr. Maria Hayes, Teagasc Ashtown, with young Science Week visitors examining baked goods which include healthy marine algae.



Johnstown Castle

Johnstown Castle Estate, Museum and Gardens formally opened to the public at the beginning of August. So far, eight of the castle's rooms have been restored. The restoration is part of a four-year project to create the new Johnstown Castle Estate, Museum and Gardens Experience.

"The restored castle rooms give a glimpse of life both upstairs and downstairs at the castle. This includes an 86-metre long servants' tunnel that runs underground from the meat house to the kitchens, the kitchens themselves, wine cellar, impressive Apostles Hall, library and dining room with their 3D carved ceilings and the grand drawing room and bedroom on the first floor," Tom Doherty, Chief Operations Officer, Teagasc. Visitors also have access to the Irish Agricultural Museum's fascinating exhibits.

While Teagasc will still own the entire estate, the castle and gardens are being leased to the Irish Heritage Trust for 10 years and they will operate the attraction. Funding for the castle renovation and the other new facilities was provided by the Department of Agriculture, Food and the Marine (€5.0m) and Fáilte Ireland (€2.5m).

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 2019, Teagasc consumed 26,112 MWh of energy, which is a decrease of almost 3% on its 2018 consumption. This is broken down as follows:

- 10,964 MWh of electricity (42% of total energy);
- 10,058 MWh of fossil fuel for space heating (38.5% of total energy);
- 4,439 MWh of vehicle fuel, consisting of agricultural, commercial transport and car fleet (17% of total energy);
- 660 MWh of renewable fuels (2.5% 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 and Teagasc is conducting condition surveys on all its buildings which will inform the development and implementation of a building upgrade programme. Teagasc has developed an energy action plan and project pipeline as a result of a strategic energy auditing program.

A number of projects, such as insulation, solar and heat pump installations, Heating, Ventilation and Air-conditioning (HVAC) controls optimisation & Building Management System (BMS) upgrades across the organisation continue to be delivered as funding becomes available. A group wide LED lighting retrofit programme has also commenced, which will deliver carbon emissions reductions of c.700t/year when delivered.



Pictured following the signing of an agreement to form the China-Ireland Sustainable Dairy Development Centre in Beijing on in May are from left to right: Professor Gerry Boyle, Director, Teagasc; Professor Alexander Evans, Dean of Agriculture, UCD; Mr. Michael Creed, Minister for Agriculture Food and Marine; Mr. Han Changfu, Minister of Agriculture and Rural Affairs, China; Professor Qin Yuchang, Director General, Institute of Animal Science, Chinese Academy of Agricultural Sciences; Ms. Ma Ying, Secretary General and Deputy Director, Institute of Animal Science, Chinese Academy of Agricultural Sciences and Professor Frank O'Mara, Director of Research, Teagasc.

RECOGNISING ACHIEVEMENT

UCC recognises outstanding leaders

Teagasc Director Professor Gerry Boyle was awarded an Honorary Doctorate of Science by University College Cork.



Pictured following the award ceremony are Professor Gerry Boyle, Daragh Horgan, Rena Buckley, Siobhán Talbot and Marty Meehan.

The Royal Swedish Academy

The Royal Swedish Academy of Agriculture and Forestry (KSLA) appointed Professor Tom Kelly, Director of Knowledge Transfer in Teagasc, as an International Fellow of the Academy's General section. The award ceremony took place in Stockholm in January, and is in recognition of Professor Kelly's work towards the development of European agriculture and rural areas.



Professor Tom Kelly (left) pictured with Eva Pettersson, General Secretary and Managing Director of the KSLA, (Royal Swedish Academy for Agriculture and Forestry) and Shane Hamill, Trade Manager, Bord Bia (North East Europe).

Royal Irish Academy

Professor Catherine Stanton, Teagasc Food Research Centre, Moorepark, one of the 27 new members of the Royal Irish Academy. Pictured receiving her scroll from Professor Peter Kennedy, President of the Royal Irish Academy.



Gold Medal Award



Mr. Dermot McCarthy (Head of Advisory Services) is the 2019 Gold Medal Award winner.

Dermot joined the Department of Agriculture in 1979 from where he took up a position in ACOT and was one of the key farm management specialists during the introduction of milk quotas.

During this time, Dermot was a key support to advisors in the development of financial services for farmers, including tax accounts analysis, dairy and beef management information systems and early versions of the Profit Monitor and Finpack planning tools.

In 1996, Dermot was appointed Chief Dairy Advisor and led the team of Dairy Specialists at a time when joint programmes with dairy industry partners were embedded as a critical component in supporting the dairy sector. In 2005, he took up the position of Assistant Director of Advisory Services South and in 2010 was appointed Head of Advisory Services with responsibility for all regions.

Well done to Dermot and to the other nominees: John Hogan (Farm Manager at Oak Park), Anne Birch (Head Office Receptionist) and Jim Grant (Statistician, Research Directorate). Statistician).

Teagasc Annual Walsh Fellowships Seminar

The overall Teagasc Walsh Fellow of the year in 2019 was Hazel Rooney. She was the Winner of 'Best oral presentation and winner of Teagasc Gold Medal' at the annual Teagasc Walsh Fellowship seminar. Gerry Boyle and Hazel Rooney. Pictured right: Professor Gerry Boyle and Dr. Hazel Rooney.



Animal Welfare award

Dr. Laura Boyle, Senior Research Officer at Teagasc, received the 2019 British Society of Animal Science (BSAS) and Royal Society for the Prevention of Cruelty to Animals (RSPCA) award for Innovative Development in Animal Welfare, which was presented at the BSAS Annual Conference in Edinburgh.

Science Foundation Ireland award

Dr. Orla O'Sullivan, APC Microbiome Ireland SFI Research Centre and Vistamilk SFI Research Centre, Teagasc receiving the SFI Early Career Researcher of the Year award 2019 from Prof. Mark Ferguson Director General SFI (right) and Prof. Paul Ross, UCC.



BT Young Scientist

County Westmeath student Charlie Drumm was the winner of the Teagasc award at BT Young Scientist and Technology Exhibition 2019. Charlie was presented with the award by Teagasc Director, Professor Gerry Boyle. Charlie developed the Freshgraze system – an automated cloud-controlled moving fence for livestock.

The Freshgraze device means the cows never get a chance to walk on the fresh grass but will always have fresh grass available. The grass allocated can easily be changed by the farmer at any time during the day from their smartphone.



Equine success

Rosemary Gaffney (Equine Course Director, Kildalton College) was part of the winning Irish Para Dressage team at Showjumping's Longines Global Champions Tour in Doha, Qatar, in March 2019. Rosemary and her three team-mates won third place at the CHI Al Shaqab, one of the most prestigious events on the international equestrian calendar.





Report of the Authority and Consolidated Financial Statements

Financial Year ended 31 December 2019

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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 2019 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 2019 and of the Group's income and expenditure for 2019 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
29 June 2020

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 a significant effect on the activity of Teagasc. The Authority is closely monitoring the potential impact of the pandemic on the 2020 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.

A number of Teagasc income sources are expected to fall short of original expectations for 2020 and as a result a very cautious approach to expenditure is being taken. The majority of Teagasc's income comes from the state in the form of Grant in Aid, research project funding and other grants. At the date of signing the financial statements Teagasc has received no indication that state funding is at risk. The indications from the review of income arising from Covid-19 are that the risk is manageable. The Authority has responsibility for ensuring the preparation of the annual report and consolidated financial statements for each financial year. The Authority believes it appropriate to continue to adopt the going concern basis in preparing the financial statements.

GOVERNANCE STATEMENT AND AUTHORITY MEMBERS' REPORT

This view is based on income, expenditure and cashflow forecasts for a period of twelve months from the date of signing of the financial statements which demonstrate that there is no material uncertainty regarding Teagasc's ability to meet its liabilities as they fall due. Based on all information available to the Authority and the expected continuation of education courses, research projects and advisory services the Authority deem it viable that the going concern basis continues into future financial years.

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 04 March 2020.

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.

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 2019.

Authority performance review

An external performance evaluation of the how the Board of Teagasc operates was undertaken in 2019.

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 2019:

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
Larkin, Mr. Joseph	Ordinary Member	10 October 2014 – 09 October 2019
Murphy, Ms. Cliona	Ordinary Member	29 April 2015 – 28 April 2020
O'Connell, Ms. Eilís	Ordinary Member	30 October 2018 – 21 January 2023
Woulfe, Mr. Liam	Ordinary Member	29 April 2015 – 28 April 2020

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 2019 were: Mr. Liam Woulfe, Chairperson, Prof. Thia Hennessy and Ms. Eilís O'Connell. The external member was Mr. Noel O'Connell. There were four meetings of the ARC in 2019.

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 2019 were: Mr. Tommy Cooke, Chairperson, Mr. Liam Herlihy,

GOVERNANCE STATEMENT AND AUTHORITY MEMBERS' REPORT

Ms. Cliona Murphy and Mr. Joe Larkin. There were four meetings of the OC in 2019. During 2019 Mr. Joe Larkin completed his term on the Authority and was replaced on the committee by Ms. Martina Donnelly.

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 2019 were: Mr. Richard Kennedy, Chairperson, Mr. Patrick Duffy, Mr. Joe Larkin, Mr. Tommy Cooke and Mr. John Buckley. There were three meetings of the AEC in 2019. During 2019 Mr. Joe Larkin completed his term on the Authority and was replaced on the committee by Ms. Martina Donnelly.

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 2019 were: Prof. Gerald Fitzgerald, Chairperson, Mr. Richard Kennedy, Mr. Joe Larkin, Mr. John Buckley and Prof. Thia Hennessy. There were two meetings of the RC in 2019. During 2019 Mr. Joe Larkin completed his term on the Authority and was replaced on the committee by Ms. Martina Donnelly.

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 2019 were: Mr. Liam Herlihy, Chairperson, Prof. Gerald Fitzgerald, Mr. Tommy Cooke, Ms. Cliona Murphy, Prof. Thia Hennessy and Mr. Patrick Duffy. There was no meeting of the NC in 2019.

Schedule of attendance, fees and expenses

Schedule of attendances at the Authority and Committee meetings for 2019 is set out below including the fees and expenses received by each member:

Authority Meetings 2019	09 - Jan	06 - Feb	06 - Mar	03 - Apr	01 - May	05 - Jun	03 - Jul	04 - Sep	02 - Oct	06 - Nov	04 - Dec	Fees 2019 €	Expenses 2019 €
Herlihy, Mr. Liam	√	√	√	√	√	√	√	√	√	√	√	20,520	9,644
Buckley, Mr. John	√	√	√	√	√	√	√	√	√	√	√	11,970	4,582
Cooke, Mr. Tommy	√	√	√	√	√	√	√	√	√	√	√	11,970	860
Donnelly, Ms. Martina										√	√	-	641
Duffy, Mr. Patrick	√	√	√	√	√	√	√	√	√	√	√	11,970	3,359
Fitzgerald, Prof. Gerald	√	√	√	√	√	√	√	√	-	√	√	3,990	2,643
Hennessy, Prof. Thia	√	√	√	√	√	√	√	√	√	√	√	-	1,886
Kennedy, Mr. Richard	√	√	√	√	-	√	√	√	√	√	√	11,970	1,068
Larkin, Mr. Joe	√	√	√	√	√	√	√	√	√			-	1,865
Murphy, Ms. Cliona	√	√	√	√	√	√	√	-	-	√	√	-	1,717
O'Connell, Ms. Eilís	√	√	√	√	√	-	-	√	√	√	√	-	982
Woulfe, Mr. Liam	√	√	√	-	√	√	√	√	√	√	√	11,970	1,626
												84,360	30,873

There were four Authority members who 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 €5,652 in 2019.

TEAGASC CONSOLIDATED FINANCIAL STATEMENTS

FINANCIAL YEAR ENDED 31 DECEMBER 2019

GOVERNANCE STATEMENT AND AUTHORITY MEMBERS' REPORT

Audit & Risk Committee	22 - Feb	02 - Jul	02 - Oct	04 - Dec
Woulfe, Mr. Liam	√	√	√	√
Hennessy, Prof. Thia	√	√	√	√
O'Connell, Ms. Eilís	√	-	√	√
O'Connell, Mr. Noel	√	√	√	√

Operations Committee	26 - Feb	27 - May	26 - Aug	20 - Dec
Cooke, Mr. Tommy	√	√	√	√
Herlihy, Mr. Liam	√	-	√	-
Murphy, Ms. Cliona	√	-	√	√
Larkin, Mr. Joe	√	√	√	
Donnelly, Ms. Martina				√

Advisory & Education Committee	22 - Feb	31 - Jul	15 - Nov
Kennedy, Mr. Richard	√	√	√
Duffy, Mr. Patrick	√	√	-
Larkin, Mr. Joe	√	√	
Cooke, Mr. Tommy	-	√	√
Buckley, Mr. John	√	√	√
Donnelly, Ms. Martina			-

Research Committee	05 - Jun	15 - Nov
Fitzgerald, Prof. Gerald	√	√
Kennedy, Mr. Richard	-	√
Larkin, Mr. Joe	√	
Hennessy, Prof. Thia	√	-
Buckley, Mr. John	√	√
Donnelly, Ms. Martina		-

Key personnel changes

Following one retirement one new member was appointed to the Authority during 2019.

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.

	2019	2018
	€'000	€'000
Legal advice	201	430
Financial/ tax advice	27	85
Pensions/ human resources	76	78
Architectural/ engineering advice	813	1,034
Research advice	226	347
Other	289	215
Total consultancy costs	<u>1,632</u>	<u>2,189</u>
Consultancy costs capitalised	736	837
Consultancy costs charged to Income and Expenditure and Retained Revenue Reserves	896	1,352
Total	<u>1,632</u>	<u>2,189</u>

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.

	2019	2018
	€'000	€'000
Legal fees – legal proceedings	43	81
Counterparty legal costs	9	17
Settlements	175	179
Total	<u>227</u>	<u>277</u>

The total number of cases included in the 2019 settlements is 24 (2018: 22).

Travel and subsistence expenditure

Travel and subsistence expenditure is categorised as follows:

	2019	2018
	€'000	€'000
Domestic		
Authority	31	30
Employees	4,768	4,794
International		
Authority	-	-
Employees	837	814
	<u>5,636</u>	<u>5,638</u>

GOVERNANCE STATEMENT AND AUTHORITY MEMBERS' REPORT

Hospitality expenditure

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

	2019	2018
	€'000	€'000
Staff hospitality	36	28
Client hospitality	18	12
Total	<u>54</u>	<u>40</u>

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 2019 was €41,362 (2018: €42,086).

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 2019 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 2019.

Mr. Liam Herlihy
Chairman
26 June 2020

Mr. Tommy Cooke
Member of the Authority
26 June 2020

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 2019 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 four times in 2019.

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 €59.7m. Teagasc reviews the compliance status of all purchase orders with a value greater than €25,000. In 2019 Teagasc found that of 233 purchase orders, those relating to four suppliers were non-compliant and the value of non-compliant purchase orders was €168,098. A further €309,645 was incurred with a telecommunications supplier and Teagasc network lines are being replaced on a phased basis under a compliant contract. Notwithstanding that these procurements were non-compliant Teagasc is satisfied that they achieved good value for money.

Of the seven non-compliant suppliers in 2018 three remained in 2019. The telecommunications supplier referred to above has a compliant contract with the OGP and once the remaining lines have been installed to this network Teagasc will be compliant. Included in the non-compliant purchase orders for 2019 is another telecommunication supplier and an outsourcing supplier that were non-compliant in 2018. The telecommunication supplier's lines are being moved on a phased basis to a compliant provider and a procurement process is being commenced for the outsourcing supplier.

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 have 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. At 31 December 2019 this sanction was outstanding.

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 2019 on 05 February 2020.

Internal control issues

No weaknesses in internal control, apart from those noted under Procurement, were identified in relation to 2019 that require disclosure in the financial statements.

Mr. Liam Herlihy
Chairman
26 June 2020

TEAGASC CONSOLIDATED FINANCIAL STATEMENTS

FINANCIAL YEAR ENDED 31 DECEMBER 2019

CONSOLIDATED STATEMENT OF INCOME AND EXPENDITURE YEAR ENDED 31 DECEMBER 2019

	Notes	2019 €'000	2018 €'000
Income			
Oireachtas grants	4	149,594	149,171
EU funding	5	3,440	2,045
Livestock trading income		3,302	2,692
Operational income	6	34,684	33,245
Net deferred funding for retirement benefits	10	(6,421)	(2,644)
Gain on disposal of fixed assets	12	162	34
Other grants, donations and voluntary levies		4,665	5,693
Sale of goods		134	103
Research and technology services		1,819	1,867
Total Income		<u>191,379</u>	<u>192,206</u>
Expenditure			
	7	<u>(185,684)</u>	<u>(186,612)</u>
Operating surplus		5,695	5,594
Interest receivable		16	15
Surplus before transfers and taxation		5,711	5,609
Transfer to Capital Account	24	<u>(5,787)</u>	<u>(4,802)</u>
(Deficit)/ surplus for the financial year before taxation		(76)	807
Taxation	11	<u>(9)</u>	<u>(18)</u>
(Deficit)/ surplus for the financial year		<u>(85)</u>	<u>789</u>
(Deficit)/ surplus attributable to			
Teagasc		(98)	739
Non-controlling interest		13	50
		<u>(85)</u>	<u>789</u>

The Statement of Cash Flow and Notes 1-36 form part of these financial statements.

Mr. Liam Herlihy
Chairman
26 June 2020

Professor Gerry Boyle
Director
26 June 2020

TEAGASC CONSOLIDATED FINANCIAL STATEMENTS

FINANCIAL YEAR ENDED 31 DECEMBER 2019

CONSOLIDATED STATEMENT OF COMPREHENSIVE INCOME

YEAR ENDED 31 DECEMBER 2019

	Notes	2019 €'000	2018 €'000
(Deficit)/ surplus for the financial year		(85)	789
Actuarial (loss)/ gain on retirement benefit liabilities	10	(156,742)	136,676
Adjustment to deferred retirement benefit funding	10	156,742	(136,676)
Total comprehensive income for the year		<u>(85)</u>	<u>789</u>
Teagasc		(98)	739
Non-controlling interest		13	50
		<u>(85)</u>	<u>789</u>

The Statement of Cash Flow and Notes 1-36 form part of these financial statements.

Mr. Liam Herlihy
Chairman
26 June 2020

Professor Gerry Boyle
Director
26 June 2020

TEAGASC CONSOLIDATED FINANCIAL STATEMENTS

FINANCIAL YEAR ENDED 31 DECEMBER 2019

STATEMENT OF FINANCIAL POSITION AS AT 31 DECEMBER 2019

	Note	Group		Teagasc	
		2019 €'000	2018 €'000	2019 €'000	2018 €'000
Non-current assets					
Property, plant and equipment	12	121,211	110,865	108,768	102,981
Investments	14	616	719	617	720
		<u>121,827</u>	<u>111,584</u>	<u>109,385</u>	<u>103,701</u>
Current assets					
Inventories	15	5,542	5,265	5,542	5,265
Receivables: amounts falling due within one year	17	27,142	27,610	26,605	27,005
Cash and cash equivalents	18	35,230	27,645	32,127	25,709
		<u>67,914</u>	<u>60,520</u>	<u>64,274</u>	<u>57,979</u>
Payables: amounts falling due within one year					
Payables and accruals	19	21,649	18,802	20,551	18,314
Deferred income	21	30,286	26,299	30,226	26,200
		<u>51,935</u>	<u>45,101</u>	<u>50,777</u>	<u>44,514</u>
Net current assets		<u>15,979</u>	<u>15,419</u>	<u>13,497</u>	<u>13,465</u>
Total assets less current liabilities		137,806	127,003	122,882	117,166
Provisions for liabilities					
Deferred tax	23	120	119	-	-
Payables: amounts falling due after one year					
Deferred income	22	350	354	151	108
Payables and accruals	20	375	-	-	-
		<u>136,961</u>	<u>126,530</u>	<u>122,731</u>	<u>117,058</u>
Deferred retirement benefit funding	10	1,299,840	1,149,519	1,299,840	1,149,519
Retirement benefit liabilities	10	(1,299,840)	(1,149,519)	(1,299,840)	(1,149,519)
Net assets		<u>136,961</u>	<u>126,530</u>	<u>122,731</u>	<u>117,058</u>
Capital and reserves					
Capital account		108,768	102,981	108,768	102,981
Revenue reserves		15,448	15,533	13,963	14,077
Capital contribution		12,745	8,016	-	-
		<u>136,961</u>	<u>126,530</u>	<u>122,731</u>	<u>117,058</u>
Reserves attributable to Teagasc		129,974	120,445	122,731	117,058
Non-controlling interest		6,987	6,085	-	-
		<u>136,961</u>	<u>126,530</u>	<u>122,731</u>	<u>117,058</u>

The Statement of Cash Flow and Notes 1-36 form part of these financial statements.

Mr. Liam Herlihy
Chairman
26 June 2020

Professor Gerry Boyle
Director
26 June 2020

TEAGASC CONSOLIDATED FINANCIAL STATEMENTS

FINANCIAL YEAR ENDED 31 DECEMBER 2019

CONSOLIDATED STATEMENT OF CHANGES IN CAPITAL AND RESERVES AS AT 31 DECEMBER 2019

GROUP

		Capital account	Capital contribution	Revenue reserves	Capital contribution	Total	
				Group	Non- controlling interest		
	Note	€'000	€'000	€'000	€'000	€'000	
At 1 January 2018		98,179	-	14,165	579	3,044	115,967
Surplus for the year		-	-	739	50	-	789
Actuarial gain on retirement benefit liabilities	10	-	-	136,676	-	-	136,676
Adjustment to deferred retirement benefit funding	10	-	-	(136,676)	-	-	(136,676)
Total comprehensive income		-	-	739	50	-	789
Addition to capital contribution		-	2,560	-	-	2,412	4,972
Amounts capitalised in respect of purchased assets	12	12,899	-	-	-	-	12,899
Net amount released on disposals	12	(468)	-	-	-	-	(468)
Less: amortised in line with asset depreciation	12	(7,629)	-	-	-	-	(7,629)
At 31 December 2018		102,981	2,560	14,904	629	5,456	126,530
			120,445		6,085		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

The Statement of Cash Flow and Notes 1-36 form part of these financial statements.

TEAGASC CONSOLIDATED FINANCIAL STATEMENTS

FINANCIAL YEAR ENDED 31 DECEMBER 2019

STATEMENT OF CHANGES IN CAPITAL AND RESERVES AS AT 31 DECEMBER 2019

TEAGASC

	Note	Capital account €'000	Revenue reserves €'000	Total €'000
At 1 January 2018		98,179	13,405	111,584
Surplus for the year		-	672	672
Actuarial loss on retirement benefit liabilities	10	-	136,676	136,676
Adjustment to deferred retirement benefit funding	10	-	(136,676)	(136,676)
Total comprehensive income		-	672	672
Amounts capitalised in respect of purchased assets	12	12,899	-	12,899
Net amount released on disposals	12	(468)	-	(468)
Less: amortised in line with asset depreciation	12	(7,629)	-	(7,629)
At 31 December 2018		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

The Statement of Cash Flow and Notes 1-36 form part of these financial statements.

TEAGASC CONSOLIDATED FINANCIAL STATEMENTS

FINANCIAL YEAR ENDED 31 DECEMBER 2019

CONSOLIDATED STATEMENT OF CASH FLOW AS AT 31 DECEMBER 2019

GROUP

	Note	2019 €'000	2018 €'000
Cash flow from operating activities	28	21,065	19,523
Interest paid		(91)	(77)
Taxation paid		(9)	(9)
Net cash flow from operating activities		<u>20,965</u>	<u>19,437</u>
Cash flow from investing activities			
Payments to acquire tangible fixed assets	12	(18,309)	(18,058)
Receipts from sales of tangible fixed assets	12	230	547
Payments to acquire investments	14	(70)	(263)
Receipts from disposals of investments	14	24	-
Interest received		16	15
Receipt of capital contribution		4,729	4,972
Net cash used in investing activities		<u>(13,380)</u>	<u>(12,787)</u>
Net increase in cash and cash equivalents		7,585	6,650
Cash and cash equivalents at 1 January		<u>27,645</u>	<u>20,995</u>
Cash and cash equivalents at 31 December		<u>35,230</u>	<u>27,645</u>
Cash and cash equivalents consists of:			
Cash at bank and in hand	18	19,730	12,145
Short term deposits	18	15,500	15,500
Cash and cash equivalents at 31 December		<u>35,230</u>	<u>27,645</u>

The Statement of Cash Flow and Notes 1-36 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 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 2019 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 charged 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 profit or loss.

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 profit or loss. 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 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 Statement of Income and Expenditure and 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 Statement of Income and Expenditure and 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 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 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.

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.

Going concern

The Authority has reviewed budget forecasts and cash flows for a period of twelve months from the date of signing of the financial statements which demonstrate that there is no material uncertainty regarding Teagasc's ability to meet liabilities as they fall due, and to continue as a going concern. In making this assessment, the Authority has considered the impact of Covid-19 and does not consider that the impact will be so significant as to cast doubt on the ability of the organisation to continue in operational existence. On this basis the Authority considers it appropriate to prepare the financial statements on a going concern basis. Accordingly, these financial statements do not include any adjustments to the carrying amounts and classification of assets and liabilities that may arise if Teagasc were unable to continue as a going concern.

NOTES TO THE FINANCIAL STATEMENTS

4. Oireachtas grants

	Subhead	2019 €'000	2018 €'000
Vote 30: Agriculture, Food and the Marine Grant-in-aid for general expenses	C.5	124,220	122,629
Grant for human resource purposes	C.5	10,500	10,500
Grant for Johnstown Castle development	C.11	1,020	2,500
Agricultural sustainability support and advisory programme	B.3	130	-
Food research and agriculture research	C.3	2,279	2,360
Stimulus collaborative research programme	C.3	2,519	3,118
Agricultural catchments programme	B.3	1,630	1,594
GLAS scheme	B.3	19	310
Knowledge transfer programme	B.7	3,269	3,685
Prepared consumer foods centre	C.4	4,001	2,288
Carbon navigator	C.10	-	36
Grant for forestry publicity and awareness and training	B.10	670	670
Grant for forestry education	B.10	26	38
Single pension scheme members' contributions		(689)	(557)
		<u>149,594</u>	<u>149,171</u>

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	2019 €'000	2018 €'000
Food research and agriculture research	21	2,178	2,335
Stimulus collaborative research programme	21	2,207	2,018
Prepared consumer foods centre	21	2,503	2,572
		<u>6,888</u>	<u>6,925</u>

5. EU funding

	2019 €'000	2018 €'000
Farm Survey Income	152	148
INTERREG	253	153
Marie Curie	456	165
Framework Programme VII	241	31
Horizon 2020	2,271	1,492
Other EU Income	67	56
	<u>3,440</u>	<u>2,045</u>

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 runs 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	2019	2018
		€'000	€'000
Framework Programme VII		-	244
Horizon 2020		9,322	6,628
Marie Curie		881	244
Other EU Income		1,739	322
	21	<u>11,942</u>	<u>7,438</u>

6. Operational income

	Operations	Knowledge	Research	2019	2018
	€'000	Transfer	€'000	€'000	€'000
Advisory service fees	-	10,241	90	10,331	10,583
Course fee income	37	3,950	302	4,289	4,679
Other fees*	124	1,488	15,002	16,614	14,039
Other farming operations	-	831	2,234	3,065	3,166
Publications and miscellaneous	(125)	78	432	385	778
	<u>36</u>	<u>16,588</u>	<u>18,060</u>	<u>34,684</u>	<u>33,245</u>

* Included in Other fees are state grants from Science Foundation Ireland of €4.027m and Enterprise Ireland of €3.440m.

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	2019	2018
		€'000	€'000
Science Foundation Ireland	21	4,358	5,074
Enterprise Ireland	21	3,000	3,039
		<u>7,358</u>	<u>8,113</u>

TEAGASC CONSOLIDATED FINANCIAL STATEMENTS

FINANCIAL YEAR ENDED 31 DECEMBER 2019

NOTES TO THE FINANCIAL STATEMENTS

7. Expenditure

	Operations	Knowledge Transfer	Research	2019	2018
	€'000	€'000	€'000	€'000	€'000
Pay (Note 9)	6,547	32,157	39,700	78,404	75,322
Travelling and subsistence	376	2,539	2,727	5,642	5,655
Staff training	474	12	166	652	532
General operating expenses (Note 8)	8,752	10,931	21,979	41,662	42,022
Financial charges	191	230	11	432	382
Depreciation (Note 12)	231	1,401	6,264	7,896	8,047
Grants to private colleges (Note 29)	-	2,759	-	2,759	2,921
Student grants	-	557	8	565	547
Cost of livestock purchases	-	18	604	622	756
Cost of research and development services	-	-	141	141	133
Walsh scholarship grants	-	771	5,364	6,135	6,314
Other grants	41	3	571	615	841
Capital contribution to Moorepark Technology Ltd	-	-	3,840	3,840	2,560
	<u>16,612</u>	<u>51,378</u>	<u>81,375</u>	<u>149,365</u>	<u>146,032</u>
Retirement benefits (Note 10)				<u>36,319</u>	<u>40,580</u>
				<u>185,684</u>	<u>186,612</u>

In 2019 150 (2018: 154) staff received overtime payments. The highest aggregate amount paid to an individual was €19,345 (2018: €23,067).

NOTES TO THE FINANCIAL STATEMENTS

8. Analysis of general operating expenses

	Operations	Knowledge Transfer	Research	2019	2018
	€'000	€'000	€'000	€'000	€'000
Farming supplies/ services	-	980	4,011	4,991	5,042
Maintenance/ repairs	461	2,646	5,781	8,888	6,647
Rents/ rates/ insurances	1,085	369	950	2,404	2,385
Postage/ telephones	705	889	265	1,859	2,016
Power/ fuel/ petrol	114	669	1,673	2,456	2,608
Laboratory supplies	-	-	4,070	4,070	4,137
Printing/ stationery/ publicity	647	1,357	821	2,825	3,181
Seminar/ classroom/ library supplies	56	1,492	1,090	2,638	2,830
Services of external agencies	930	1,496	921	3,347	5,027
Student and staff canteen supplies	92	283	410	785	727
Audit fee	67	-	13	80	73
ICT supplies/ services	3,361	214	487	4,062	3,851
Legal/ professional fees	1,270	360	538	2,168	2,452
Miscellaneous programme costs	(62)	157	899	993	542
Special events and miscellaneous	26	19	51	96	144
	<u>8,752</u>	<u>10,931</u>	<u>21,979</u>	<u>41,662</u>	<u>42,022</u>

9. Staff

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

	2019	2018
Professional	769	743
Technical	154	156
Administrative/ clerical	223	215
Farm/ domestic	112	116
	<u>1,258</u>	<u>1,230</u>

Additional superannuation contributions of €2,822,560 (Pension related deductions 2018: €3,222,263) 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. ASC has replaced the pension related deduction (PRD) which ceased at the end of 2018. While PRD was a temporary emergency measure ASC is a permanent contribution in respect of pensionable remuneration.

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:

Employee benefits	Teagasc Number of employees
€60,000 to €69,999	205
€70,000 to €79,999	100
€80,000 to €89,999	58
€90,000 to €99,999	30
€100,000 to €109,999	25
€110,000 to €119,999	23
€120,000 to €129,999	3
€130,000 to €139,999	-
€140,000 to €149,999	-
€150,000 to €159,999	3
€160,000 to €169,999	1

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

	2019 €'000	2018 €'000
Staff short-term benefits	71,260	68,633
Termination benefits	5	-
Retirement benefit costs	36,319	40,580
Employer's contribution to social welfare	6,307	5,825
	<u>113,891</u>	<u>115,038</u>

The total number of staff employed (WTE) at year end was 1,270 (2018: 1,254). The termination benefits relates to one case and there were no associated legal fees.

Staff short-term benefits

	2019 €'000	2018 €'000
Basic pay	68,457	65,859
Overtime	1,016	1,063
Allowances	1,787	1,711
	<u>71,260</u>	<u>68,633</u>

Termination benefits

	2019 €'000	2018 €'000
Termination benefits charged to income and expenditure	5	-
	<u>5</u>	<u>-</u>

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:

	2019	2018
	€'000	€'000
Salaries and other short term benefits:		
Key management remuneration	719	690
	<u>719</u>	<u>690</u>

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 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:

	2019	2018
	€'000	€'000
Basic pay	163	158
	<u>163</u>	<u>158</u>

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 2019 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 1,741 (2018: 1,730).

NOTES TO THE FINANCIAL STATEMENTS

10. Retirement benefit plans (continued)

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

	2019	2018
	€'000	€'000
Current service cost	19,608	21,665
Interest on scheme liabilities	20,271	22,526
Staff contributions	(3,560)	(3,611)
	<u>36,319</u>	<u>40,580</u>

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

	2019	2018
	€'000	€'000
Net retirement benefit liability at 01 January	1,149,519	1,288,839
Current service cost	19,608	21,665
Benefits paid	(46,300)	(46,835)
Interest on scheme liabilities	20,271	22,526
Actuarial loss/ (gain)	156,742	(136,676)
Net retirement benefit liability at 31 December	<u>1,299,840</u>	<u>1,149,519</u>

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

	2019	2018
	€'000	€'000
Funding recoverable in respect of current years retirement benefits	39,879	44,191
Resources applied to pay retirement benefits	(46,300)	(46,835)
	<u>(6,421)</u>	<u>(2,644)</u>

The deferred funding asset for retirement benefits as at 31 December 2019 was €1.300m (2018: €1.150m).

NOTES TO THE FINANCIAL STATEMENTS

10. Retirement benefit plans (continued)

iv. History of defined benefit obligations

	2019	2018	2017	2016
	€'000	€'000	€'000	€'000
Experience (loss)/ gain	(18,834)	70,948	(80,343)	(13,272)
Percentage of present value of scheme liabilities	1.4%	6.2%	6.2%	1.1%
Changes in assumptions	(137,908)	65,728	20,602	(53,573)
Percentage of present value of scheme liabilities	10.6%	5.7%	1.6%	4.4%
Actuarial (loss)/ gain recognised in other comprehensive income	(156,742)	136,676	(59,741)	(66,845)

The cumulative actuarial loss recognised in the Statement of Comprehensive Income amounts to €180.651m (2018: €23.909m).

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. Normal retirement age is a members 65th birthday, and pre 2004 members have an entitlement to retire without actuarial reduction from age 60. Retirement benefits in payment (and deferment) normally increase 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 11 February 2020 in order to assess the scheme liabilities at 31 December 2019.

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

	2019	2018
	% per annum	% per annum
Inflation rate	1.40	1.50
Salary rate	2.90	3.00
State pension	2.90	3.00
Pension rate increase – Main Scheme	2.15	2.25
Pension rate increase – Single Scheme	1.40	1.50
Scheme liabilities discount rate	1.00	1.80

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 2019 and 2039.

Year of attaining 65	2019	2039
Life expectancy - males	86.5	88.9
Life expectancy - females	89.0	91.0

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

	2019	2018
	€'000	€'000
Total accrued retirement benefit liability	<u>1,299,840</u>	<u>1,149,519</u>

11. Tax on profit on ordinary activities

	2019	2018
	€'000	€'000
Based on results for the year:		
Current tax charge	9	8
Deferred tax (Note 23)	<u>-</u>	<u>9</u>
	<u>9</u>	<u>17</u>
Provision in respect of prior years:		
Corporation tax	<u>-</u>	<u>1</u>
	<u>9</u>	<u>18</u>

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:

	2019	2018
	€'000	€'000
(Loss)/ profit on ordinary activities before taxation	(76)	807
(Loss)/ profit on ordinary activities multiplied by Standard rate of corporation tax in Ireland -12.5%	(10)	101
Effects of:		
Excess of capital allowances over depreciation	(27)	(22)
Higher tax rate on profits	4	4
Unutilised trading losses	27	9
Parent loss/ (profit) on ordinary activities multiplied by 12.5%	<u>15</u>	<u>(84)</u>
Current tax charge for the year	<u>9</u>	<u>8</u>

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

TEAGASC CONSOLIDATED FINANCIAL STATEMENTS

FINANCIAL YEAR ENDED 31 DECEMBER 2019

NOTES TO THE FINANCIAL STATEMENTS

12. Property, plant and equipment

GROUP

	Land €'000	Buildings €'000	Assets under construction €'000	Plant and equipment €'000	Total €'000
Cost or valuation					
At 1 January 2018	6,381	137,307	2,432	88,977	235,097
Additions	334	4,144	7,548	6,031	18,058
Buildings completed	-	1,039	(1,039)	-	-
Disposals	(598)	(468)	-	(6,057)	(7,123)
Reclassification	-	57	-	(57)	-
At 31 December 2018	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)
At 31 December 2019	6,127	156,887	3,990	96,474	263,478
Accumulated depreciation and impairment losses					
At 1 January 2018	344	59,631	-	73,753	133,728
Charge for year	-	4,232	-	3,816	8,047
Disposals	(344)	(413)	-	(5,853)	(6,610)
At 31 December 2018	-	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
Carrying value					
At 31 December 2019	6,127	89,631	3,990	21,463	121,211
At 31 December 2018	6,117	78,630	8,941	17,177	110,865

TEAGASC CONSOLIDATED FINANCIAL STATEMENTS

FINANCIAL YEAR ENDED 31 DECEMBER 2019

NOTES TO THE FINANCIAL STATEMENTS

12. Property, plant and equipment (continued)

TEAGASC

	Land €'000	Buildings €'000	Assets under construction €'000	Plant and equipment €'000	Total €'000
Cost or valuation					
At 1 January 2018	6,381	132,584	2,239	83,213	224,417
Additions	334	1,008	6,046	5,511	12,899
Buildings completed	-	1,039	(1,039)	-	-
Disposals	(598)	(412)	-	(5,575)	(6,585)
Reclassification	-	57	-	(57)	-
At 31 December 2018	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
Accumulated depreciation and impairment losses					
At 1 January 2018	344	56,733	-	69,161	126,238
Charge for year	-	4,024	-	3,605	7,629
Disposals	(344)	(402)	-	(5,371)	(6,117)
At 31 December 2018	-	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
Carrying value					
At 31 December 2019	6,127	80,559	2,418	19,664	108,768
At 31 December 2018	6,117	73,921	7,246	15,697	102,981

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.

NOTES TO THE FINANCIAL STATEMENTS

12. Property, plant and equipment (continued)

Disposal of property, plant and equipment

	Proceeds/ costs	Proceeds/ costs
	2019	2018
	€'000	€'000
Proceeds from sale of property:		
Property sales during year	142	670
Cost of sales	(18)	(182)
	<u>124</u>	<u>488</u>
Proceeds from sale of other assets	106	59
	<u>230</u>	<u>547</u>
Net book value of fixed assets disposed:		
Property assets	(10)	(310)
Other assets	(58)	(203)
	<u>(68)</u>	<u>(513)</u>
Gain on disposal of fixed assets	<u>162</u>	<u>34</u>

There was no transfer to the Exchequer of asset sales proceeds in 2019.

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 construction of a new visitor centre and renovation of the castle which became operational in 2019. The centre is managed and operated by Irish Heritage Trust. All construction costs have been capitalised and are being depreciated in line with Teagasc's property, plant and equipment accounting policy.

TEAGASC CONSOLIDATED FINANCIAL STATEMENTS

FINANCIAL YEAR ENDED 31 DECEMBER 2019

NOTES TO THE FINANCIAL STATEMENTS

14. Investments

	Group		Teagasc	
	2019	2018	2019	2018
	€'000	€'000	€'000	€'000
Investment in quoted shares	346	506	346	506
Investment in unquoted shares	270	213	271	214
	<u>616</u>	<u>719</u>	<u>617</u>	<u>720</u>

Investments in quoted shares

	Group		Teagasc	
	2019	2018	2019	2018
	€'000	€'000	€'000	€'000
Fair value at 1 January	506	265	506	265
Additions	-	223	-	223
(Loss)/ gain on fair value movement in the year	(160)	18	(160)	18
Fair value at 31 December	<u>346</u>	<u>506</u>	<u>346</u>	<u>506</u>

Investments in unquoted shares

	Group		Teagasc	
	2019	2018	2019	2018
	€'000	€'000	€'000	€'000
Value at acquisition date				
At 1 January	213	173	214	174
Additions	70	40	70	40
Share redemption	(24)	-	(24)	-
Gain on fair value movement in the year	11	-	11	-
At 31 December	<u>270</u>	<u>213</u>	<u>271</u>	<u>214</u>

Net book value

	Group		Teagasc	
	2019	2018	2019	2018
	€'000	€'000	€'000	€'000
At 1 January	213	173	214	174
Movement in unquoted shares	57	40	57	40
At 31 December	<u>270</u>	<u>213</u>	<u>271</u>	<u>214</u>

TEAGASC CONSOLIDATED FINANCIAL STATEMENTS

FINANCIAL YEAR ENDED 31 DECEMBER 2019

NOTES TO THE FINANCIAL STATEMENTS

14. Investments (continued)

Analysed as:

	Group		Teagasc	
	2019 €'000	2018 €'000	2019 €'000	2018 €'000
Glanbia plc	288	461	288	461
Kerry Group plc	58	45	58	45
Moorepark Technology Limited	-	-	1	1
Wexford Milk Producers Limited	1	25	1	25
Lakeland Dairies	10	5	10	5
Aurivo	2	2	2	2
Glanbia Co-Op Ltd	14	14	14	14
Carbery Creameries Ltd	82	69	82	69
Barryroe Creameries Ltd	3	2	3	2
Dairygold Co-Op Society Ltd	71	49	71	49
Dairygold Co-Op Society (Revolving fund)	87	47	87	47
	<u>616</u>	<u>719</u>	<u>617</u>	<u>720</u>

Details of investments:

Company name	Country of incorporation	Registered number	Number of shares	Nominal value per share at 31.12.2019	Dividend received	Nature of business of company
Glanbia plc	Ireland	129933	28,119	€10.26	2019 - €13,882 2018 - €2,995	Global nutrition company
Kerry Group plc	Ireland	111471	522	€111.10	2019 - €304 2018 - €271	Provider of taste and nutrition technologies
Moorepark Technology Ltd	Ireland	168270	5,102	€0.13	2019 - €nil 2018 - €nil	Provision of services for R&D
Wexford Milk Producers Ltd	Ireland	2640R	767	€1.00	2019 - €nil 2018 - €nil	Milk production and supply
Lakeland Dairies Co-Operative Society Ltd	Ireland	4622R	208,742	€0.05	2019 - €nil 2018 - €52	Milk production and supply
Aurivo Co-Operative Society Ltd	Ireland	5113R	1,715	€1.00	2019 - €34 2018 - €34	Milk production and supply
Glanbia Co-Operative Ltd	Ireland	4928R	13,742	€1.00	2019 - €1,009 2018 - €2,704	Milk production and supply
Kerry Co-Operative Ltd	Ireland	3618R	87	€1.25	2019 - €309 2018 - €274	Milk production and supply
Carbery Creameries Ltd	Ireland	2899R	19,605	€4.08	2019 - €nil 2018 - €nil	Milk production and supply
Carbery Creameries Ltd	Ireland	2899R	2,695	€1.00	2019 - €nil 2018 - €nil	Milk production and supply
Barryroe Co-Operative Ltd	Ireland	1736R	2,594	€1.00	2019 - €nil 2018 - €nil	Milk production and supply
Dairygold Co-Operative Society Ltd	Ireland	4621R	70,769	€1.00	2019 - €nil 2018 - €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

	2019	2018
	€'000	€'000
Livestock	4,590	4,523
Farm produce, fertilisers and feeding stocks	756	566
General supplies	196	176
	<u>5,542</u>	<u>5,265</u>

Stocks are stated after provision for impairment of €nil (2018: €nil).

Reconciliation of movements in livestock:

	2019	2018
	€'000	€'000
Balance at start of year	4,523	5,138
Purchases	622	757
Sales	(2,656)	(2,768)
Births	1,136	1,150
Deaths	(114)	(163)
Fair value adjustments	1,079	409
Balance at end of year	<u>4,590</u>	<u>4,523</u>

16. Assets held for sale

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

		Carrying	Carrying
		value at 31	value at 31
		December	December
		2019	2018
	Note	€'000	€'000
Kinsealy East, Co. Dublin	12	447	540
		<u>447</u>	<u>540</u>

NOTES TO THE FINANCIAL STATEMENTS

17. Receivables

	Group		Teagasc	
	2019	2018	2019	2018
	€'000	€'000	€'000	€'000
Trade receivables	12,742	11,182	12,240	10,714
Other receivables	195	170	180	144
Accrued operational income	7,149	5,800	7,149	5,800
Accrued Oireachtas grant income	5,311	8,979	5,311	8,979
Prepayments	1,745	1,384	1,725	1,368
VAT and other taxes	-	95	-	-
	<u>27,142</u>	<u>27,610</u>	<u>26,605</u>	<u>27,005</u>

All amounts included above fall due within one year.

Trade receivables are stated after provision for impairment of €206,904 (2018: €189,529).

18. Cash and cash equivalents

	Group		Teagasc	
	2019	2018	2019	2018
	€'000	€'000	€'000	€'000
Cash at bank and in hand	19,730	12,145	16,627	10,209
Short-term deposits	15,500	15,500	15,500	15,500
	<u>35,230</u>	<u>27,645</u>	<u>32,127</u>	<u>25,709</u>

NOTES TO THE FINANCIAL STATEMENTS

19. Payables – amounts falling due within one year

	Group		Teagasc	
	2019	2018	2019	2018
	€'000	€'000	€'000	€'000
Trade payables	736	1,766	812	1,691
Other payables and accruals	15,902	12,723	14,766	12,327
Legal provisions	194	134	194	134
PAYE/ PRSI	2,492	2,379	2,471	2,362
Value added tax	726	209	713	209
Corporation tax	1	-	-	-
Withholding tax/ RCT	144	111	141	111
Other payroll deductions	1,454	1,480	1,454	1,480
	<u>21,649</u>	<u>18,802</u>	<u>20,551</u>	<u>18,314</u>
Payables for taxation and social welfare included above	<u>3,363</u>	<u>2,710</u>	<u>3,325</u>	<u>2,693</u>

Included in the other payables and accruals of €14.77m are: wages, salaries and other payroll related costs €3.40m (including an annual leave accrual of €1.75m), repairs and maintenance €2.48m, equipment and capital items €2.16m, professional fees including legal and analytical services €1.84m, ICT costs €1.60m, general operating costs including utilities €0.97m, farm running costs €0.75m, grants/ seminars €0.59m, other accruals €0.41m, public relations and advertising €0.29m and travel and subsistence €0.27m.

The payment of trade payables varies between on demand and thirty days. Prompt payment interest and compensation of €48,143 was payable on trade payables in 2019 (2018: €55,566).

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. No interest was due at the end of the financial year for late payment of taxes.

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	
	2019	2018	2019	2018
	€'000	€'000	€'000	€'000
Other payables and accruals	375	-	-	-
	<u>375</u>	<u>-</u>	<u>-</u>	<u>-</u>

NOTES TO THE FINANCIAL STATEMENTS

21. Deferred income due within one year

Teagasc carries out public funded research 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. At 31 December the source and amount of deferred income in respect of research and other projects was as follows:

	Note	Group		Teagasc	
		2019 €'000	2018 €'000	2019 €'000	2018 €'000
Department of Agriculture, Food and the Marine - advance for FIRM projects	4	2,178	2,335	2,178	2,335
Department of Agriculture, Food and the Marine - advance for Stimulus projects	4	2,207	2,018	2,207	2,018
Department of Agriculture, Food and the Marine - Prepared Consumer Foods Centre	4	2,503	2,572	2,503	2,572
Enterprise Ireland	6	3,000	3,039	3,000	3,039
Environmental Protection Agency		496	645	496	645
Science Foundation Ireland	6	4,358	5,074	4,358	5,074
European Union	5	11,942	7,438	11,942	7,438
General research and other deferrals		1,543	1,260	1,483	1,161
Course fee deferrals		1,549	1,408	1,549	1,408
Amounts received in advance for work associated with the completion of sale of land at Athenry		510	510	510	510
		<u>30,286</u>	<u>26,299</u>	<u>30,226</u>	<u>26,200</u>

22. Deferred income due after more than one year

	Group		Teagasc	
	2019 €'000	2018 €'000	2019 €'000	2018 €'000
At beginning of year	354	468	108	175
Released to income and expenditure account	(47)	(47)	-	-
Recategorised to within one year	(108)	(175)	(108)	(175)
Course fee deferrals	151	108	151	108
At end of year	<u>350</u>	<u>354</u>	<u>151</u>	<u>108</u>

NOTES TO THE FINANCIAL STATEMENTS

23. Provision for liabilities

Deferred tax	Group		Teagasc	
	2019	2018	2019	2018
	€'000	€'000	€'000	€'000
At beginning of year	119	110	-	-
Charged to income and expenditure account	1	9	-	-
At end of year	<u>120</u>	<u>119</u>	<u>-</u>	<u>-</u>

Components of deferred taxation	Group		Teagasc	
	2019	2018	2019	2018
	€'000	€'000	€'000	€'000
Unutilised trading losses	(35)	(9)	-	-
Accelerated capital allowance	155	128	-	-
	<u>120</u>	<u>119</u>	<u>-</u>	<u>-</u>

24. Capital Account

The balance on this account of €108.768m (2018: €102.981m) represents the unamortised value of funds used to purchase property, plant and equipment, increasing by €5.787m in 2019 (2018: €4.802m).

25. Revenue reserves

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

26. 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.

27. Leases

Operating leases

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

	Group		Teagasc	
	2019	2018	2019	2018
	€'000	€'000	€'000	€'000
Leases which expire:				
Within one year	672	686	672	686
Between two and five years	1,119	1,314	1,119	1,314
After five years	940	1,015	940	1,015
	<u>2,731</u>	<u>3,015</u>	<u>2,731</u>	<u>3,015</u>

NOTES TO THE FINANCIAL STATEMENTS

28. Reconciliation of surplus to cash flow from operating activities

	2019	2018
	€'000	€'000
(Deficit)/ surplus for the year before taxation	(76)	807
Depreciation expense	7,896	8,047
Fair value adjustments on biological assets	(1,168)	(409)
Fair value adjustments on investments	149	(18)
(Gain) on disposal of tangible fixed assets	(162)	(34)
Interest paid	91	77
Interest income	(16)	(15)
Transfer to capital account	5,787	4,802
Total operating cash flows before movements in working capital	<u>12,501</u>	<u>13,257</u>
Decrease in inventory	891	1,007
Decrease/ (increase) in receivables	468	(697)
Increase in payables	7,205	5,956
Cash flow from operating activities	<u>21,065</u>	<u>19,523</u>

29. Private colleges

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

	2019	2018
	€'000	€'000
Grants to private colleges	2,759	2,921
Salary costs of staff seconded to private colleges (included in the total pay expenditure in Note 7 above)	434	685
External service provider costs for teaching services provided to private colleges (included in the general operating expenditure in Note 8 above)	131	96
	<u>3,324</u>	<u>3,702</u>

In addition to grants outlined above Teagasc provided workbooks to private colleges to the value of €60,300 (2018: €69,850). Income of €317,038 (2018: €521,220) was received from private colleges for course resources provided by Teagasc and the agreed share of Rural Development Programme course learner fees.

30. Commitments

Capital commitments

Teagasc had capital commitments outstanding at 31 December 2019 amounting to €7.700m which relate to construction of buildings and facilities at Moorepark (2018: €2.727m).

Grant commitments

Teagasc had grant commitments outstanding at 31 December 2019 amounting to €10.226m which relate to Walsh Scholars €5.772m, Private College Grants €3.111m and Other Grants €1.343m (2018: €10.817m).

NOTES TO THE FINANCIAL STATEMENTS

31. 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.

32. 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.

33. Related party transactions

The following transactions were carried out with related parties:

Sales of goods and services:

	Group		Teagasc	
	2019 €'000	2018 €'000	2019 €'000	2018 €'000
Subsidiary	-	-	18	10
	<u>-</u>	<u>-</u>	<u>18</u>	<u>10</u>

Purchases of goods and services:

	Group		Teagasc	
	2019 €'000	2018 €'000	2019 €'000	2018 €'000
Subsidiary	-	-	630	517
	<u>-</u>	<u>-</u>	<u>630</u>	<u>517</u>

Payable to related parties:

	Group		Teagasc	
	2019 €'000	2018 €'000	2019 €'000	2018 €'000
Subsidiary	129	22	129	22
	<u>129</u>	<u>22</u>	<u>129</u>	<u>22</u>

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 (2018: €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. During 2019 Teagasc made a capital contribution of €3.840m to Moorepark Technology Limited towards the capital expansion of the facilities.

NOTES TO THE FINANCIAL STATEMENTS

34. Financial instruments

The Group and Teagasc have the following financial instruments:

	Group		Teagasc	
	2019	2018	2019	2018
	€'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	346	506	346	506
Unlisted non-current asset investments	270	213	271	214
Financial assets				
Trade receivables	12,742	11,182	12,240	10,714
Other receivables	195	170	180	144
Cash in hand (including short-term deposits)	35,230	27,645	32,127	25,709
Financial liabilities measured at amortised cost				
Trade payables	736	1,766	812	1,691
Other payables	15,902	12,723	14,766	12,327

35. Events after the reporting period

At the time of signing the Financial Statements, Ireland is responding to the outbreak of coronavirus (Covid-19). The Authority has considered the impact of Covid-19 on the projected performance of Teagasc for 2020 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 2019 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.

36. Approval of the financial statements

The Authority approved the financial statements on 03 June 2020.



