Landwards

@IAgrE

The professional journal for the Institution of Agricultural Engineers

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In this issue...

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Dr Emma Wilcox
Chief Executive Officer of the
Society for the Environment

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Contents:

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On-farm methane recovery plant see p16

Editors Welcome

Procrastination is an editor's prerogative. And yet, as the inbox fills, and the articles arrive, a theme (or themes) often emerge.

In this edition that is certainly the case (much to the relief of your humble correspondent!). Whether by luck or judgement the simultaneous nature of COP26 and the Institution's Landwards conference on Future Fuels for Agriculture certainly brought the programme to life. More of that in Practice (p16).

I certainly came away from the IAgrE conference feeling much encouraged about how innovation and engineering is becoming pivotal in tackling some of society's big issues.

Speaking of innovation, we report on the Agri-EPI Centre's conference and the evergreen message that new technology needs to be straightforward to understand and easy to use with clear benefits otherwise it won't be adopted. Have a look (p24).

The Institution enjoys close links with the Royal Academy of Engineering via several eminent members and we have been fortunate to be able to support their latest outreach with their This is Engineering initiative. The article is well worth a read (p30).

Our programme of branch activities and lunchtime lectures via Zoom continues apace. Landwards caught a recent lunchtime lecture on the state of dairy technology, ably presented by John Baines. Whilst we include a brief write up (p34), I would recommend visiting the IAgrE's YouTube channel for the full presentation.

I wish you well for Christmas and the New Year and hope that you find time to settle down and immerse yourself in this edition.

Andy Newbold

Andy Newbold

Editor

andy@farm-smart.co.uk

National championship winning ploughman

Five Champions – the winners of the Plough-Off Finals, from left to right, John Crowder, Ashley Boyles, Brian Baxter, David Thomlinson and Charlie Nicklin

Our own CEO, Charlie Nicklin, after much effort, in his own words, won the 70th British National Ploughing Championships on the weekend of the 9-10th October at Mindrum Mill, Northumberland.

In the Vintage Hydraulic Final, Charlie used his Massey Ferguson 35 and Ransome TS54 with great effect to gain 258 points, three points ahead of Richard Ingram from Atherstone, Warwickshire who had been the reigning champion. In third place was John Sivewright from Blairgowrie, Perthshire with 238 points.

Well done Charlie!

A winning solution for autonomous farming safety

Agri-tech company Agribot AI has won the Agri-EPI and Hands Free Farm (HFF) hackathon tackling safety and security concerns around autonomous agricultural vehicles.

Agribot's winning concept brought together cutting-edge AI and vision technology to provide a cost-effective, anonymised human and animal detection system that could work with notoriously patchy rural connectivity. The company is now in conversation with the Hands Free Farm team on developing and implementing the technology on the HFF site.

Agri-EPI chief executive Dave Ross said: "The quality of ideas and solutions from the teams that took part in the hackathon has blown away everyone at Agri-EPI, the team at Hands Free Farm and our judges- Clive Blacker; Kit Franklin from the Hands Free Farm; Landwards editor, Andy Newbold; and Sarah Walton. We were particularly impressed with Agribot AI's proposal which has very real potential, and we are excited to see how it develops at Hands Free Farm."

Benefits and barriers

Autonomous vehicles offer arable farmers a wide range of benefits, such as better utilisation of farm staff together with increased precision and reduced inputs, all of which combine to improve farm economics.

However, to ensure the implementation of agri-tech can keep pace with the rate of innovation, safety, security and reliability of new technologies must be guaranteed.

The lack of formal safety regulations, codes of practice and other legislation pose a potential barrier to widespread use of cutting-edge agri-tech, hindering progress across the entire agri-food sector. Hands Free Farm partners with Precision Decisions, part of the Map of Ag group. Clive Blacker, head of arable Produce at Map of Ag said:

"The diverse nature of agriculture and robotics operating in off-road and on-road environments poses many challenges. Our aim with the hackathon was to bring great ideas from any background into agriculture that have the potential to support robotic safety. We have been delighted and inspired by the solutions put forward."

About the Hackathon

A hackathon funded by Smart Agri-Hubs, Agri-EPI Centre in collaboration with Hands Free Farm tasked participants to 'hack' a safety solution for unmanned machinery. The participating teams came from a range of disciplines, such as robotics, artificial intelligence, machine learning, Internet of Things, drones and computer vision.

The IAgrE App is live

If you haven't already done so, head to the App Store or Google Play and download the IAgrE App.

The IAgrE Membership App is the perfect place to manage your membership and much more in a simple to use format. This app is for the exclusive use of IAgrE members and you will need to login to gain access to the features on offer.

- **Events**- Find out about upcoming events in the IAgrE calendar – new events will send a notification so you never miss an event.
- **News**- Keep up to date with all the latest industry news – again notifications ensure you don't miss out.
- **CPD**- Submit details of your CPD on the move to assist your career development (to edit them you'll have to login to the main IAgrE website).
- **Discounts**- the app details the exclusive benefits to IAgrE members.
- **Forum** – Discuss the latest news and topics with other IAgrE members and increase your network.
- **Member Search** – this feature makes finding other members an easy process.
- **Documents** – access the Landwards Archive, Annual Reports, eNews and more.

To login you will need your username (your surname and initials, no gap and not case sensitive eg BloggsFG) and your password, which unless you have changed it will be your membership number. This login is the same for access to our website. If you need assistance please contact Alison or Sarah who will be pleased to help.

Prize-winning apprentices at Midlands Machinery Show

A group of aspiring young agricultural engineers were recognised for their dedication and achievements at the Midlands Machinery Show recently.

The annual Newark and Nottinghamshire Agricultural Society's Engineering Apprenticeship award saw six students step up to accept a cheque for £250, the first instalment of a two-year award totalling £500.

Oliver Coupland in his second year at Ripon Farm Services, Retford loves visiting different farms with a variety of challenges. "I like the satisfaction of being able to get machines back to full working order," he said. "The money will benefit me as I will be able to purchase new battery-operated tools, making the jobs I do easier and more time efficient."

A steam engine fanatic, Mr Coupland would like to be a master technician with responsibility for training up new apprentices. "One day I would like to be our depot's gearbox specialist as I like the challenge of stripping and rebuilding them."

Another Ripon Farm Services apprentice – based in Louth – is Isaac Kirk, who wants to specialise in harvesting support. "So far my apprenticeship has been an eye opener, the knowledge and skills I have gained are immense," he said. "Every day is different. I am learning all the time; it's my dream job."

Chandlers also boasted two apprentice winners: Kieran Snowden at the Grantham depot and Zac Elsdon at Holbech. Both have a passion for farming and are looking forward to developing their careers. "It makes me very proud that the work I do helps farmers to carry on working and put food on our tables," said Mr Snowden. "It is a great honour to have been selected for this award. It will help me progress in my career as well as giving me confidence that the industry is behind me."

Mr Elsdon's love of tractors spans the years, from his current work on cutting edge kit to vintage tractors; something he has inherited from his grandfather's existing collection. "I helped to restore an old Massey Ferguson TE20 for the city of Norwich aviation museum; I have been interested in tractors and how things work for as long as I can remember."

A proud moment

It's a sentiment echoed by Luke Hatton, who works at Russells, Newark. "Growing up on a farm with my Grandad I enjoyed helping repair machinery and driving the tractor," he said. "My proudest moment so far would be last harvest when one of our customers snapped the front axle on his combine. It was estimated the job would take about 10 days but my mentor and I ended up doing it in under half that, allowing the customer to get back to harvest without too much disruption."

Carrying the flame for women in the industry was Stella Hubbard, who works at Farol as a John Deere apprentice. "At the age of five I would come into Farol with my dad and assist with picking parts for jobs/customers," she said. "During school I developed an interest in metal work and design. I took a particular interest in removing and installing components."

Having worked at John Deere in both Australia and the UK, she is now enjoying being given the independence to carry out jobs by herself. "I would like to inspire more women to take on this career. I would also love to own my own farm and develop a career in farming."

John Edwards, technology consultant at Farol, started out as a John Deere apprentice at the age of 16; 10 years later he was setting up the firm's new technology department. "It's a great career path," he said. "It's so important that apprentices have exposure to this new technology; it's moving on so quickly. It's nice to have career progression and it's key to have young blood coming through."

"I would like to inspire more women to take on this career."

Stella Hubbard, Farol

Soil 22 – Carbon, traffic and tillage

Farming's environmental impact and its ability to sequester carbon is under the spotlight like never before, there is much talk of soil protection, management and making carbon pay. The Soil and Water Management Centre conference strongly addresses these issues with a group of leading farmers and researchers.

When: Thursday 13th January 2022
Where: Harper Adams University, Newport, Shropshire, TF10 8NB or virtually.
How to book: register online via *www.harper-adams.ac.uk/events*

Programme:
Coffee from 9.30 am
Morning session – 9.50am – 12.30
9.50am Welcome and introduction – Chairman – Guy Smith
Ten years of Tillage and Traffic field experiment
(timings of presentations to include Q&A)
10.00 Introduction, background and design, Paula Misiewicz
10.20 Soil physical conditions and health, Magda Kaczorowska-Dolowy
10.40 Crop performance and yield, Ed Dicken
11.00 Refreshment break
11.10 Economics, Dick Godwin
11.30 Farmer case studies Chairman, Andy Newbold
12.20 General discussion
12.30 Close of morning session
12.30 – 13.00 Lunch
Post lunch visits and demos in rotation, 13.00 – 14.00
1 Long Marsh Tillage and Traffic experiment which will be in a cover crop prior to spring planting with millet – Magdelena / Simon to talk about reasons for millet & carbon monitoring. Update on GNSS systems and RTK correction.
2 Tyres and tracks.
Afternoon session – Carbon, an opportunity – but what are the knowns and unknowns? – 14.00–16.00 Include 15 min break
Kindly sponsored by Bayer
14.00 Carbon market and trading – Jonathan Cooper, HAU
14.20 Building soil organic matter – Matthew Shepherd, Natural England,
14.45 Capacity of soils to hold carbon- David Powlson, Rothamsted Research
15.10 Refreshment break
15.20 Farmer case study – Craig Livingstone, Farm Manager, Lockerley Estate
15.40 The carbon market based on soil management- Bayer CropScience
15.55 General discussion
16.10 Chairman's concluding remarks

About the Soil and Water Management Centre

The SWMC is an agri-research and industry-led initiative to help UK farming make the most of its two most precious assets: soil and water

The SWMC is a central source of soil and water management information and expertise, and a national forum for establishing essential improvement priorities.

Making practical soil and water management training and advisory materials widely accessible and co-ordinating farm-based workshops and demonstration projects.

Instigating and supporting applied soil and water management research addressing challenges and improvement opportunities.

Based at Harper Adams University, the SWMC works together with farmers as well as key research and training providers for the greatest overall industry value.

From the CEO's desk

The past three months have certainly flown past. One minute we're basking in the sun with harvest in full swing and the next maize is chopped, fields drilled and the dark nights are upon us. I'm actually more worried about how fast my year in this role has gone! The good thing is we're getting out and about a bit more now with various events taking place.

Out and about

One such event I attended was The British Guild of Agricultural Journalists harvest lunch and awards ceremony in London. The IAgrE made an award for the best technical article by a member of the Guild. Travelling on a train full of people without masks felt quite an odd situation, however I survived! The award was won by Charlotte Cunningham for her excellent article in Crop Production Magazine about a farm using its excess heat from their new AD plant to floor dry lucerne, a new crop venture they'd established.

Future fuels

This quarter has seen our annual conference, Future Fuels for Agriculture take place; the timing was perfect with COP26 being held the same week. If any of our members have been involved in COP26 we'd love to hear from you. Although our conference was held virtually, it was a live event with an excellent attendance. The diversity of our industry was shown by the conference starting with Caroline Drummond MBE from LEAF presenting on sustainable farming and ending with Jon Swain from NFU Energy taking us through the energy demand challenges for glasshouses. In between we had two world leading tractor manufacturers talk about future engine and tractor design, with IAgrE member Alastair Walshaw taking us through CNH's fascinating methane tractor and Jarno Ratia explaining AGCO's plans live from Linnavuori in Finland. For those that are wondering where the methane could come from, Dr Chris Mann then took us through Bennamann's fugitive methane capturing process from the non-milk output from dairy cows. What industry could have that much diversity in a conference? For those of

Advanced Farm Technologies is a US-based startup seeking to raise efficiency in the agriculture field by developing and manufacturing robots for strawberry harvesting. Their TX robotic strawberry harvester combines an unmanned ground vehicle (UGV) with image sensors and artificial intelligence (AI).

you that were unable to attend the recordings are on our website, and YouTube channel. The conference is covered in more detail from page 18.

Autonomous steps

It seems that in my last couple of articles I've mentioned large ag machinery OEM's acquiring stakes in autonomous machine companies. This edition's turn is CNH, who have recently entered into a licensing agreement with California-based Monarch Tractor, who specialise in fully electric and autonomous tractors; this brings two really important types of technology into the CNH fold. Who will be next I wonder, Kubota?
With the help of some members we plan to get a Robotics and Autonomous Machine Special Interest Group going in the early part of next year, which I really look forward to. Various members have also been supporting the start of a BSI code of practice for robotic and autonomous crop machines, which will be an interesting process. There is certainly lots of activity in this area and I'm sure we'll see it continue to grow.

Awards

I have been asked to judge various innovation competitions, the first was the Agri-EPI Agritech Excellence awards. There were some fascinating entries which my fellow judges and I had presented to us. The international winner (Alvatech) had developed a means to remove saline from irrigation water powered via solar panels and the runner up (WiCow) had developed an internal reusable connected device for dairy cows for reporting data before and during calving. Both showed real technological advancement, but many entries seem to fall quite short. There seemed to be too many that focussed on software/data from companies who want to 'digitise agriculture' with systems they've adapted from other industries; certainly not innovative technology to me. Next up is LAMMA where we're sponsoring the young engineer's competition. I'm really looking forward to seeing some practical solutions from people in the early part of their careers.

Membership

With the new-found freedom, the IAgrE team has at last started making progress with some promotional videos for our industry, and of course membership of IAgrE. Filming across the country has taken place, kindly supported by various businesses and members. Thank you for supporting this. We have a great production company involved and we're really looking forward to the end result. You may have seen via our eNews the output of another project, our new mobile app, which is now available to download for your smart phone/tablet. The app will be really useful for keeping you up to date with industry news and events. It can also be used to quickly log CPD which you can then update at a later date on your PC with more detail.

Practice makes perfect

And finally, as a few will know, I do a bit of vintage match ploughing and have qualified and competed at the British Ploughing Championships for the past 10 years. I've had a few 4ths, 3rds and a 2nd, but this year in Mindrum, Northumberland, I walked away with the trophy for 1st place. It was a long way to go and plough a couple of ¼ acre plots over a weekend, but I'm very glad I did!

Charlie Nicklin
charlie@iagre.org

President's Musings

So, as we leave the autumn and head into winter it gives us a chance to look back on a relatively dry few months in most of the country which has allowed grain harvest and winter planting to be pretty well completed by the end of October.

Commodity prices have stayed fairly firm although the rising costs of inputs, with as an example, straight nitrogen having more than doubled to north of £650 per tonne, will definitely make farmers concerned for their profitability going forward. Steel prices have also seen huge increases over the past 12 months and this is bound to impact machinery prices. The meteoric rise in energy prices in the past six weeks or so is extraordinary, not to say concerning. One way or another we seem to be heading for challenging times.

I write this at the mid-point of the COP26 summit. Whilst positive announcements are being made these are easy enough. The global buy-in, and particularly by the countries that are contributing most to greenhouse gas emissions is patchy to say the least. The challenge for all nations is going to be playing their part in delivery of real change, quickly.

A timely message

I felt this year's IAgrE conference on Future Fuels for Agriculture was right on message and coinciding as it did with COP26, the timing was excellent. I was again impressed by the quality of the speakers, their passion for their subject areas and the engagement of the audience. I thought the Q&A session generated some lively discussion too.

For those of you who were not able to log in on the day, I hope you will catch up with the presentations on the IAgrE website when you have a moment. This is one of the biggest benefits of a virtual conference along of course with a much-reduced carbon footprint. I was intrigued to learn that the event was beamed live into the Fastrac Engineering office at JCB to allow the engineers to listen into the presentations. My thanks are due to the whole Secretariat team for convening the event along with Andy Newbold who chaired the Q&A.

Back to face to face

I very much hope that the upcoming 'live' shows such as the Midland Machinery Show, CropTec and LAMMA are (or in some cases have been as you read this) well attended. I am sure that I am not alone in being keen to attend this type of event as we seek return to normality.

CO_2 confusion

I was unaware that the fertiliser plants in the UK are such critical players in the production of CO_2 which is heavily utilised by the food and drink industries, not to mention the all important brewers. Was I alone in being bemused that half the national news for a few days in September was dedicated to the shortage of the gas whilst the other half was dedicated to the reduction of its emission as a greenhouse gas?

May I be amongst the first to wish you all a very Peaceful Christmas and a very Happy and Prosperous New Year.

Paul Hemingway
president@iagre.org

People

Pershore College trainer assessor gains engineering professional status

A Pershore College trainer assessor has been awarded a major engineering professional status and is now set to pass on his expertise to college students.

Andy Tabberer-Catt has been recognised by the Engineering Council and the Institution of Agricultural Engineers.

Following a rigorous assessment, he has achieved MIAgrE status which demonstrates his commitment to keeping high standards in engineering training.

The Engineering Council assessed Andy for his suitability and professionalism, while also assessing how he passed his own high standards onto his students.

Andy works with Level 2 and Level 3 Land-Based Engineering apprentices at Pershore College, which is part of college group WCG.

He said: "It has been a long road to achieve this professional status but it was all worth it and it can only be of great benefit to the reputation of land-based engineering at Pershore College.

"I completed a major report with supporting evidence demonstrating my commitment to keeping the high standards set by the council and then also display how that impacts my students.

"I have already had businesses and students comment on the new letters after my name and I hope it will bring a renewed confidence in employers who are considering sending their apprentices to train with us.

"It is fantastic to have been recognised in this way and I look forward to continuing to strengthen my relationship with the Institution of Agricultural Engineers.

Mark Eden, Director of Work-Based Learning at WCG, added: "WCG is delighted with Andy's recent certification of professional status through the Engineering Council.

"It demonstrates the high level of expertise, experience and knowledge Andy holds within the land based service engineering area.

"It provides confidence to our clients that learners and apprentices are receiving a high standard of delivery ensuring they all benefit from a quality provision which is recognised by a reputable independent regulatory body."

Biosystems Engineering

Biosystems Engineering, owned by the IAgrE, and the official scientific journal of EurAgEng, is published monthly with occasional special issues.

Head to https://www.sciencedirect.com/journal/biosystems-engineering to view the full article list of the latest edition and to find out more about depth and breadth of articles accepted for publication.

Reduced subscriptions are available to IAgrE members. Go to **https://iagre.org/biosystemsinformation** for details of the preferential rates for both paper and electronic versions.

The managing editor of Biosystems Engineering, Dr Steve Parkin, has kindly summarised a selection of papers published in the last three issues, which will be of interest to IAgrE members.

Biosystems Engineering
Volume 207, July 2021,
Pages 92-105

Investigation of the potential to reduce waste through sampling and spatial analysis of grain bulks

Ruth Kerry, Benjamin R. Ingram, Esther Garcia-Celac, Naresh Magan

Brigham Young University, Provo, UT, USA

Facultad de Ingeniería, Universidad de Talca, Chile

University of Hertfordshire, Hatfield. AL10 9AB, UK

Batches of grain are accepted or rejected based on average mycotoxin concentrations in a composite grain sample. Spatial analysis of mycotoxins in two grain bulks was performed to determine the spatial distribution of toxins, whether they were co-located and the proportions of grain over legislative limits. The 2D distribution of deoxynivalenol (DON) and ochratoxin A (OTA) in a truck load of wheat grain was analysed, as was the distribution of fumonisins (FB1 and FB2) in a 3D maize grain pile. The data had been previously analysed, but results here show that highly skewed data would need to be transformed to investigate spatial autocorrelation properly. In the truck of wheat grain, DON and OTA showed co-variation and, in contrast to previous studies, OTA showed spatial structure when converted to normal scores. Post-harvest, strategically placed sensors could be used to monitor environmental conditions within the stored grain in real time and detect the first signs of spoilage allowing swift remediative action so less grain is wasted. Pre-harvest approaches for mycotoxin management are suggested as additional food waste reduction strategies.

Biosystems Engineering
Volume 208, August 2021,
Pages 272-286

Sensitivity analysis of fine dust spreading from litter in poultry houses

Sayed M. Derakhshani, Nico W.M. Ogink, Bram A.P. Bos Peter W.G. Groot Koerkamp

Wageningen University, Wageningen, the Netherlands

Wageningen Livestock Research, Wageningen, the Netherlands

Poultry houses are one of the major sources of agricultural particulate matter (PM) emissions into the environment. Litter properties, poultry activities, and indoor climate of poultry houses are the main parameters that influence the dust emission, but precise quantitative effects and their interactions are hardly known. This study aimed to gain quantitative insight into the dust spreading process from poultry litter by using the discrete parcel method (DPM) and global sensitivity analysis (GSA). The dust spreading process includes the creep, suspension, and saltation of fine particles was simulated with the DPM within the aerial region close to the litter. The simulations proved that a collision between an object and the litter should happen to release particles from the litter into the air. It was indicated that the released particles with a diameter ≥30μm and particle density ≥1400kg m−3 were deposited on the litter for all tested air velocities. Also, particles <10μm diameter remained suspended for airflow velocities >1.5m s−1. The GSA indicated that the creep process has a direct relation with the airflow velocity and coefficient of restitution and an inverse relation with the particle density and the coefficient of friction.

Biosystems Engineering
Volume 20209, September 2021,
Pages 256-270

A mechanistic thermal balance model of dairy cattle

Jinghui Li, Vinod Narayanan, Ermias Kebreab, Serdal Dikmen, James G. Fadel

Department of Animal Science, University of California, Davis, CA, USA

Department of Mechanical and Aerospace Engineering, University of California, Davis, CA, USA

Department of Animal Science, Bursa Uludag University, Bursa, Turkey

A dynamic model describing the thermal balance of Holstein dairy cattle was developed. The model quantified the heat flow of five main nodes at the body core, top and bottom skin, and top and bottom coat of a dairy cow. Heat production by the animal and heat flows between the animal and the environment, including conduction, convection, evaporation and radiation, were calculated based on existing models and physical principles. The model requires information of climate, animal characteristics and location as inputs, and returns body core, skin and coat temperatures as outputs. The thermal balance model was evaluated through two datasets. A simulation study was conducted based on a Holstein dairy cow with 600kg of body weight and 25kg of daily milk yield under a typical summer environment in California, USA for three days. The average simulated temperatures of body, top and bottom skin, and top and bottom coat were 40.9, 35.6, 35.9, 34.1 and 33.7°C, respectively. A local and a global sensitivity analyses showed that heat production, surface area and the parameters relative to respiration and sweating were the most sensitive. The model is able to predict the dynamic change of body temperature under hot weather, and to guide the use of physical cooling strategies, such as shade, fans, sprinklers and cooling mats in dairy facilities.

The Landwards podcast

A series of podcasts have been commissioned with a monthly news podcast and a monthly interview with an agricultural engineer or influential person in the land based sector. The Landwards podcast is on iTunes, Spotify or click on https://www.buzzsprout.com/1067353/episodes for the latest one.

The Engineering Horizon

Here's a quick roundup of some fascinating developments, both at home and away

Food group develops world's first hybrid biomethane and electric tractor

Based in Lithuania, the Auga group is Europe's largest vertically integrated organic food producer running 39,000ha of organic cereals, root crops and vegetables, plus a large dairy farm with 3,400 cows.

The tractor is 6m long, 4m high and runs on 900/60R 42 tyres. The Auga group says its tractor can work for 12 hours on one fuel cartridge.

Kestutis Juscius, CEO of Auga group, said: "Three years ago, when we first calculated our emissions, we saw that as much as 30 percent of them come from the use of fossil fuels on farms. There were simply no solutions to change it. The choice of biomethane as an alternative fuel was not accidental as it is one of the greenest types of biofuel. Methane, collected from livestock waste and converted to biomethane, offsets more emissions per unit of energy in its production and use cycle than it emits.

Currently, biomethane-powered tractors are able to operate for only two to four hours because the gas cylinders do not physically fit into the tractor structure.

The Auga M1 tractor uses a hybrid biomethane-electric fuel system. When the tractor is running, an internal combustion engine powered by biomethane generates energy and transmits it directly to the electric motors that spin the wheels. The company's patented design allows the tractor to accommodate larger biomethane gas cylinders.

Mushroom harvesting robot is among innovations from new agri-tech

Robotic mushroom picking is focus of a company emerging from projects funded by Ceres Agri-Tech – a partnership between five leading UK universities and three renowned agricultural research institutes.

The market for fresh mushrooms in the UK is worth £450 million and growing annually. But, until now, the picking has had to be done by hand to prevent damage to the delicate mushrooms. Existing robotic harvesters are not suitable for mushrooms – which is a major issue as the industry struggles to cope with the current labour shortages. But Ceres spin-out Agaricus Robotics is developing a robot that can harvest even the most challenging dense clusters of mushrooms.

"In the UK alone, approximately 4,500 people are required every day to pick mushrooms – with labour costs representing a third of total production costs," said Agaricus Robotics founder Bashir Al Diri. "It takes up to six months to train a picker and their skill determines the productivity of each mushroom bed. But our patented intelligent mushroom harvesting robot can pick whole crops without bruising the mushrooms and will lead to 20-30% yield increases from optimised 24/7 harvesting 365 days a year. The backing of Ceres is proving invaluable as we now accelerate the commercialisation of our technology."

Led by Cambridge Enterprise, the commercialisation arm of the University of Cambridge, Ceres was launched in 2018 – funded by Research England – to commercialise innovative agri-tech based on university research. The other partners are the University of East Anglia, the University of Hertfordshire, the University of Lincoln and the University of Reading, as well as the NIAB (National Institute of Agricultural Botany), Rothamsted Research and the John Innes Centre.

Neat Norwegian solution for livestock manures

N2 Applied is speeding up commercial availability of its technology that converts livestock manure into sustainable fertiliser while trapping greenhouse gases.

With the dairy industry under increased scrutiny around the world to reduce its methane emissions, there is a huge drive to develop technology that can assist.

The company has developed a patented technology that enables farmers to cut emissions and produce their own fertiliser locally, using only liquid organic waste, such as livestock slurry or digestate, air and electricity.

N2's scalable process enables the production of fertiliser to be re-distributed to the end-user, the farmer, therefore cutting long and expensive value chains, and reducing the need for chemical fertiliser production based on fossil gas or coal.

N2 Applied has run multiple trials and pilot projects across nine countries that have shown practical elimination of emissions and improved grassland yields, as well as the ability to suppress odours from ammonia leakage.

Following this, the business is now moving to offer both further trials and full international commercial availability of its technology, as dairy brands and individual farms seek to reduce emissions from their supply and production chains.

While lowering carbon dioxide emissions is key to managing the effects of climate change, methane is also a potent greenhouse gas, with the recent United Nations IPCC report and its Economic Commission for Europe outlining that it contains more than 80 times the global warming potential of carbon dioxide over a 20-year period.

Using a scientific technique that applies just air and electricity to slurry, the technology within the N2 unit performs a plasma conversion that 'locks in' both methane and ammonia to the liquid waste material, producing a sustainable fertiliser. Treated slurry produced on-farm has the potential to reduce the need for chemical fertiliser, and therefore further reduce greenhouse gas emissions.

Landwards Conference 2021

Alistair Walshaw

Future Fuels in Agriculture

The Institution's annual conference was delivered virtually again this year, on Wednesday 3rd November and focused on alternatives to carbon-based fuels for farming. A range of expert speakers took delegates through the options.

Making the most of a waste

Farming has a significant chance to reduce its carbon footprint by converting methane, a green-house gas many times more dangerous than carbon dioxide, into a valuable asset.

Livestock production generates a significant volume of methane, but the sector has a unique ability to capture most of that gas and use it as a fuel, suggest researchers. While other alternative fuels have been discussed, tested and experimented on, methane has several key advantages over them.

CNH's first available methane farm tractor is due off the production line soon.

The methane tractor

Firstly, the technology is already available – with CNH's first commercially available methane farm tractor due off the production line soon.

And the technology to harvest methane produced on most livestock farms is already available.

Delegates tuning in to the Institution of Agricultural Engineers' autumn conference, heard that the first methane powered tractors would be rolling off CNH's Basildon production line in December 2021.

The company has developed the concept, building on work done by its partner company Iveco, CNH's Alistair Walshaw told the audience. Iveco now runs fully methane powered lorries of up to 460hp, having started work on the concept in the mid-1990s.

Energy density challenges

One drawback is that diesel is five times as 'energy dense' as methane. So while a normal tractor might run all day on a 150 litre tank, the equivalent methane-powered machine would consume 750 litres in the same time.

Using methane as a fuel would reduce a range of emissions, he says, and the source of the fuel – livestock slurry – is widely available across the country.

By contrast, other alternative fuels could not be widely adopted until a significant rural supply network had been developed.

Landwards Conference 2021

Chris Mann

Fuel from slurry

Among the companies leading the development of fuel production is Bennamann, which has established a research base on a Cornish dairy farm.

Dr Chris Mann, from the company, says their system completes a very virtuous circle:

"We are managing waste and turning a powerful greenhouse gas into a green fuel. A lot of methane is being lost from slurry lagoons."

If it were harvested, he says, farmers could meet all their own energy needs and be able to sell the surplus.

To harvest methane contained in - and normally released gradually to the atmosphere from- slurry, his company has developed a patented chamber that covers and seals the lagoon.

The gas is processed into a liquid that can be used as a fuel by a range of engines.

The only emission, when it is burnt, is a volume of carbon dioxide equivalent to that absorbed by the grass when it grew.

The remaining digestate from the slurry pit can be applied to the ground like normal slurry, returning the nutrients it contains to the soil.

Chris says the system is suitable for use on any dairy unit of 50 or more cows.

While the company's storage system is twice as expensive as conventional systems, the income from harvested methane normally achieves payback in four to six years.

We still need big machines

Farmers will still need big machines to produce the nation's food – and that machinery will need a reliable power source.

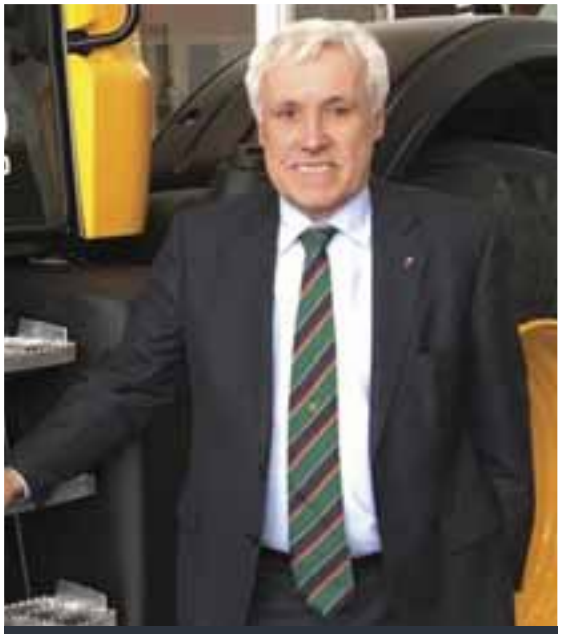
That was the message from Paul Hemingway, President of IAgrE, while opening the Institution's autumn conference, entitled 'Future Fuels in Agriculture'.

While much media coverage recently has predicted a future in which farm machinery might become smaller, Mr Hemingway says larger machines might still be needed. In some circumstances the need for them might grow:

"Climate change means weather windows are getting shorter.

"Therefore, we will need to use big tackle and need energy sources that are environmentally friendly and enable us to operate in remote locations for long periods."

And the industry would continue to need glasshouses to extend growing seasons and meet food demand.



Paul Hemingway

No silver bullet

There is no 'silver bullet' solution to farming's need for new fuels to power field vehicles, Jarno Ratia, engine specialist with AGCO told the conference.

Instead, he suggests different sectors of industry will find solutions most appropriate to them.

Meanwhile, farmers can expect the emissions of existing and future machines to be gradually ratcheted down.

And to put the whole debate in context, he pointed out that Allis Chalmers first developed a 20-horsepower fuel cell tractor in 1959, and that concept had been widely examined before that.

When considering alternative fuels, like electricity and hydrogen, he said that smaller machines handling lighter tasks appeared to be the most likely to 'go electric'.

Larger machines with higher power requirements were more likely to benefit from developments in hybrid power units.

AGCO - Jarno Ratia

Landwards Conference 2021

Going electric

There were benefits to going fully electric, he noted, with Fendt first showing its E-Vario model at Agritechnica some years ago, and the machine is due to go on sale soon.

Using electric power would satisfy exhaust emission regulations, and electricity was currently cheaper than fossil fuels due to taxes on the latter.

Going electric would also facilitate greater levels of autonomy, which might enable farmers to access a faster machine that did not require a driver. Using an electric motor would also have benefits – notably in dispensing with the high noise levels of a conventional combustion engine:"It would also dispose of the cooling package required for a combustion engine."

For heavy duty electric tractors, acheiving sufficient battery 'energy density' is a challenge.

Battery capacity

The technology was still relatively young and achieving high enough 'energy density' remained an issue, although he expects the capacity of batteries to increase two or threefold over the next few years. But that would still leave electricity lagging behind other fuels in terms of energy density.

Hydrogen simplicity?

Hydrogen could present a simpler solution, most notably because the technology to use it already exists.

It also meets environmental challenges, because the only emissions are water vapour and a few particulates.

But while hydrogen fuel cells were very quiet, they require significant cooling, something he suggested might limit their potential market.

One other issue is that they are most efficient when subjected to less than 50% loading – something that, he suggested, might make them impractical in many farming applications.

The immediate development of hydrogen as a fuel for farming and the countryside are limited by lack of a supporting infrastructure.

While it could be expected to develop in the next 20 years, he said localized production was an option, but that it would require significant investment from the farmer or estate looking to adopt the technology.

Energy storage issues

To illustrate the energy storage issue, he presented figures comparing how much of four different fuels might be needed to complete eight hours of ploughing.

Conventional diesel was compared against hydrogen being burned through a conventional diesel engine; hydrogen being used to power a fuel cell and electric power via a battery.

Diesel is the most 'energy dense' fuel, with 179 litres of fuel lasting a whole day and weighing 152 kilogrammes, with the storage tank typically costing under one thousand Euros.

The hydrogen required to do the same work via an internal combustion engine would only weight 53 kilogrammes, but would be 3,200 litres, with the storage vessels costing some 30,000 Euros.

The figures for hydrogen being used in a fuel cell were very little different: 49 kilogrammes weight of fuel would be needed, which would mean 2,600 litres of fuel and a storage tank costing some 25,000 Euros.

By contrast, the figures for electric batteries are eye-opening: the batteries required to do eight hours work would weight 4.1 tonnes – containing the equivalent of 3,400 litres – and costing some 150,000 Euros.

While electricity was now being used to power lorries on the road, he pointed out that agricultural vehicles faced different challenges and would need different solutions.

Horticulture

While many industries are examining ways to minimise their carbon dioxide emissions, horticulture has a rather different issue, says Jon Swain, technical director of NFU Energy.

The sector needs a huge amount of energy to produce heated and lit crops. It also needs good CO_2 supplies for glasshouse enrichment to help crops grow.

Jon Swain

Horticulture needs huge amounts of energy and good CO_2 supplies.

But industry could still help farming work towards its 'net zero' targets:

"Getting to net zero means reducing emissions and then doing something about emissions that are unavoidable."

Farming's main greenhouse emissions were nitrous oxide from livestock (40% of total emissions) and methane from animals (50%), with carbon dioxide from across the industry accounting for the remaining 10%.

He suggests the industry could reduce its emissions by adopting systems which help capture carbon, and by ensuring systems are as efficient as possible and by making productivity improvements.

The CO_2 conundrum

Horticulture has a significant reliance on gas for powering boilers as well as heat and combined power plants:

"We already have relatively low emissions other than CO_2, but we also produce CO_2 used to enrich glasshouses to promote growth and optimise yields.

"The problem we might have moving forward is that if no CO_2 is available for enrichment then we would need another source."

Horticulture uses a lot of energy to illuminate crops to trigger photosynthesis to extend growing seasons and enable them to be grown 'out of season'.

Using renewable energy sources could help industry halve emissions involved in lit crop production and reduce that of un-lit crops by some 90%, he suggests.

The sector needs to think creatively about using different heat sources and decarbonizing its practices; but he warns that many facilities don't have sufficient land available:

"Bio-energy does have a role to play and can provide a way of reducing carbon emissions relatively quickly."

Savings could be made if the location of both glasshouses and factories producing heat were re-imagined:

"If we could move horticultural production to places where heat and CO_2 are both available, we could benefit from that. We could also look at how to capture methane."

In that respect horticulture has an advantage over livestock, he suggests, because its facilities are generally closed.

By contrast livestock buildings are designed to be well ventilated.

Energy reduction first

He believes farming needs to aim to reduce its use of power considerably as a first step, before moving on to consider alternative energy sources.

And glasshouses of the future could look very different to those used today, with a potential that they might be vertical farms, sealed boxes.

Whatever form it took, the sector needed to be as efficient as possible in its use of power, or risk having decisions on such issues made outside the industry.

Seeking out renewables

Caroline Drummond

Alternative power is already being widely adopted among LEAF members, the organisation's CEO Caroline Drummond said when opening the conference.

The effects of climate change were already being felt with rainstorms, hailstones and wildfires affecting farming, wildlife and the public's lives.

Many LEAF members had responded to growing threats of climate change and were reducing their reliance on fossil fuels, with some 67% using at least one form of renewable power on their farm.

And they were also addressing their emissions, with 39% of them using tools to assess their carbon footprint.

Using such tools may become a requirement of the LEAF Marque standard in future, she added.
And while much of the focus was on cutting the size of the livestock industry, she highlighted its role in farming's future:

"As everybody strives for more regenerative and integrated approaches, livestock and the manures it produces play a really important role in improving soil health and structure.

"We should also stress the rich and varied biodiversity of grassland, which is also very good for carbon capture."

She adds that much of the data being quoted about livestock comes as a 'snapshot' of the industry rather than a full industry analysis.

Watch again

on the IAgrE YouTube channel

https://bit.ly/3kpKVF8

Practice:
Agri-EPI Centre conference

Tim Mordan, Defra Deputy Director

Easing the path to technology adoption

New technology needs to be simple, easy to use and offer farmers proven benefits if it is to be widely adopted. That was the broad consensus from the Agri-EPI Centre's autumn conference, which was held virtually recently.

The discussion was put in sharp context by the results of a survey that Agri-EPI Centre released in the same week as the event.

It showed that 87% of farmers own at least one internet-enabled device on the farm, and 78% use agri-technology.

But significantly 48% said they had patchy or no mobile reception across the farm- something that could severely restrict its ability to use location and guidance tools.

Support for the challenges

In his key note speech – and during the following seminars- Tim Mordan, a deputy director at Defra, gave a clear hint that research on gene editing might be allowed in future.

He also highlighted a range of grants available to help companies and farmers innovating and investing in equipment.

In the post-Brexit era he said government's aim was to use public money to provide environmental benefits.

It also wanted to ensure a thriving and resilient farming sector which had a 'trusting and productive' relationship with government, and to ensure UK farmers maintained world class animal welfare standards:

"Government is serious about getting behind innovation in the farming sector. Could we free up the regulations regarding gene editing? As a first step we want to make it easier for researchers to carry out that work."

The new ELMS scheme aims to reward farmers for protecting the environment, and includes a sustainable farming initiative; schemes to aid local nature recovery and enhance landscape recovery.

Labour availability remained a key issue, he added:

"We need to encourage more people into the industry. That is not easy and we need more help from the industry itself. We want farming to be an exciting career."

He expected the launch of the Institute for Agriculture and Horticulture (TIAH), an industry initiative to address the issue which the Government will fund:

"That will be looking at things like supply chains and fairness, to ensure margins are spread evenly."

efficient and productive usually offers a win-win for sustainability.

"The findings of our research provide important insights for Agri-EPI and our fellow Agri-Tech centres, as well as for those with a role in developing, evaluating and promoting technology, particularly the agri-food sector, policy makers, agri-tech companies and the R&D community. The farmers we spoke to told us they need accessible training, funding, and more evidence and independent advice to help them make the best use of agri-tech. We want to collaborate with partners across all areas to ensure the benefits of agri-tech are clear and avenues to adoption are easily accessible."

Of the farmers interviewed who are using agri-tech, popular technologies include machine guidance systems (40% using this), soil mapping (35%), livestock growth monitoring (30%) and variable rate application (28%).

Robotics and automation for a variety of purposes featured strongly in farmers' thoughts on the tech that will be important in future, along with the capability to integrate data gathered by different systems on the farm.

Dave Ross, Agri-EPI Centre's Chief Executive

Environmental sustainability

Agri-EPI centre's chief executive, David Ross, said: "While the majority of UK farmers recognise that agri-tech has an important role in supporting their priorities of productivity and profit, we are struck by the fact that only around a third felt that tech has a role to play in environmental sustainability.

"Technology is one of the solutions to help farmers reduce emissions – agri-tech that helps farmers be more

"The Government is serious about getting behind innovation in the farming sector."
Tim Mordan,
Deputy Director, Defra

Profession:
Agri-EPI Awards

Innovative approaches at home and away

The Agri-EPI Centre has launched and run the inaugural Agri Excellence Awards. These Awards recognise the ground-breaking work of agri-tech companies that have had significant impact on sustainable productivity on-farm, in the UK and internationally, between January 2019 and January 2021. The IAgrE's CEO Charlie Nicklin was part of the judging panel.

The system uses solar power to disrupt the molecular behaviour of water, breaking down the salt particles without the use of chemicals or the creation of harmful by-products.

The technology enables farmers to irrigate crops with saline, brackish and hard water.

In this way it helps conserve water supplies and enable soils, that might be deteriorating due to salination, to be returned to sustainable production.

Treated water is proven to improve both yield and quality as well as to reduce crop need for fertilisers.

"Its great to see the diversity of the sector we're in and the clever engineering technology being applied." Charlie Nicklin IAgrE CEO

International winner

ALVATECH's chemical-free water treatment can prevent farmland from being lost to salination, while expanding the amount of water that can be used in food production. The urgency of the situation is exemplified by the fact that some 5,000 acres of farmland has been lost to salination every day since the 1990s, while global water demand is expected to double by 2050.

International winner

Profession:
Agri EPI awards

International runner up

International runner up

WICOW, from muTech-Gmbh, alerts farmers and vets about the onset of key health events in a cow's life.

The device is effectively a complete and constant health monitoring system that fits inside the cow's vagina.

It compiles a continuous record of the cow's health status and sends alerts to the farmer and/or vet.

As a result they are quickly alerted to the onset of heat, and 24 hours before the onset of calving.

It will also activate if it detects the onset of temperature or fever, allowing it to be treated swiftly and – usually – with less need for medicines or veterinary involvement.

The company says this effectively eliminates the 'silent spots' that might otherwise occur at critical stages of the cow's life-cycle.

This means any treatment required can be applied quickly and effectively, and often involving less serious intervention than might be required if the problem had not been detected so swiftly.
In the long term, it suggests that the cumulative effect will be a healthier, longer and more productive life for the cow from a system that also saves time and money.

UK Winner

The UK winner Pruex uses intelligent monitors and air sensors spread around poultry barns to monitor conditions.

The company was started five years ago by Aled Davies after he completed a Nuffield Scholarship examining alternatives to antibiotic use in agriculture.

During his studies he realised that many livestock suffered low level bacterial infections which – while not actually making them sick – reduced their health and productivity.

And he also realised that this problem was endemic to housed livestock, with faecal bacteria affecting the air their air, water and feed.

His company tests the living environment of livestock, including bedding.

It then distributes non-infective bacteria- similar to cultures of soil bacteria – to help dry up the litter and reduce production of harmful gases including ammonia.

This helps ensure a healthier living environment for birds and healthier, safer working conditions for farm staff.

UK Winner

Charlie's comments:

IAgrE was pleased to be represented on the judging panel for the recent Agri-EPI Agri-Tech Excellence Awards. For the International category, the winner and runner up's innovations showed real technological advancement that would benefit the farmer.

The winning entry from Alvatech was a cost-effective solar powered system that reduced salinity in irrigation water. The self-contained system could be installed into irrigation lines protecting the soil from excessive salinity as well as dramatically improving plant health and productivity.

WiCow, the runner up's technology, focussed on telemetry. With its innovative intravaginal reusable sensor, installed into a cow before calving, allowing real-time health monitoring and calving prediction via a smart phone app.

It's great to see the diversity of the sector we're in and the clever engineering technology being applied.

It also avoids using some alternative products to combat such infections, many of which are becoming more tightly regulated due to side effects.

UK-runner up

Oxi-tech Solutions uses patented technology to create a powerful industrial disinfectant from water, ozone and low voltage electricity.

This helps ensure dairy parlours are cleaned more efficiently, with its products completely replacing peracetic acid for cluster flushing and all the sodium hypochloride used in the CIP wash.

It says that it reduces the amount of chemicals used for these tasks – and all the attendant pollution and waste.

It also avoids a range of other risks, including manual handling, acid burns and fire risks, and parlour parts last much longer with less frequent replacement.

UK-runner up

Receiving what was effectively the UK bronze medal was Taylor Technologies, whose invention met the demands of one particular local farmer.

In 2018 that farmer wanted to spray docks without harming valuable clover around them with blanket applications of herbicides.

Taylor built a system combining cameras, computers, special software and precision spray nozzle control to 'spot treat' weeds.

The system can be 'trained' to recognize weed species, differentiating between them and other vegetation. So it controls weeds while leaving surrounding grass and clover unaffected.

Trials completed this spring (in less-than-ideal conditions) in a sward containing 18% docks destroyed 80% of them with the first treatment.

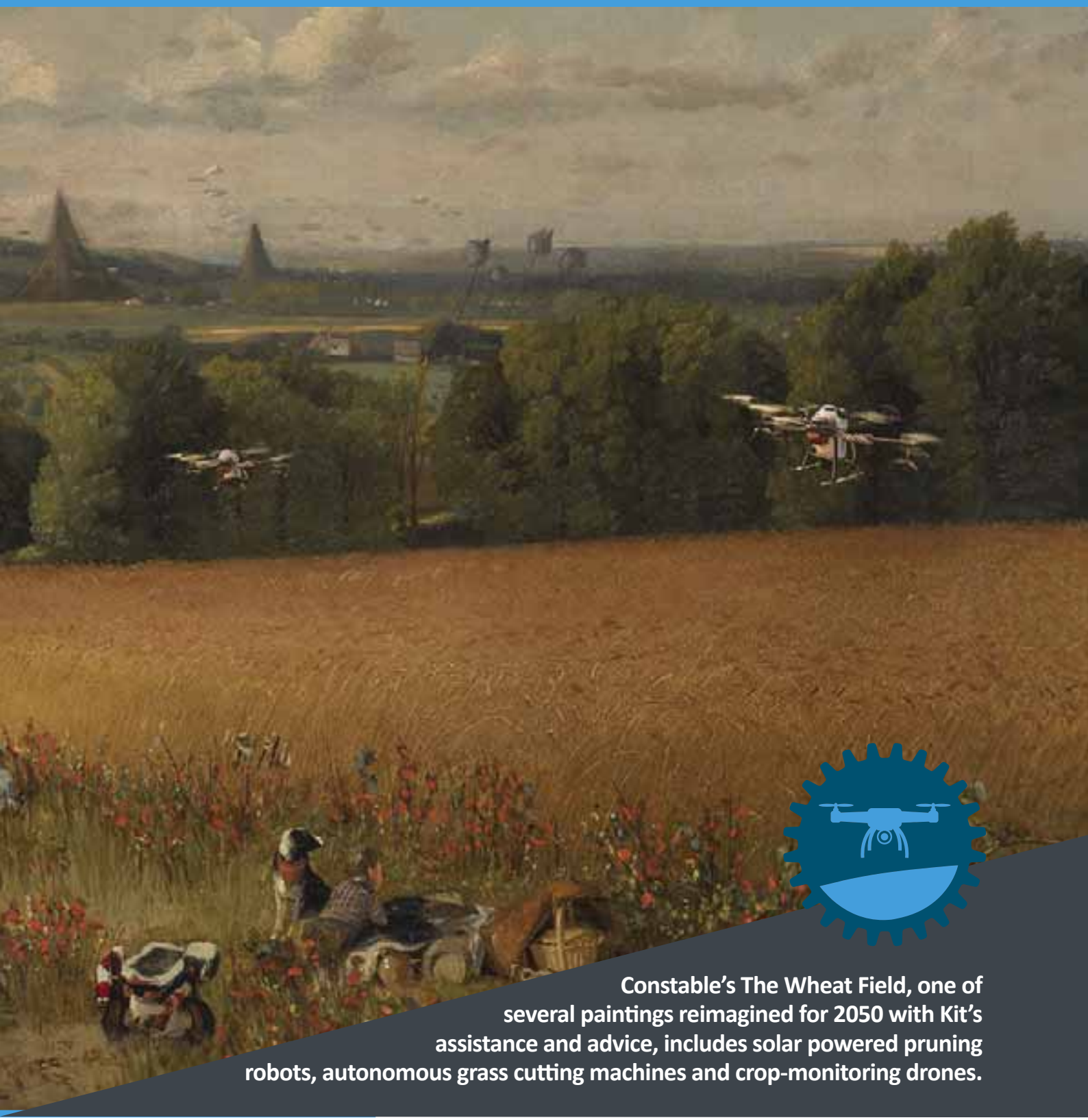
UK-runner up- Oxi-tech Solutions

UK-runner up- Taylor Technologies

Profession:
Engineering the future

This is Engineering – Engineer the Future

The This is Engineering - Engineer the Future exhibition, by the Royal Academy of Engineering, looks at some classic works by painters such as Constable, Monet, Pissarro, and Van Gogh who all made their mark during the first industrial revolution. The event re-imagines them, for the 21st century, with the help of contemporary engineers.



Constable's The Wheat Field, one of several paintings reimagined for 2050 with Kit's assistance and advice, includes solar powered pruning robots, autonomous grass cutting machines and crop-monitoring drones.

With the eyes of the world on Glasgow as delegates gathered for the COP26 Summit, the exhibition, which is being run both online and physically as an exhibition in the city, aims to examine how engineering advances can help to achieve net zero carbon emissions by 2050.

Engineer the Future sees Van Gogh's Factories at Clichy, Constable's The Wheat Field, Pissarro's La Rue Saint-Honoré and Monet's The Seashore at Sainte-Adresse digitally remastered by contemporary artist, Ashly Lovett, to show how engineering innovations could help to transform everyday life and landscapes.

Profession:
Engineering the future

Kit Franklin

Agricultural engineering input

Kit Franklin, senior lecturer in agricultural engineering at Harper Adams University and Principal Investigator on the Hands Free Farm project, said: "It is always an honour to work with the Royal Academy of Engineering on a project and I was delighted to be asked to assist with this thought-provoking campaign.

"Helping to develop artwork like this was about sending a message to both policymakers and the public regarding the vital contribution that the UK's agricultural engineering sector can make to our net zero goals during COP26. I also hope it will capture the imaginations of prospective students and inspire current students here at Harper Adams University."

Meanwhile, environmentally friendly hydrogen planes can be seen in the sky, with futuristic shapes that maximise fuel-efficiency and range of travel.

Kit says: "The artistic reinterpretation of Constable has removed the hard physical labour and repetitive tasks of agricultural farmhands as autonomous robots take on the work humans would have traditionally done. "Agbots make farming more precise to conserve vital resources like water and energy. And we'll see smaller machines in future to help preserve soil quality and health. A healthy soil is not only vital for growing food, it can also sequester carbon more effectively than one that has been compacted by large machinery.

"If Constable were to walk in the British countryside in 2050, he'd see smaller fields with strips of different coloured crops, and less productive fields rewilded with trees, wildflowers and shrubs to boost biodiversity and pollination."

As well as seeking to raise awareness of how engineering can help meet net zero targets, the This is Engineering campaign also seeks to promote engineering careers to tackle a significant skills and diversity shortfall in the profession.

This is Engineering

Is a campaign to bring engineering to life for young people, and give more people the opportunity to pursue a career that is rewarding, future-shaping, varied, well-paid and in demand.

Engineering is at the cutting edge: from robotics, machine learning and artificial intelligence, to mobile phones, medical technology, advanced sports equipment and driverless cars, engineering is shaping the future all around us. Engineering is for everyone: whatever your background and whatever you love – whether it's fashion, film, sport, music or technology.

The aim is to show more young people what engineering really looks like and how it could be an exciting and rewarding path for them.

This is Engineering is led by the Royal Academy of Engineering, in collaboration with EngineeringUK, and with the generous support of their partners.

Reaching net zero

Dr Rhys Morgan, Director of Engineering and Education at the Royal Academy of Engineering, added: "The UK's goal of reaching net zero carbon emissions by 2050 is a massive undertaking. Decarbonisation on this timescale and magnitude will bring widespread and rapid change to every aspect of daily life and meeting our goal of a net zero future will not be achieved without engineering expertise.

"From the ways we heat, cool and light our homes, to how we produce our food, how we build our houses and how we travel around, our future daily lives will be shaped by today's engineers and engineering. "These famous masterpieces originally captured a snapshot of daily life at a time when the consequences of carbon emissions were not known. By reimagining them for 2050 we hope to start a conversation about how engineers can help shape our net zero future and inspire the next generation to join the profession. To realise the emission-saving technologies imagined in these artworks, the UK needs more engineers – for example, National Grid estimates that the UK energy sector alone will need to fill 400,000 roles between now and 2050 to reach net zero."

In a bid to boost recruitment and challenge the narrow stereotypes of what engineers look like and do, This is Engineering Day – held this year on Wednesday, November 3 - is an annual reminder of the importance of engineering to our daily lives.

Created by the Royal Academy of Engineering in 2018, the day celebrates the varied and vital roles that engineers play, from developing medical technologies like brain scanners and clean energy solutions, to powering the social media platforms and smartphones we rely on to keep in touch every day.
The exhibition can be seen here: **artsandculture.google.com/story/FgWRsEOj0UGA-Q**

Practice:

Lunchtime lecture

John Baines, dairy consultant

Automation key to dairy future

Automation is helping the dairy industry solve its most pressing crisis - that of managing ever bigger herds with a dwindling number of staff. The extent to which dairy units have grown was highlighted by dairy consultant John Baines during a recent IAgrE Lunchtime lecture.

"It's very difficult to manage large herds without some degree of automation."

Between 1996 and 2018 the average English dairy herd grew from 78 cows to 151, while in Scotland the rise was from 105 to 194 head and in Wales 70 to 147.

Within those averages are 4,000 herds with less than 10 cows. These, he suggests, are hobby/house herds and not commercially viable, although they do distort the statistics.

The most significant increases were in herds above 250 head, of which there are now over 1,000 in the UK, with some 200 herds above 500 head and 25 above 1,000.

Management needs automation

"It is very difficult to manage that kind of herd size without some degree of automation," he said. Modern cow housing already included a lot of technology in terms of both design and equipment. And some of the newer ideas could help overcome the pressures faced by those managing modern herds.

One key issue is that staff have far less time to 'get to know' cows than their predecessors did: "The guy sitting on the milking stool next to the cow was quite in tune with her mood and how she was feeling."

By contrast, a milker in the parlour of a big herd might have only 10 seconds contact: "They know about the stars and the sinners. But they don't know much about that huge population of cows in the middle".

Practice:
Lunchtime lecture

Awash with milk data

While milking machines have been able to record multiple lines of data for some years, that was not always helpful: “Staff can end up drowning in data but starved of information.”

One area where it could really help is in monitoring cow behaviour around both conception and calving. The three main reasons dairy cows leave the herd are mastitis, lameness and failure to breed.

In relation to the last factor, he says technology could help overcome the problem in detecting oestrus in cows that are ready to breed. A cow only expresses oestrus for a few hours every few weeks – maybe even shorter in the winter – which can make it very hard for under-pressure staff to spot, he said.

That was particularly true in modern, high-capacity parlours where another challenge was effectively cooling the high volumes of milk produced.

Staff training

Staff working on such complex equipment needed proper training, he added, so incidents were avoided. Quoting Stelios (Haji-Ioannau), the founder of EasyJet, he said: “If you think health and safety is expensive, try having an accident.”

Complex machines like rotary parlours come with a lot of technology, including control systems and IT to record information. One of the big challenges was that on a big rotary parlour the cow might only be in the operator’s field of vision for 30 seconds, and thereafter everything had to be monitored by the system. Modern milking stations can take a huge range of measurements relating to the cow, its weight, milk yield and the composition of that milk.

The rise of the robots

Figures from the Milking Equipment Association (MEA) covering 2014 - 2020 show that significantly more robotic milking systems have been installed than conventional parlours in those seven years.

For instance, in 2019 there were over 180 robotic systems installed against fewer than 120 conventional parlours: “This is not novel or new technology. It is well


Mike Whiting

Parlour telematics

A more recent advance was in the connectivity of the machinery and the ability to distil data and provide alerts to farm staff about which cows need attention: “We are also seeing the ability to use a telemetric approach to monitoring machine function, not just with robots but with those very large-scale milking operations – it’s a true 24/7 operation.

“Many people involved in the arable sector know how important it is if the combine breaks down in the middle of harvest. Well every day is harvest on a dairy farm and down-time is a catastrophe.”

Technology transfer

Dairying had benefitted from a huge import of technology from other industries, such as the servo motors that power moving machine parts and systems that track all movements accurately.

Other innovations help the machine sense the cow and respond to its movements, so it can withdraw if she kicks out.

Cameras and 3D image analysis can provide information on a cow’s condition and weight that is superior to a weighbridge. Conventional weighing has the drawback that it is a single snapshot, when the cow’s weight naturally varies – typically by up to 30kg/day- according to what she eats and drinks; how much milk she gives and how much she defecates.

Technology borrowed from the 3D gaming consoles meant farmers now had movement detectors that could reveal changes in activity.

This enables farmers to pinpoint when a cow is ready to breed; whether she is eating and ruminating and how much time she is either lying or standing.

For many dairy farmers who use robots the first sign that a cow is not well comes when she doesn't visit it to milk. But before her milk yield is depressed she is likely to have laid down for longer – or in some instances have stood up more. Those changes in behaviour – which will be accurately recorded by the systems – are valuable data.

Milk monitor

Individual milk recording has been offered for over 40 years, he said. But it had now progressed to measuring fat, protein and lactose 'in line', so the farmer can assess the efficiency of a cow's diet in real time.

Among the newer technologies being developed was 'Milk amyloid-a' monitoring, which provides a very early marker of disease.

Breath monitoring – which was examined as a way of detecting cows with ketosis – is now being investigated as a way of monitoring cows for their methane emissions.

Still room for the stockman

For all their capabilities, there was a significant list of tasks that an automated milking system cannot do:

"There are quite a lot of things for which we still need a good stockman. For instance, we still need to be able to formulate rations and know what to do with sick cows. Above all the whole purpose of high tech is to direct us to those cows that need attention."

Watch again

Don't forget that the Lunchtime Lectures are available to watch on the IAgrE's youtube channel:

https://bit.ly/3kpKVF8

Membership matters

NI branch members enjoying the visit.

Northern Ireland

Branch visit to JB Tyres

Report by Terence Chambers

IAgrE Members recently enjoyed a visit to J B Tyres at the village of Tobermore in Co Londonderry. They are widely known for their supply of tyres to agriculture and a wide range of other industries.

Mr James Barfoot is from a farming family and started the business by selling tractor and implement tyres from a garage site of tractor dealer Bobby McKee in Main Street of his local village of Tobermore, 35 years ago.

James' business developed steadily and, 14 years ago, he moved to its nearby present base on the site of a former filling station. It now has 18 specialist employees supplying customers throughout the UK and Ireland as well as some in Germany and Holland. A distribution depot has also been set up at Lusk, near Dublin. The company deals directly with major tyre manufacturers including Michelin, Kleber, Trelleborg, CEAT, Camso and others.

Range of tyres

The range of stock at JB Tyres is vast and as James described the available products we learned that most tyre sizes now have alternative technical specifications to suit specific applications across a price range. For example, light commercial /van tyres may look like some car tyres but have a different construction to carry heavier loads. Other variables include speed rating and wear / grip properties. JB's customer service includes analysing all this information to guide choice of the most suitable product and how to maintain it correctly.

Service

The workshop areas are equipped with specialist equipment to fit and remove all sizes and the extensive repair facilities also include rubber vulcanisation. The solid or tubeless tyres on forklift trucks are fitted by pressing into the wheel rims. This requires a force of up to 100 tonnes and in addition to their workshop facility, JB Tyres has developed a trailer- mounted hydraulic press which can be taken on site. This includes a local construction products customer who operates numerous forklift trucks.

Agricultural tyres

This popular market sector, of particular interest to our members, has changed a lot since James started in business. Although basic cross-ply tyres are still available they now tend to be fitted to older and classic tractors

The sizes, weights and travel speeds of newer tractors have increased dramatically and larger tubeless radial-tyres for them now take most of their market. Popular rear tyre sizes, in various widths, now cover a range from R28 to R42 rim diameters. The typical front tyre size for a 4wd 120hp tractor is now R28 or more. The tyre designs, from the mainstream manufacturers, are developing rapidly to increase grip, reduce compaction in field work and support faster road travel.

The ETRTO (European Tyre and Rim Technical Organisation) approved standards of IF (improved flexion) recognised a 20% increase in load for the same inflation pressure as the previous designs. But the latest VF (very high flexion) standard now specifies 40% more load for the same pressure or permits operating with 40% less pressure for the same load.

This normally involves the use of lower inflation pressures in the field taking advantage of increased tyre wall flexibility and special tread design to exploit a longer foot print. To maximise performance and avoid tyre damage, customers must always check and strictly adhere to the tyre manufacturer's rules for inflation pressure when carrying loads at various travel speeds. This includes knowing the permitted axle loads and how to take account of any added ballast.

For circumstances where regular changes in inflation pressures are needed (such as in large-scale remote arable locations), some major tractor manufacturers can now offer the option of a CTIS (central tyre inflation system) where the driver can adjust and maintain the required inflation pressures (on both the tractor and trailed implements) from the cab.

A comprehensive service

Given the vast range of applications, specifications, brands and prices for the tyres available from JB Tyres it was most impressive to hear James and his staff deal with the detail.

Mobile hydraulic tyre press

We got instant answers to our many questions and obviously customers benefit from this fund of knowledge every day. Having heard the detailed properties of the available tyres, looking at and choosing them in future will mean so much more to us all.

Ken Gardiner, Branch Chairman, thanked James and his staff (especially Alister Stewart and Andy Robinson) for making us so very welcome and hosting such an informative and enjoyable evening and wished them all continued success for the future.

Membership matters

Western Branch

AgriTech opens its doors at Wiltshire College Lackham

Report by Mike Whiting

The Western Branch set its sights on a tour of the recently completed £9 million investment at Wiltshire College Lackham as an opener for the 2021/22 session.

Robot Classroom

The project provided the college with a modern AgriTech facility, ensuring students are ready for the opportunities in a rapidly evolving agricultural sector. In addition, a 120 dairy cubicle building with integral robotic milking units completed the construction works.

On entering the campus-based new two-tier building, students and visitors are greeted by a huge display screen. This provides visual images of the zoological animal centre and live feed statistics for the cows housed in the new facility. The sight of bearded dragons, iguanas and other non-typical farm livestock is attracting students seeking a City & Guilds qualification in Animal Care & Welfare.

The facility has state of the art laboratory facilities which will bring Environmental Science degree courses into the mix. Our host, Sharon Jarvis explained that lecturers buried bones in the soil during the summer allowing nature to take effect. New students were then tasked with retrieving them and applying various levels of analysis, providing detailed information for their course reports. Fortunately, the same calcium exhibits were dug up as those originally placed, and the Wiltshire constabulary weren't requested to set up camp!

As the early autumn light began to fade the group moved onto the new robotic dairy facility. Here Richard Ingram, the herd manager explained how £2 million of the funding was allocated. Adequate natural ventilation is a priority for healthy livestock and the open sided building encompasses the cubicles, two robotic milking units and lecture rooms. DeLaval were chosen as the partner providing the milking technology. A fully working stand-alone automated milking unit is dedicated for teaching, with working cluster units and downstream pipework to a bulk tank. This provides the college with a new course offering in 2023; HND in Dairy Engineering. Considering the lack of skilled technicians in this discipline industry players will be taking a keen interest in the first intake.

Richard explained that the herd is split over two units, with an existing 16:16 refurbished herringbone parlour taking care of 80 lower yielding cows which are loose housed. This ensures the DeLaval technology is fully exploited with cows typically producing 33 litres per day. This is expected to rise as freshly calved cows re-enter the high yielding herd. Data monitoring via ear tags shows that daily visits to the robot are in the 3.0–3.2 range, rising to 3.6 or higher. An improvement over the figure of 2.6 when the new dairy was first commissioned in November 2020.

Other important cow health information is captured such as feet condition and mastitis. Lame cattle do not want to walk far and therefore won't visit the milking stall as often. DeLaval have developed a Mastitis Detection index (MDi) as part of their product offering. This has a scale of 1 to 6, which indicates the health of an udder via individual milk meters for each quarter. A combination of measuring conductivity, blood, milk flow and the overall miking duration.

This 'early warning' system has enabled treatment via non-prescriptive methods such as peppermint cream applied to the outside of the cow's milk bag. The cumulative savings quickly demonstrate the benefits of robotic milkers. No requirement to quarantine milk and subsequent loss of income. Reduced medication costs, and most importantly heading off infection before it takes hold and becomes persistent. This reoccurrence would eventually result in culling an otherwise healthy cow which could have several lactations remaining in its working lifespan.

Richard and his team are relieved this investment was completed before the recent hike in prices for construction materials and delays in supply chains. As an indication of the benefits delivered by robotic milkers, DeLaval have seen enquiries for similar installations grow exponentially. With Richard's enthusiasm and attention to detail, new students are set for a rewarding learning experience at Wiltshire College Lackham.

Membership matters

Wrekin Branch

The Claas Terra Trac

Report by Bill Basford

Colin Arnold and Dean Cottey from Claas and both ex Harper Adams students led the first of the Wrekin Branch's meetings following 2020 lockdown.

This was a face to face meeting at Harper Adams University with 57 people, mainly students, attending, but additionally streamed live over Zoom with 19 attending from as far afield as Germany.

Colin and Dean, in introducing themselves, did a splendid job of reinforcing the Harper experience linking with placement and subsequent careers as well as membership of IAgrE.

Colin introduced the evening summarising the history of tracks on combines developing from 1955 with steel tracks on combines harvesting rice. Through Claas's collaboration with Caterpillar rubber belt tracked tractors in 1985 much was learnt with the first showing of a tracked combine at the Royal Show in 1989 – how soon have we forgotten the Royal's influence in UK agriculture?

At that time this was a full track mounting but soon the company concentrated on half tracks adopting a friction drive, unlike lugs on other systems. Studies by Dirk Ansorge at Cranfield showed some 30% less compaction at depth compared to tyres though at 10-12cm depth an increase was found, alleviated by 'normal' cultivation.

Advantages of the Terra Trac included, smoother running, more stable sideways movement, increased forward speed all of which now results in 75% of Claas hybrid combines sold in UK including Terra Tracs.

Colin elaborated on Axion tractor Terra Trac fitment from 1997 onwards to the present day. The main difference from combine use being an increased diameter drive wheel to offer great friction for drive. The latest developments being within development of autonomous tractors and sales of the TerraTrac components to root harvester manufacturers.

Dean, being responsible for forage equipment then highlighted the system differences when fitted to self-propelled foragers and trailers involved. He spoke particularly about the 960 and 990 TT models normally having the 300mm track width option. All the previous benefits of combine and tractor use were confirmed but with the additional benefit that on foragers the front part of the Terra Trac can be lifted allowing less damage when turning on grass and maize headlands particularly. This reduces the effective track length – by around 40% which though increasing the loading on that part, reduced surface screwing and scuffing of the turf particularly. This feature also contributed to the forager's ability to pass through 'boggy' ground.

This presentation was recorded and will be able to be viewed on the IAgrE web site.

Membership Changes

1/8/2021- 31/10/2021

Admissions

Fellow

Member

Mr Richard Hawkins (East Midlands)

Associate Member

Associate

Affiliate

Miss Sharon Jarvis (Western)

Mr Abdualhafith Khiddir (Saudi Arabia)

Technician

Mr James Currier-Teal (Western)

Mr Scott Finlay (Northern Ireland)

Student

Readmission

Mr Joachim Daudu (Nigeria)

Deaths

We have recently learned of the death of the following members and we send our condolences to their family and friends:

Mr Terence Massen – IEng MIAgrE. Joined IAgrE as a student in 1980. Transferred to Member in 1986 and gained IEng Registration in 1989. A valued member of the Institution for over 40 years.

Transfers

Fellow

Dr James Welsh (S E Midlands)

Member

Dr Charles Veys (Yorkshire)

Mr Abdualhafith Shareef (Saudi Arabia)

Associate Member

Mr Rhodri Sollis (Western)

Mr Ben Record (Southern)

Mr Alan Holmes (S Eastern)

Mr Tom Evans (Western)

Affiliate

Technician

Engineering Council

Registrations

CEng

IEng

Mr C Melvin Johnson (Wrekin)

Mr Linden Dixon (Yorkshire)

EngTech

Mr Rhodri Sollis (Western)

Society for the Environment

CEnv

Academic Members

Berkshire College of Agriculture
Hall Place, Burchetts Green, Maidenhead, Berks, SL6 6QR

Bishop Burton College
York Road, Bishop Burton, Beverley, HU17 8QG

Brooksby Melton College
Asfordby Road, Melton Mowbray, Leics, LE13 0HJ

Coleg sir Gar
Gelli Aur Campus, Llandeilo, Carmarthenshire, SA32 8NJ

Cranfield University
Cranfield, Bedfordshire, MK43 0AL

Duchy College
Stoke Climsland, Callington, Cornwall, PL17 8PB

Easton & Otley College
Easton, Norwich, Norfolk, NR9 5DX

Greenmount College
CAFRE, 22 Greenmount Road, Antrim, Northern Ireland, BT41 4PU

Harper Adams University
Newport, Shropshire, TF10 8NB

Hartpury College and University
Gloucester, GL19 3BE

Institute of Technology
Tralee Clash, Tralee, Co Kerry, Ireland

Lincoln Institute of Agri-Food
Technology, Lincoln University, Lincoln, LN6 7TS

Manchester University
School of Electrical and Electronic Engineering, C39, Sackville Street Building, Sackville Street, Manchester, M1 3WE

Myerscough College
Bilsbarrow, Preston, Lancashire, PR3 0RY

Newcastle University
King's Gate, Newcastle Upon Tyne, NE1 7RU

Pallaskenry Agricultural College
Co Limerick, Ireland

Plumpton College
Ditchling Road, Lewes, East Sussex, BN7 3AE

Reaseheath College
Reaseheath, Nantwich, Cheshire, CW5 6DF

Royal Agricultural University
Cirencester, Gloucester, GL7 6JS

Sparsholt College
Sparsholt, Winchester, SO21 2NF

SRUC – Auchincruive
Auchincruive Estate, Ayr, KA6 5HW

University of Manitoba
Winnipeg, Canada, MB R3T 2N2

Warwickshire College Group
Warwick New Road, Leamington Spa, CV32 5JE

Wiltshire College Lackham
Lacock, Chippenham, Wiltshire, SN15 2NY

Long Service Certificates
2021

60 years

Name	Grade	Date of Anniversary
Martin Edward Nellist	FIAgrE	24 Jan 2021
Edward Hervey Elwes	MIAgrE	28 Mar 2021
Michael Anderson-Upcott	MIAgrE	27 Jun 2021
Alan Lavers	MIAgrE	26 Sept 2021
Gordon Spoor	MIAgrE	26 Sept 2021

50 years

Name	Grade	Date of Anniversary
Frank John Pitkin	MIAgrE	17 Jan 2021
Charles Daniel Mitchell	HonFIAgrE	28 Jan 2021
Ayob Bin Sukra	MIAgrE	28 Jan 2021
David Suffolk Culy	MIAgrE	28 Jan 2021
Keith Charles Marsh	MIAgrE	28 Jan 2021
Ian Frederic Ruston	AMIAgrE	28 Jan 2021
Michael C Sheldon	FIAgrE	28 Jan 2021
William Charles Timothy Chamen	FIAgrE	28 Feb 2021
David Edward Huntley Pullen	MIAgrE	15 Apr 2021
Allan Langley	MIAgrE	22 Jul 2021
Peter Worland Woodliffe	MIAgrE	22 Jul 2021
Jeffrey George Beck	FIAgrE	22 Jul 2021
Richard David John Lacey	FIAgrE	22 Jul 2021
Michael Douglas Parry Matthews	MIAgrE	22 Jul 2021
Leonard Bryan Ollier	MIAgrE	22 Jul 2021
Christopher John Gaunt	AIAgrE	28 Oct 2021

35 years

Name	Grade	Date of Anniversary
Timothy Christopher Landsell	MIAgrE	8 Jan 2021
Thomas Overbury	MIAgrE	8 Jan 2021
Stuart William Albert Glover	MIAgrE	10 Jan 2021
Catherine Gail Martin	AIAgrE	31 Jan 2021
Robert Ian Barker	AMIAgrE	10 Feb 2021
Karl Vincent Searson	AMIAgrE	20 Feb 2021
Gavin Peter Simons	AMIAgrE	23 Feb 2021
Ashley Hollingshead Knibb	AMIAgrE	26 Feb 2021
Andrew Donald Haslock	AIAgrE	28 Feb 2021
Jeremy Neil Short	MIAgrE	5 Mar 2021
Christopher James Cronin	MIAgrE	27 Mar 2021
Stuart James Michael Renfree	AIAgrE	21 Apr 2021
David John Welch	MIAgrE	29 May 2021
Peter John Williams	MIAgrE	9 Jun 2021
John Penrose Mills	MIAgrE	16 Jul 2021
David Kenneth Hemstock	MIAgrE	24 Jul 2021
James Martin Brook	MIAgrE	24 Jul 2021
Keith Jenkins	MIAgrE	24 Jul 2021
Michael Eric Chamley	MIAgrE	23 Oct 2021
Robin Andrew Chase	MIAgrE	23 Oct 2021
Richard Francis Flach	AMIAgrE	2 Nov 2021
Ben Ndobe Epie Ewamg	MIAgrE	20 Nov 2021
Stephen Anthony Crowther	MIAgrE	20 Nov 2021

25 years

Name	Grade	Date of Anniversary
Marcus J Oliver	AMIAgrE	1 Mar 2021
Robert Christopher Petts	MIAgrE	12 Mar 2021
Peter Edward Steele	MIAgrE	23 Mar 2021
Craig Douglas Grant	MIAgrE	30 May 2021
Ronald David Wilson	MIAgrE	3 Jun 2021
Nitiraj Toolsee	MIAgrE	17 Jul 2021
James Alexander Wilson	AIAgrE	1 Aug 2021
Martin James Holden	MIAgrE	1 Aug 2021
Michael Walton Bell	MIAgrE	13 Sept 2021
Sumantlall Seerttun	MIAgrE	26 Sept 2021
Bhagwansing Dabseesing	MIAgrE	8 Oct 2021
James Maurice John O'Sullivan	MIAgrE	16 Oct 2021
Malcolm Adamson	AMIAgrE	21 Oct 2021
Matthew Stephen Atyeo	AIAgrE	1 Nov 2021
Keith Norman Victor Barrowcliff	MIAgrE	22 Nov 2021
Andrew John Garnett	AIAgrE	5 Dec 2021
Christopher Justin Wilfrid Rylands	MIAgrE	5 Dec 2021
Antony Robert Johnson	AIAgrE	12 Dec 2021
James Fergus Robertson	MIAgrE	12 Dec 2021

Commercial Members

Ace Aquatec Ltd
16B City Quay, Camperdown Street
Dundee, DD1 3JA

Agri-EPI Centre
1-4 Bush House Cottages, Edinburgh,
Technopole, EH26 0BA

Agricultural Engineers
Association (AEA)
Samuelson House, 62 Forder Way,
Hampton, Peterborough, PE7 8JB

AGCO Ltd
Stoneleigh, Abbey Park, Kenilworth,
Warwickshire, CV8 2TQ

Alvan Blanch Development Co
Chelworth, Malmesbury,
Wiltshire, SN16 9SG

Amazone Ltd
Orchard Farm, Hurst Lane, Auckley,
Doncaster, South Yorks, DN9 3NW

Autoguide Equipment Ltd
Stockley Road, Hedington, Calne,
Wiltshire, SN11 0PS

BAGMA
225 Bristol Road, Birmingham,
B5 7UB

Briggs Irrigation
Boyle Road, Corby, Northants,
NN17 5XU

City and Guilds
1 Giltspur Street, London, EC1A 9DD

City Farm Systems Ltd
25 Hepplewhite Close, High
Wycombe, Bucks, HP13 6BZ

CLAAS UK Ltd,
Saxham, Bury St Edmonds, Suffolk,
IP28 6QZ

David Ritchie (Implements) Ltd
Carseview Road, Suttieside, Forfar,
Angus, DD8 3EE

De Lacey Executive
Suite 7, Malvern Gate, Bromwich
Road, Worcester, WR2 4BN

Douglas Bomford Trust
The Bullock Building, University Way,
Cranfield, Bedford, MK34 0GH

DSL Systems
Adbolton Hall, Adbolton Lane, West
Bridgford, Nottingham, NG2 5AS

NFU Energy Services
Stoneleigh Park, Kenilworth,
Warwickshire, CV8 2LS

Fullwood
Grange Road, Ellesmere, Cheshire,
SY12 9DF

Household Sprayers
Roughton Moor, Woodhall Spa, Lincs,
LN10 6YQ

HSS Hire
25 Willow Lane, Mitcham, London,
CR4 4TS

JCB
Rocester, Staffs, ST14 5JR

John Deere Ltd
Harby Road, Langar, Nottinghamshire,
NG13 9HT

Knight Farm Machinery
Wireless Hill Industrial Estate,
South Luffenham, Rutland,
Leicestershire, LE15 8NF

Marks & Clerk LLP
90 Long Acre, London, WC2E 9RA

Mastenbroek Ltd
83 Swineshead Road, Boston, Lincs,
PE21 7JG

National Fluid Power Centre
Carlton Road, Worksop, Notts,
S81 7HP

Nick Young Tractor Parts
Unit 2, The Forge, Moor Road,
North Owersby, Market Rasen,
Lincolnshire, LN8 3PR

Orby Engineering
Craigmore Road, Newry, BT35 6JR

Reesink Turfcare UK
1-3 Station Road, St Neots,
Huntingdon, PE19 1QH

PlantTech Research Institute
Bay of Plenty, New Zealand

Shelbourne Reynolds
Shepherds Grove Ind Estate, Stanton,
Bury St Edmunds, Suffolk, IP31 2AR

Spaldings Limited
25-35 Sadler Road, Lincoln,
Lincolnshire, LN6 3XJ

SSAB Swedish Steel Ltd
Narrowboat Way, Hurst Business Park,
Brierley Hill, West Midlands, DY5 1UF

Teagle Ltd
Blackwater,Truro, Cornwall, TR4 8HQ

TeeJet London Ltd
Headley House, Headley Road,
Hindhead, Surrey, GU26 6UK

Witham Oil and Paint Ltd
Outer Circle Road, Lincoln, LN10 6YQ

Profession
Research roundup

Soil Health Initiative guides launched to help farmers manage their soil

The UK Soil Health initiative (UKSHi) has produced a series of guides for farmers and growers seeking advice on soil health and husbandry and have been launched to coincide with World Earthworm Day.

Six guides are available, covering different farming systems:

Upland livestock farms
Lowland livestock
Mixed farms
Combinable cropping
Root crops and maize
Field vegetables

The broad, cross-industry collaboration that developed the key messages and advice contained within these new guides creates a sound foundation for action by farmers and the wider agricultural sector. This wide-ranging partnership was brought together by the UK Soil Health initiative, the WWF-Tesco Partnership and Championing the Farmed Environment (CFE) to help identify the actions that can be taken on-farm to better manage soils for a sustainable future.

Healthy, well-managed soils are the foundation for productive farming systems. Taking steps to improve soil health is a vital part of future-proofing all farms against the challenges of climate change and changing government support, by supporting good yields and reducing environmental impacts.

Elizabeth Stockdale, head of farming systems research at NIAB said: "These simple, practical guides mark a real step-forward in helping farmers manage soil, for the benefit of all.

"Each guide contains a simple starting place of three things to consider, and three things to avoid. We'd love all farmers to start with that, and this would make a real difference to our soils – potentially improving crop yields, alleviating flooding and improving biodiversity. For any farmers that want to do more, the 'Going beyond the norm' section of the guides gives advice on more advanced soil management options."

Callum Weir, sustainable agriculture specialist, WWF-UK, added: "The cross-industry support and collaboration we've had in putting these together has been invaluable. The guides contain real-life, practical advice to help farmers and land managers.

"So many stakeholders, who have different roles in managing our farmed landscape, have aligned behind the message in these six guides. It really is worth the whole industry taking a look and implementing the messages contained in the guides."

The guides can be downloaded at **www.cfeonline.org.uk/environmental-management/soils/uk-soil-health-initiative-guides**

"The guides contain real-life, practical advice to help farmers and land managers."
Callum Weir, sustainable agriculture specialist

Plotting a new course

- An Aberdeen crop trial field which has been providing Britain's farmers with vital scientific data for 60 years is being dug up and transported a mile along the road

- Around 450 tonnes of soil – the equivalent of 90 full-grown elephants – is being taken by tractor and trailer from Woodlands Field at Craibstone to a pre-prepared field nearby to 'preserve the unique historical legacy of the soil's management'

The soil will be used for new research to better understand the relationships between acidity, carbon and nutrient dynamics and help design agricultural systems with lower greenhouse gas emissions.

Operated by SRUC, Woodlands Field has been home to a pH gradient rotational experiment since 1961.

The maintenance of soils at different pHs (levels of acidity) from 4.5 (very acid) to 7.5 (alkaline) has resulted in a range of chemical environments and microbial communities which create a unique facility for investigating how soils, plants and microbes work together to influence productivity. It will also address important questions about carbon dynamics in soils.

But with the Woodlands Field site now earmarked for housing, the soils from the pH experiment will be used for new research. This is thanks to a partnership with the University of Aberdeen, which owns the recipient field at Ashtown – the steading next door to Craibstone.

The two institutions have created the Aberdeen Cropping systems Experimental (ACE) platform, which not only secures the legacy of the Woodlands Field long-term experiments but has the potential to reinvigorate cropping systems research in the Northeast of Scotland.

The partnership hopes to develop and fund additional crop and soil experiments as well as instrumentation at the new site. These will address issues such as climate change, carbon sequestration, novel crops and alternative inputs as well as assess the impacts of extreme soil environments on crop productivity and soil functioning.

Professor Christine Watson from SRUC, who is leading the project, said: "This is a unique opportunity to build on the heritage of decades of experimentation at Craibstone in a way which allows us to combine modern experimental design and unique soil microbiomes to address critical questions around the role of soil health in future agricultural systems.

"The partnership with the University of Aberdeen brings together a strong team of plant and soil scientists with the capacity to bring national and international research funding to this new experimental platform."

Professor Paul Hallett, who co-ordinates the MSc Soil Science at the University of Aberdeen, said: "From the climate emergency to the threats of soil degradation on food security, this revamp of SRUC's classic field experiments provides an excellent resource on our doorstep to help tackle these challenges. Through this partnership with SRUC our teaching and research on these important topics will benefit considerably."

Profession
Research roundup

Recent weather patterns lead to smaller harvests

- Winter wheat and spring barley yields greater under typical 20th Century than 21st Century climate
- Weather conditions typical of the past 30 years have significantly limited harvests of winter wheat and spring barley, according to analyses of 124 years of crop yields from long term experiments

Looking at monthly summaries of daily temperatures, rainfall, and sunshine hours, for one site in southern England, researchers have identified 10 distinct 'clusters' of yearly weather patterns that occurred from 1892 to 2016.

The annual weather cluster most

The past 20 years weather conditions have significantly limited winter wheat and spring barley harvests.

dominant after 1991 generally had higher summer temperatures and more intense winter rainfall distributions but with a particularly dry June - and it is this weather pattern which was also associated with the lowest cereal yields.

Hay yields from pasture under the same weather pattern were not impacted to the same extent, however.

The scientists from Rothamsted Research used data collected from the weather station and crop experiments first set up at their Hertfordshire institute in the 19th Century, and say that their analysis of weather patterns and associations with crop yields is more relevant and realistic than solely looking at the effect of average temperature.

They found that five annual weather patterns which occurred frequently during much of the 20th Century have not recurred in more recent years, according to lead author Dr John Addy.

“This provides unambiguous evidence of climate change in several more dimensions than mean temperature alone.

“Climate change is about more than just increasing temperature. The long-term trend of annual mean temperature is only one aspect of recent climate change. Other changes in climate, seen in within-year weather patterns relevant to crop production, have also occurred since the late-19th Century.”

Understanding simultaneous changes across multiple weather variables provides an understanding of how the climate has changed for agriculture, and potentially how these influences yield, he added.

The team used multivariate statistical analysis approaches to provide insight into the different patterns of variation in multiple weather variables during a year, the variation in these patterns amongst years, and how the frequency of the different patterns has changed, particularly in the past 25 years.

The frequency of occurrence of years within each weather cluster varied considerably during the study period, with the late 20th and early 21st Century having distinctly different distributions across clusters to earlier in the 20th Century.

Three clusters (‘Cold Winter and early-Spring’; ‘Cold August to September’; ‘Cool and dry March’) contained 64% of years during the 20th Century whilst one cluster, ‘High temperatures, drier June’ contained 63% of the 21st Century years included in the analysis.

The data for the study came from the Rothamsted Meteorological Station, which has recorded daily rainfall, temperature, and sunlight since 1892, and Rothamsted's famous long-term experiments with winter wheat, spring barley and pasture grasses, which began even earlier in the mid-19th Century.

Analysis of the annual yields of winter wheat, spring barley, and grassland across the different weather clusters showed that, on average, years in clusters typical of the 20th Century climate provided greater off-take of cereals than those from the early-21st Century.

Years with a cooler winter and early-spring provided the greatest winter wheat yields, whilst drier years with a warm early-summer provided the highest spring barley harvests.

However, the impact of weather was smaller for grassland pasture than for the two cereal crops implying herbage production was more resilient to changing climate at this site.

The three experiments analysed were the Broadbalk winter wheat experiment, Hoosfield continuous spring barley experiment, and the Park Grass continuous herbage experiment.

Professional
The Douglas Bomford Trust

Douglas Bomford Trust (DBT) Secretary Alan Plom reflects on the Trust's (virtual) activities over the past few months and looks forward to 2022:

Supporting IAgrE and Students

We have continued to take advantage of IAgrE's wide-ranging series of online Lunchtime Lectures and Branch meetings to catch up with some of our current and previous DBT Scholarship winners. Most recently, Harper Adams student Rhodri Williams, who tuned in to the 'Future Fuels' Landwards Conference from Germany, where he is now working for Claas at Harsewinkel.

Like his predecessors, Rhodri is enjoying his work and the challenge of learning German too. He recognised that his international experience and working towards his EngTech will be of interest to others. Achieving his professional qualification will be helped by gaining useful CPD from attending IAgrE's online meetings too.

As reported previously, DBT and IAgrE have been discussing creating a forum for students and graduates to share their experiences, to help others progress their projects and careers. If you are willing to share your knowledge and experience, please let us know, via enquiries@dbt.org.uk. .

Another contact made during the 'Future Fuels' Conference was another Harper student Barnabas Pickford, who previously received a DBT-funded 2-year Arkwright Scholarship when he was still at school. Under this Scheme, the Trust funds two new A-Level students each year. These are awarded to selected pupils who have specifically expressed an interest in agricultural engineering. With personal mentoring, we hope to encourage them into studying a related subject at University and ultimately pursue a career in the industry.

Arkwright Awards

The Arkwright Awards are usually announced and presented at a grand ceremony held each year at The Institute of Engineering & Technology (IET), Savoy Place in London. Unfortunately, for this year's new Scholars (and our Trustee/ Student Mentor Richard Robinson), this event was held online again. We hope to be able to meet the recipients some time, and will be encouraging them to attend their local IAgrE Branch meetings – or any others – in person or online, over the next two years.

Project Funding

We have received more applications to fund a more diverse range of research projects than in recent years, so we look forward to an interesting (and challenging) Board meeting in mid-November.

Applications for financial support for projects or other purposes may be submitted at any time (via the email below), although requests for amounts over £5,000 are only considered twice yearly (in mid-April and mid-November).

See our website **www.dbt.org.uk** for guidance, to download the application form, and for a selection of reports from past and current projects.

Golden Anniversary 2022

We are also looking forward to celebrating the Trust's 50th year throughout 2022. We would welcome any recollections of how the Trust has helped individuals or groups over the past 5 decades – particularly in the 'early days'. Please email your stories to enquiries@dbt.org.uk. Our special 'Jubilee' event in September will be looking forwards too.

Watch this space and follow us on Twitter and LinkedIn @BomfordTrust for further announcements.

For further information see our website www.dbt.org.uk or contact the Trust via enquiries@dbt.org.uk or phone 07951 527051.

South East Midland Branch Talk - History of a field – Broadbalk
Speaker: IAgrE Fellow Chris Watts
This 3 ha field is the site of the longest running field experiment in the world. It continues to provide a platform for advances in agricultural science and technology.
01/12/2021 - 7.30pm
via Zoom

West Midlands Branch online Technical Talk - An introduction to Li-ion battery packs
Talk by Dr Peter Miller from UTAC - Topic - Battery pack engineering, battery management systems and thermal management.
07/12/2021 - 7.30pm
Online Technical Talk

Wrekin Branch Online Technical Talk - subject TBC
Topic and speaker to be confirmed
Contact David Clare, Branch Secretary for information on Wrekin Branch Events ...
14/12/2021 - 7.15pm for 7.30pm
Online via Zoom

Lunchtime Lecture - How a code of practice for crop robot equipment can support innovation and production
The BSI, the British Standards Institution, are tasked by Government with facilitating and implementing standards for UK businesses and are currently working to compile standards for the use of crop robots.
14/12/2021 - 1pm-2pm
Online Meeting

ADBA National Conference 2021
Highlights include:
1. COP26 Debrief
2. An update from the Climate Change Committee
3. KEYNOTE A government update on the role of biogas over the next decade, in the context of its Net Zero Strategy and the Methane Pledge

14/12/2021 - All Day

South East Midlands Branch Talk - Adoption Pathways for Autonomous Crop Equipment
Speaker: James Lowenberg de Boer, Harper Adams University
Autonomous crop equipment is being marketed for arable and horticultural farms. For the arable sector, co-robotic smart equipment is being adopted in areas with large, rectangular fields where large scale agriculture was highly successful, but driverless equipment may be more practical and profitable in areas with small irregularly shaped fields.
12/01/2022 - 7.30pm
via Zoom

TECHNICIAN GRADE

NEW ROUTE INTO IAgrE FAMILY

DAIRY EQUIPMENT TECHNICIAN

The Technician grade of IAgrE Membership is for those who are qualified at a vocational or technical level. They may have completed an apprenticeship or extended diploma. Alternatively they may have gathered technical training at work or participation on an IAgrE approved training programme such as Parlour Safe.

To qualify, you will be working in industry and will have built up experience and career development in the workplace.

You will be keen to be part of the IAgrE family and seeking a cost effective way of getting involved and benefiting from being part of the community of professional engineers.

The IAgrE Technician Grade for Parlour Safe Technicians

If you are registered under the Parlour Safe scheme and have attended training courses at Reaseheath or Hartpury Colleges you are eligible to apply for IAgrE membership and use the letters TIAgrE after your name and on your business card as a way of demonstrating your high standards to your customers and colleagues.

If you have completed the training and assessment at Parlour Safe Category 3 and above you can also apply to become a professionally registered engineer.

This will permit you to use the title of Engineering Technician and join the growing number of engineers who use the letters EngTech as a demonstration of high standards and professionalism.

PARLOUR SAFE

To apply and find out more:

Go to the IAgrE website and complete the Application Form iagre.org/technician. With your completed application form, you will also need to provide a current full and detailed CV which describes in detail your working history and experience. We will need copies of academic certificates and details of education/training.

For further information contact Alison membership@iagre.org or 01234 750 876