



REAP CONFERENCE 2023  
**Adaptation Through  
Innovation; Beyond  
the Comfort Zone**



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## INTRODUCTION: Adaption through innovation

*REAP was opened by John Barrett, Director of Sentry and Chair of the Agri-TechE Stakeholder Group.*

"2023 has been quite a year in the farming industry. We started the year with wheat prices at a record high and have finished with wheat prices falling and crop input costs seemingly out of control.

"Such is the rollercoaster of farming, but our challenge is to try and take back some of that control and reduce those costs, by adapting our businesses and learning from others. This is very much the ethos of REAP.

"REAP is now in its 10th year. When I think back to 2014, it was the start of the environmental payments, and the focus was on what this meant in practical terms on-farm. Today the Sustainable Farming Initiative (SFI) is very high on the agenda, and we are all transitioning our businesses to align with the Net Zero goals.

"Sentry, as a business, is benefiting from being part of Agri-TechE on this journey and I would like to highlight some of the opportunities that we have gained from membership.

"Diversification is a key priority. I attended an Agri-TechE event earlier in the year on alternative cropping. Hemp, I think, offers a great opportunity for light soils and is something I have wanted to grow for a while. It is a fascinating crop with a very short growing period. It requires no herbicides, no insecticide, just a little bit of fertiliser and it grows like stink, so hopefully that's a crop for the future.

"Flax is another crop that came out of that event; we tried 18 hectares of it down in Kent. Although not a great crop – 268 millimetres of rain in March and April didn't help – it was a learning experience, and we are planning to grow more next year. As luck would have it, the rest of Europe had a poor harvest, so what we have produced this year is actually worth a good bit of money.



"Finally, at REAP 2022, I saw the ROBOTTI demonstration outside and didn't think too much of it. But we gave it a little bit more thought and talked to Tom, from Autonomous Agri Solutions, and knew that we and he could make it work. We used the robot to drill 150 hectares of sugar beet – not an insignificant amount – on two farms, one in Lincolnshire and one in Cambridgeshire. It worked well and made a significant reduction on our input costs and environmental impacts. It was a real success and we're planning on developing it, adapting it and progressing next year.

"I hope that you too will gain a positive learning experience from REAP and together we can move forward into the stretch zone where innovation happens."



# FOOD PRODUCTION, CLIMATE MITIGATION, AND REVERSING BIODIVERSITY LOSS ON LIMITED LAND

*To keep global warming to no more than 1.5°C – as called for in the Paris Agreement – emissions need to be reduced by 45% by 2030 and reach Net Zero by 2050.*

*The UK was first to sign up to this commitment and agriculture currently contributes to 10 percent of UK emissions. But this must not be achieved by exporting food production.*

**Professor Gideon Henderson**, Defra Chief Scientific Advisor, gave an overview of the government response to Net Zero with reference to agriculture.



## **Produce more on less land**

61 percent of the food we eat (by cost) is produced in the UK, so there is a need to increase productivity to produce more, in different ways, and on a smaller footprint, in addition to releasing land for environmental benefit.

This strategy is a major driver for government policy. It includes a desire to remove food production from least productive areas or environmentally vulnerable areas, and to provide incentives to ensure that land taken out of production is used in environmentally beneficial ways

## **Delivering for the environment**

- Tree planting: target to increase tree cover by 30,000 hectares per year
- Peatlands: these soils are of major importance to food production and are also a carbon store, however degradation is releasing carbon into the atmosphere. Plans are developing to inform a change of land use in these vulnerable ecosystems.
- Biomass strategy: energy production from biomass is predicted to provide a major contribution to Net Zero strategy. The focus will be on negative carbon technology where carbon is taken out of the system.
- Habitat restoration: an ideal objective for the future is for a patchwork of environmental schemes to work alongside food production, with a target of two million hectares to be taken out of food production.

## **Increasing productivity**

- Genetic improvement networks (GINS): these are focused on a major crop plant, for example wheat at Rothamsted Research and John Innes Centre (JIC), pulse crops at JIC, oilseed rape at University of York, and vegetables at University of Warwick. One example of the progress being made is a programme that has been successful in breeding resistance to orange blossom midge into 40% of UK wheat.
- Precision breeding: gene editing offers the potential for greater productivity, disease resistance, and greater climate and food security. Through reduction on dependence on agrochemicals it also offers environmental and public health benefits.
- Diversification: there are more than 700 edible plant varieties but only six are used as staple foods. Research is directed at increasing the variety of species used for agriculture.
- New food systems: hydroponics, controlled environments, ocean production provide the opportunity to produce more on a smaller footprint.

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### Investment in agri-tech to provide solutions

A number of large-scale applied science programmes aim to underpin the strategy. These include:

Natural Capital and Ecosystem Assessment (NCEA) programme – collecting evidence on the extent, condition and change in England’s ecosystems and natural capital, and their benefits to society.

Innovation in environmental monitoring – research to develop and improve monitoring to provide cost-effective tools.

Farm Innovation Programme – a multi-tier industry-led research programme that includes Farming Futures R&D fund with themes such as:

- Climate-smart farming
- Sustainable farm-based problems
- Automation and robotics
- On-farm environment



*In his response, NFU Vice President **David Exwood** stressed his vision that the UK could a world leader in sustainable farming.*

He called for government support to create:

- a land use framework to balance the needs of food security, energy security and environmental services.
- a national action plan on pesticides to address pressing issues such as use of glyphosate and neonicotinoids.
- an industrial strategy for fossil fuel-free farming that looks at biomass, but also the use of hydrogen and green ammonia, and includes measures for equipment manufacturers to look beyond diesel.
- Support for new crops that can respond to climate change and enable diversification.
- improved rural connectivity to support productivity; David said: “farming through my phone was not possible five years ago, but now it is possible for those with the necessary connectivity.”

David is a strong advocate for agri-tech and says that the use of technologies to support precision livestock and to manage grazing with virtual fencing are revolutionizing livestock farming. He also praised the development of weather stations that can provide micro weather forecasts in real-time, as this helps to enable timely decision-making.



# THE FARMER BREAKFAST

The Farmer Breakfast was sponsored by **Savills**

A packed room of farmers had the opportunity to meet with the keynote speakers, Defra Chief Scientific Advisor Professor **Gideon Henderson** and NFU Vice President **David Exwood**, ahead of the conference. The lively discussion included a number of areas of topical interest.

## Withdrawal of chemicals

Two of the urgent enquiries from farmers were about the use of glyphosate to support min-till (for which it is used to burn off vegetation before direct drilling) coming up for discussion in the EU, and the use of neonicotinoids in coated seeds to control virus yellows in sugar beet. The decisions for the UK would be made by the Health and Safety Executive in due course.

One of the considerations emerging from the EU is the concept of total loading – the accumulative impact of pesticides. This is an issue that hasn't been considered before and the implications of this were discussed.

## Carbon markets

The viability of carbon credits and plans for creating consistent standards for carbon measurement were another topic raised.



Generating carbon codes for woodlands and peatland has been well established, but carbon in soil is more complex, the standards are still evolving for carbon calculators, and more long-term research is needed. As soil health is clearly vital for food and water management, so the government's current position is to encourage soil health rather than to incentivise carbon storage.

However, there is an argument that carbon and Net Zero are core values in food production and should be considered together. Concerns were expressed that UK farmers could be undercut by imports that are grown less sustainably. Various solutions were discussed, including the use of carbon border taxes on imports that are produced less sustainably, which could create a more level playing field if UK farmers move faster towards fossil fuel free farming.

Other topics of discussion included:

**Regenerative farming:** it was agreed that this is still a developing area and more research is needed on long-term impacts of a change of cultivation and best practice with regards the use of cover crops, rotations and crop varieties.

**Overseas trade:** despite an enthusiastic response from all sectors of the industry for the Precision Breeding Act in England, and evidence that the EU is accelerating its own response, there remain EU market acceptance issues for products developed using gene editing. Seed breeders, for example, are focused on the EU market and this will delay the uptake of these technologies.

There is a more positive position from the USDA and in South America, so potential for early market approval in these geographies is greater.



## EMERGING AGRI-TECH: Research Into Practice

Scientists at some of the UK's leading agricultural organisations use an object to illustrate how their research is heading for impact in the industry and provide insights into the research pipeline.

Emerging Agri-Tech was sponsored by **DIGIT Lab** and chaired by **James Green**, Director of Agriculture at G's Fresh



### The importance of removing the field heat from harvested crops

**Richard Colgan**,  
National Resources Institute, University of Greenwich

Strawberries require post-harvest cooling immediately after harvest, and the development of an in-field cooling rig called CoolBerry was able to rapidly remove the field-heat from fruit.

Richard Colgan and his team found that the field crate and punnet design had a significant bearing on the speed of cooling: ensuring there is a big enough gap in the trays to allow air to flow across the trays in the pallet was key to ensuring the quality of fruit was maintained in the supply chain – with a 200% difference between the best and worst performing trays. The project consortium developed an infra-camera system able to track changes in fruit temperature across trays during cooling.

The research is easy to implement and could result in a significant reduction in waste and extend the shelf-life of the fruit.



### You'll all be eating grass soon! Is green the new gold?

**Richard Green**, Harper Adams University

Could a new process produce protein and vegetable oils from grass without the need for livestock? Researchers at the University of Bath and Harper Adams University are developing technology to extract edible protein from grass. If scaled this could produce half the protein consumed in the UK, using less than three percent of the UK's farmland.

Oils are further created by feeding yeast on the remaining material and then processing it to extract a range of edible oils equivalent to current vegetable oils, such as soy, palm, and rapeseed, the most used food oil in the UK. Initial findings suggest that this process could be very lucrative with one tonne of silage dry matter producing 120 kg of oil and 150 kg of protein. Researchers are now scaling up the process and suggest that the process's first grass-based food products might be commercially available in less than five years.

Richard Green believes that the technology will have a huge impact on UK farming by creating a new market for grass from both arable and grassland farms.



## Enhancing root endosymbiosis to promote sustainable biological farming

**Myriam Charpentier**, John Innes Centre

The microbes surrounding the roots of crop plants play an important role in making nutrients available to the plants. In the lab, enhancing the plant mycorrhiza association can increase yield by 20 percent.

The synergy between microbes and wheat has been reduced through breeding which assumes a nutrient-rich soil.

Researchers at JIC have found a way to make plants perform better in cultivated soil. The advanced breeding technique uses gene editing to change a single nucleotide in the wheat, which has been found to be sufficient to increase the amount of nitrogen in the flag leaves of wheat (early stage of growth).



## When blondes don't have more fun: can we use innate biology to reduce postharvest quality loss?

**Ewan Gage**, Cranfield University

Broccoli deteriorates soon after harvesting if not chilled rapidly and this is seen by a yellowing of the florets.

Researchers have found that quality loss can be reduced if the harvested heads are exposed to a low-doses of oxidative stress (such as UV light) which increase resistance to stressful conditions in the supply chain. This phenomenon, known as hormesis, can also increase the nutritional content of vegetables as it promotes the production of secondary metabolites (beneficial compounds). Broccoli contains powerful health-promoting phytochemicals and antioxidants including glycosylates, which can reduce the risk of cancer and heart disease.

Ewan Gage has been experimenting with hormesis to develop a low-refrigeration post-harvest management strategies for broccoli. The intention is to extend the shelf-life, reduce the need for refrigeration and increase the nutritional value of the product.



## Beer to bovines: what's the connection?

**Jolanda van Munster**, SRUC  
(presented by **Susannah Bolton**)

We have used fungi, such as the microbes that we know as yeast, for millennia to produce useful products such as bread and beer. Similar fungi play a role in ruminant digestion – they help break down the cellulose walls of grass and other plants in the rumen to release useful nutrients.

The greenhouse gas methane is produced as a byproduct of this process. If this metabolic process was better understood it might be possible to make the microbial process more efficient, producing more protein and wasting less as gas.

Jolanda van Munster is investigating the activity of these fungi, working together with other researchers at SRUC to assess the links of these and other rumen microbes to animal performance.





## What words would a worm whisper?

*Jacqueline Stroud, University of Warwick*

Soil health is strongly influenced by soils management but measuring soil animals is very challenging using traditional methods. Soil scientist Jackie Stroud is working on a new strategy to measure soil health.

Working with Baker Consultants, her research team has found that soil earthworms and mesofauna make sounds which can be detected. The initial data suggests that a noisy soil is a healthy soil. This means that monitoring soil sounds could be used as a measure of soil ecosystem health.

They are developing prototypes of hand-held soil acoustic probes and working together to generate an acoustic library to help to interpret soil noises.



## Wildflower genomics to inform the creation of new habitats

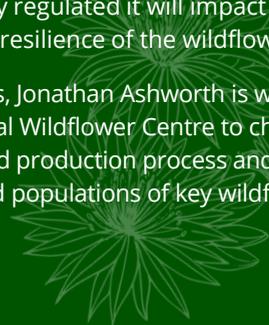
*Jonathan Ashworth, Earlham Institute*

How will commercial wildflower seed production impact the genetic diversity and therefore resilience of the wildflower 'crop'?

It is anticipated that the Biodiversity Net Gain legislation, introduced in January 2024, will increase the demand for commercial quantities of wildflower seed, as developers are required by law to create new habitats to offset negative environmental impacts.

The UK Habitat Classification (UKHab) uses native plant indicator species to define habitats. However, there are growing concerns that if the native seed production process is not adequately regulated it will impact the genetic diversity and therefore resilience of the wildflower 'crop'.

To address this, Jonathan Ashworth is working with the Eden Project National Wildflower Centre to characterise the wildflower seed production process and its effects on genotype, phenotype and populations of key wildflower species.



## Sniffing out on-farm insects - what can smoke detectors teach us?

*David Withall, Rothamsted Research*

Insects attract mates using pheromones - scents that are specific to their species. Researchers at Rothamsted Research have found a way to mimic how insects detect these unique pheromone fingerprints and use it to identify the species present in a crop in real-time.

David Withall predicts that this could be used to create a type of 'smoke alarm' that can provide early warning of a pest, such as aphids, invasive species, or even beneficial insects.

The detection technology could be cost-effective and enable informed decision about use of plant protection products.



# INNOVATION FOR A SUSTAINABLE SUPPLY CHAIN

*Although still in its infancy, new regulation is driving innovation through the value chain, requiring every link in the chain to reduce their emissions and remove 'fossil fuel' products from their operations.*

*The supply chain panel was chaired by **Jon Williams**, Public and Governmental Affairs Manager – Agricultural Solutions, UK and Ireland, BASF*

Net Zero is top of mind for larger corporates as 2023 is the first year of mandatory reporting for the Task Force on Climate-Related Financial Disclosures (TCFD). It impacts companies with over 500 employees operating in food retailing, agricultural production, food and beverage processing.

Representing these sectors were **Peter Illman**, Sustainable Agriculture Manager of Tesco, and **Andy Griffiths**, Head of Sustainable Procurement at Diageo. They spoke about how their organisations were aligning with the Net Zero vision.

A key element of TCFD is introducing measures to reduce the Scope 3 emissions from primary production, so both Tesco and Diageo had introduced trials with farmers that aimed to capture learning points for a transition to regenerative farming.

Tesco has introduced a trial of eight market-ready low carbon fertilisers. The trials, which took place on commercial farms, found the organic alternatives to be as effective as conventional fertilisers whilst cutting emissions by up to 50% – crucially, with no extra costs for farmers.

For Diageo, the goal was to identify which on-farm improvements would make the biggest reductions on emissions whilst increasing resilience to climate change. It is working with Agricarbon to improve its metrics. This includes development of baseline carbon footprint data for farms producing barley for its Guinness.



**TOP:** Peter Illman, Tesco

**MIDDLE:** Andy Griffiths, Diageo

**BOTTOM:** Barbara Correia, B-Hive Innovations

## Working together on TCFD

These presentations by Tesco and Diageo illustrated how innovation is being co-developed with their producers, to address challenges in the supply chain.

This was further developed by **Barbara Correia**, Principal Research Scientist of B-Hive Innovations. She gave some examples from the fresh produce supply chain that are aimed at improving potato handling and storage to reduce food waste and the use of chemicals:

- **TuberTurgor** detects early signs of potato bruising by investigating non-destructive methods for measuring turgor pressure in potatoes. This is the force inside cells that pushes outwards, enabling cells to withstand shocks and reducing bruising.
- **Tubersense** provides early indications of disease by detecting gases released by potatoes in storage. It will use volatile biomarkers and innovative gas sensors.

## Wishlist

The three speakers answered questions from the floor and outlined their wish list from technology developers including:

- **Fast:** real-time measurement to speed up operations
- **Accurate:** credible predictive capabilities
- **Smart:** total end-to-end technology that can be integrated into existing systems
- **Cost-effective:** make the tech work for farm businesses
- **Resilient:** robust to operate in a range of adverse environmental conditions.
- **Trust:** to enable data sharing

## START-UP SHOWCASE

The 2023 Start-Up Showcase featured an exciting line-up of emerging and growing businesses looking to meet farmers, investors and future collaborators.

The Start-Up Showcase was sponsored by **Rothamsted Enterprises** and chaired by **Nicole Sadd**, Executive Director of Rothamsted Enterprises



### Autopickr presents Gus, its adaptable asparagus harvester

"Shortage of labour is forcing smaller asparagus growers out of business, so they ask us three things: how much does our robot harvester cost, does it work and is it reliable?" explains Robyn Sands, Co-founder and CEO of **Autopickr**, the developer of Gus, an affordable, robust robot for field and undercover operations. Designed to solve a major challenge for the industry, it also offers potential to extend the harvesting season and shelf-life of this high-value crop.

Robyn was looking forward to meeting other agri-tech start-ups and potential end-users at REAP. She says: "We are very open to collaboration, as we have also designed a rugged, farm-proof and low-cost farm vehicle to carry our technology around – and this is attracting the interest of other early-stage companies. It would be possible to repurpose this technology for other equipment.

"We are always interested in feedback from end-users, particularly now as we approach a final commercial product, and of course meeting new investors is also useful as we are starting to prepare for our seed raise in February."

Find out more at [autopickr.com](https://autopickr.com)



### Sniffing out soil health in-field with results in five minutes

An electronic nose to sniff out soil health that will deliver results to a farmer's phone in five minutes is being developed by **PES Technologies**. The company is able to create an aroma fingerprint from gas released by microbes in the soil. These organisms are essential for breaking down organic matter and making nutrients available to plants, but current biological lab tests are expensive and take ten weeks to provide results.

Jim Bailey, CTO and Co-founder of PES Technologies, says: "We are interested in meeting end-users – particularly agronomists – as well as collaborators.

"Our electronic nose could potentially be trained on more indicators than the ones that we will offer on launch, and we are keen to explore what people are looking for.

"We are happy to talk to companies that would want to fund a machine learning dataset for their own market niche and then utilise our hardware and machine learning support in that market."

Find out more at [pestechologies.com](https://pestechologies.com)



## Resurrect Bio changes the code to unlock plant defences

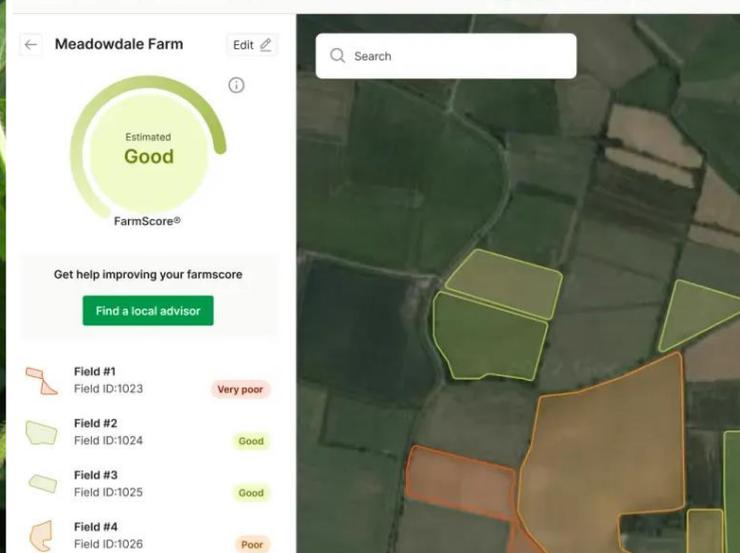
Plants have a sophisticated immune system that has co-evolved as a defence against pathogens, but it may be lying inactive in many crop varieties. Now **Resurrect Bio** has found a way to re-engineer the disease response mechanism in plants to restore resilience.

Co-founder Dr Cian Duggan says: "Our research suggests there could be a multitude of resistance genes sitting in crop genomes that are suppressed by pathogens, and that we could potentially resurrect or improve. This intriguing possibility drove us to establish a spinout company.

"Essentially, we have resurrected resistance genes by bioengineering the helper receptor. And this doesn't just apply to a specific gene; it can be implemented with a host of other resistance genes. This is a huge breakthrough and has potential to be a game-changer in plant protection."

The initial targets are Soybean Cyst Nematode and Asian Soybean Rust which collectively cost the US more than \$2Bn annually, Resurrect Bio is exploring how to re-engineer the disease response.

*Find out more about Resurrect Bio at [resurrect.bio](https://resurrect.bio)*



## Providing financial institutes with a 'sustainability rating' for arable land

Providing evidence of best environmental practice 'when the computer decides' is currently difficult to do for farmers. A new tool, 'FarmScore', from **Agtelligence** aims to distil this complexity into a simple score that can be used by banks, financial institutes, and funding agencies to quickly benchmark progress against sustainability metrics.

Nima Eskandari, Chief Executive Officer at Agtelligence, says:

"Many insurance companies currently reduce premiums for farms with additional security against theft; FarmScore would provide evidence of de-risking natural assets. We are currently in discussion with financial institutes about how they could better support farmers that have a good score. It could be a virtuous circle."

Agtelligence was recently awarded funding through the UK Space Agency and will be showcasing FarmScore in the UK pavilion at COP28.

*Find out more at [agtelligence.space](https://agtelligence.space)*



## PlentySense offers real-time monitoring of soil nitrogen availability under growing crops

Around 50 percent of nitrogen (N) applied to crops is not taken up and can leach into the environment. Now sensors developed by **PlentySense**, a spinout from John Innes Centre, can measure the amount of nitrate taken up by the growing crop and the reserve available in the soil, thereby optimising fertiliser usage.

The first sensors are designed to measure nitrate, but Dr Yi Chen in the team of Professor Tony Miller, Chief Scientific Officer, is working on adjusting the sensor chemistry to quantify other nutrients, including potassium (K) and phosphate (P).

He says that the sensors give early actionable insights: "If aerial or satellite imaging used to measure the health of the crop indicates a yellowing of the leaves, then it is too late – yield has already been affected.

"Our sensors enable action to be taken that will ensure that the plant has the right amount of nutrition throughout the year without waste or yield penalty; this will have a huge financial and environmental benefit."

*Find out more about PlentySense at [plentysense.io](https://plentysense.io)*

## Using a plant factory to mass produce rare medicinal drugs

Some of the most potent drugs known to mankind are produced by plants, but issues such as accessing source material from rare plants and modifying the complex chemicals have meant they have been largely abandoned by the drug discovery industry.

This challenge has been overcome by technology from **HotHouse Therapeutics** (a spin-out from the laboratory of Professor Anne Osbourn OBE FRS at the John Innes Centre) which enables any naturally occurring medicinal compound to be reproduced by a host plant, creating a high value crop for Controlled Environment Agriculture.

Martin Stocks, co-founder of HotHouse Therapeutics, says: "We imminently expect to close our seed funding round of more than £2.5m from a consortium of UK venture capital investors.

"The endgame for HotHouse Therapeutics will be the generation of novel plant-produced drugs, probably made in specifically engineered plant lines. Such lines will require secure, contained facilities to grow the biomass needed for drug production.

"We are considering the potential of hydroponics and vertical farming in the manufacture of our products. We are interested in engaging potential partners in this space and accessing development funding to explore routes to viable and sustainable production systems."

*Read more about Professor Anne Osbourn's research at [jic.ac.uk/people/anne-osbourn/](http://jic.ac.uk/people/anne-osbourn/)*

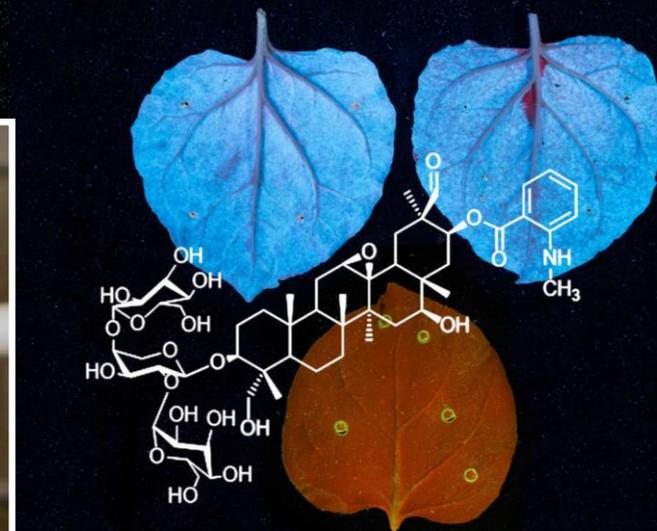
## Bringing body condition scoring to DairyComp

**HerdVision**, a robust camera system for objective body condition and mobility scoring, will soon be integrated into the dairy management software system DairyComp, enabling real-time health updates each time a cow exits the parlour.

Matthew Dobbs, co-founder of AgSenze and HerdVision says: "Body condition scoring is a key indicator of health and fertility in dairy cows, and it is often based on subjective visual observations.

"With HerdVision the camera system can be retrofitted on the parlour or cattle race and provides 2D and 3D imaging of the animal. This enables body condition to be scored and lameness or other injuries to be detected.

"The information is synced automatically with the herd management system and made available through an app. This enables timely interventions, such as a feed supplement or health inspection, to catch a potential problem early."



HerdVision has recently gained Innovate UK funding to further develop its body weight algorithm, and will be able to assess the bodyweight of calves through to adult animals, simply by passing under the camera.

The company has just closed a Series A funding round with strategic and institutional investors and is looking for further commercial partnerships and end users.

*Find out more at [herd.vision](http://herd.vision)*



## THE FARMER PANEL

The panel was chaired by **Vicky Foster**, CEO of BBRO. She asked the farmers to reflect on the day before opening up the discussion to the floor. The following are some excerpts of the discussion to provide a flavour of the session.

**Tom Clarke** is a fourth-generation farmer on the Cambridgeshire fens. He had a career in the city when the unexpected loss of his father brought him back to manage the family farm, initially as a temporary measure. However, he became enthusiastic in managing the grade 1 peat soil in a more regenerative way for food production. Tom is the AHDB Cereals and Oilseeds Sector Council Chair and a member of the NFU Net Zero steering group.

**Andrew Pitts** is a second-generation arable farmer working 2,000 acres in Northamptonshire. He hosts the Hutchinsons Helix Technology Development Farm at Whiston and has trialed soil and yield mapping to direct interventions and support a move to a more regenerative approach to farming.

**Heather Oldfield** is a mixed arable and beef farmer in Lincolnshire. The family farm grows a range of cereal crops, oil seed rape and legumes, and Heather is using her wealth of knowledge within her roles on the NFU combinable crops board and as Elsoms Seeds Business Development Manager.

**James Wright** is a first-generation beef and sheep farmer based on Exmoor. His particular interest is precision livestock management, and he is the UK Country Manager of Breedr, an app and online trading platform for beef.

**TOP:** Tom Clarke and Andrew Pitts  
**MIDDLE:** Heather Oldfield and James Wright  
**BOTTOM:** Gerard Parr

### What is the most exciting new technology you have heard discussed today?

**Tom:** "For me it was the potential of introducing nitrogen fixing bacteria into wheat seed. Nitrogen is an expensive input but available free in the air, so making it available to wheat in this way would be a massive win."

**Heather:** "I found the enthusiasm for innovation expressed during the day inspiring. A couple of standout sessions would be the potential to convert grass to protein and oil highlighted by Harper Adams University, and the grower-led development of robotics described by Autopickr."

The discussion expanded to embrace the need for enabling technology to overcome obstacles to adoption, with rural connectivity being a big issue.

**James** commented that in many places on-farm there is no phone signal and he was holding out hope that improved connectivity might be coming with satellites like Starlink.

### How is technology reducing admin on the farm?

Asked by Gerard Parr, UEA

**Heather** explained that through the use of HerdWatch the process of weighing cattle and updating cattle passports had been simplified, removing the need for pieces of paper and updating records.

**James** agreed and added that weighing was also a dangerous time and automation improved safety, but that the government was lagging behind by not including digital records in its 2025 livestock management program.

**Andrew** found that variable adjustment of the spray head had reduced dosage and he was looking to record usage directly from the sprayer in future, which would provide a time saving. >>





**The Farmer Panel:** Vicky Foster, Tom Clarke, Andrew Pitts, Heather Oldfield and James Wright



**What is the quickest way to achieve Net Zero?**

**Tom:** "Agriculture is fundamentally an extractive industry and the biggest impact on emissions is the use of fossil fuels in tractors. Converting these to biofuel would reduce the footprint."

**Andrew:** "Inorganic nitrogen is a similar factor. Increasing nitrogen use efficiency (NUE) through improved soil health and direct drilling to reduce loss to air can improve NUE from an average of 55-56 percent to a massive 80 percent efficiency. This has the potential to reduce the carbon footprint without loss of yield, but requires technology to monitor the crop, test the soil and apply with precision."

**James** agreed that driving up efficiencies would reduce waste in livestock production as well. For example, precision breeding of cattle to reach market specification in 21 months instead of 28 months would cut livestock emissions significantly.

**Heather** saw further potential with the new advanced breeding techniques which offer improved varieties. She explained how different varieties will be needed to support a switch from synthetic to organic fertilisers.

**What is your experience of grower-led research?**

*Asked by Lydia Smith, NIAB*

All the farmers responded that there needs to be evidence of future commercial viability and for there to be a value to the farmer, de-risking involvement so that participation doesn't incur a penalty for the farmer. They also observed that it would need to fit in with commercial operations on the farm.

For example, **Heather** had participated in trials for Elsoms that offered land rent and a contract fee for a trial of a variety that was core to the business.

Also, in the early days of development on the Breedr livestock app, **James** had paid a farmer for his time to test the app for its stability on-farm and in use. The app would solve a significant business problem for the farmer, so he was willing to help to improve its useability.

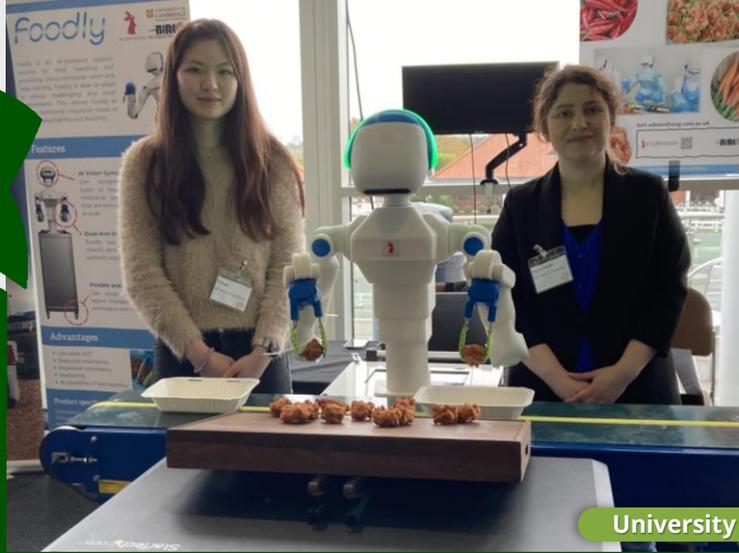
**Andrew** said he would trial products that piqued his curiosity, for example slug-resistant wheat. He also trialed a few biostimulants on wheat and spring beans, but without seeing much benefit, and had concluded that more on-farm trials were needed to test their efficacy.

# EXHIBITION

A notable feature of REAP are the technology demonstrations and networking opportunities.

By bringing together all elements of the agri-tech ecosystem the conference creates a collaborative environment for stimulating innovation.

The post-REAP networking session was sponsored by **New Anglia Local Enterprise Partnership**



University of Cambridge



Innovate UK

## SRUC

*"We are showing Agrecalc, which is a spinout from SRUC. It is basically a carbon calculator that can look at carbon on-farm. We are talking about how it works and how we can help the farmer with the environmental issues and efficiencies on-farm."*

*"We need to be looking at where the industry is going, innovations within the industry, and how we can try to join the dots together – that is a big thing – and I think we all need to start talking more than we actually do."*



SRUC



EcoNomad



FOLIUM Science



LiveFarmer



Earlham Institute



Gardin



Drone Ag

### Drone Ag

*"Today has possibly been the busiest REAP we've attended. We hope to make some interesting business out of the conversations here, not just in terms of sales but also for collaboration with other companies in attendance."*

*"Our target audience tends to be agronomists and independent farmers but at REAP we have spoken to several different research organisations – such as Rothamsted, who have their hands in many different types of tech, which we could potentially use to bolster our tech as well. It is interesting to come and see what other people are working on and to find out what is happening in the general industry."*



PES Technology



Rothamsted



ADAS



Norfolk Farming and Wildlife Advisory Group



University of Lincoln

### University of Lincoln

*"We are raising awareness of the LINCAM project, which is looking at developing place-based impact in the region – the north Cambridgeshire fens and greater Lincolnshire.*

*"REAP has provided a good environment to bring together university colleagues along with the growers, farmers and businesses – it is a really nice forum. There has been a real focus on thinking about how we innovate, bring in resilience and make our food chain systems more sustainable, which is relevant to everything we are trying to do."*



Burleigh Dodds



AgRecruit and Pondus

### Cambridge Consultants

*"We have been showcasing a portable sensor that you can use in-field to measure the nitrate concentration of soil.*

*"What I think is unique about REAP, and something that I have found useful, is engaging with the end users whose livelihood depends on this technology.*

*"This direct interaction ensures that Cambridge Consultants remains deeply attuned to our users' needs, enabling us to develop innovative technology that truly enhances their lives and work."*



Cambridge Consultants



LGC Genomics



Wyld



New Anglia Local Enterprise Partnership

Nano Electric Services

**Recipients of the Bursary**

David Bond, Chris Knock, Bruce Paterson, Elisa Ramil Brick, Alicia Showering, Rajitha de Silva, Reuben Longdon, Nikolaus Wagner, Philip Johnson, Tom Pearson, Belinda Clarke (Agri-TechE) Shannon Woodhouse (RNAA), Kate Dewally, Helen Yvanne, Andrea Carolina Olave-Achury.

Recipients not pictured: James Bennett, Chris Day, Will Clayton, Srishti Nisha, Lisa Baumgärtner

The REAP 2023 Bursary was kindly sponsored by RNAA



Bursary recipients



DIGITLAB



Aponic



18



Agrasta

## AFTERWORD: Beyond the comfort zone

Agri-TechE Director **Dr Belinda Clarke** summed up.  
**Reflections on REAP**

The original inspiration behind the theme of REAP came from the almost perfect storm of EU exit – the impacts of which are now starting to bite – the pandemic, and geopolitical instability – all of which is happening against the backdrop of climate change.

The implications of extreme weather were shockingly illustrated by rainfall figures shared by Suffolk farmer Chris Knock.

In October 2023, the local Met Office weather station recorded 253mm of rain. The 30-year average for November rainfall was 63mm, and the previous highest record for any month was 156mm (in 1970) – and this was only a very localised event.

We are going to have to get comfortable with being very uncomfortable in the very different shaped world in which we're finding ourselves.

But how inspiring to hear at REAP that innovations and technologies are being developed to help smooth some of those spiky edges.



### This year for Agri-TechE

We have a very diverse and eclectic membership in Agri-TechE. Looking back over the year, no two weeks have been the same.

We've gone from virtual reality to in-person meetings, conferences, exhibitions and out in the field on farm walks. Some of these events we host, while at others, in the UK and overseas, we represent our membership. This has included Agritechnica in Germany, Green and Agritech Asia in the Republic of Korea and a sustainability conference in Valencia.

Engaging with policy influencers is really important to keep agri-tech on the agenda. The Innovation Hub at the Royal Norfolk Show was an opportunity for Mark Spencer MP, now the Minister of State for Defra, and Daniel Zeichner MP, Shadow Minister for Defra, to meet the membership and see technology.

International relations are also vital if technology is to scale and gain economies of scale. Becky hosted a delegation from the Netherlands keen to form collaborations and partnerships. We also welcomed a group of senators and lawmakers from 13 Midwest States of America. They were looking at the UK's enabling regulatory environment, with particular interest in energy, gene editing and biotechnology.

This was followed by an inward mission from St. Louis, Missouri, where delegates came with a wish list of technologies to address their challenges, and an online mission with Saskatoon, Canada, to further develop our ongoing collaborations. >>>

**TOP:** Agritechnica 2023

**MIDDLE:** Mark Spencer MP with TSSL at the Innovation Hub

**BOTTOM:** The Missouri delegation

## Growing ecosystem

The REAP Start-Up Showcase is a barometer for the sector, and it has been a real pleasure to see how these companies have evolved and the technologies matured. Significantly, 14 of these companies have collectively raised over £120 million in the last three years.

## Early Career Innovators Forum (ECIF)

The future belongs to the young, and we recently launched a structured programme to help those early in their careers to build that all-important network. ECIF, supported by the Morley Agricultural Foundation, is attracting interest across a spectrum of disciplines and creating connections and contacts.

## Looking ahead to the next ten years

Over the last ten years, significant developments in technology and changes in economics have increased the pull for more automation, changing the dynamics in cost-benefit analysis.

In the coming year we will be looking ahead and harnessing the thinking of the membership about the desired direction of travel. As part of this we will be creating a number of 'Task and Finish' groups to look at specific challenges and push through solutions.

If the experiences of recent years have taught us anything, it is that to build a productive, profitable, and sustainable agri-food industry, we must move away from the comfort zone and become open to the new opportunities that exist when we 'stretch'.

I am looking forward to the journey.

**TOP:** Green and Agritech Asia in Korea  
**MIDDLE:** The Early Career Innovators Forum  
**BOTTOM:** The Agri-TechE team:  
Belinda, Kristina, Deryn, Laura, Sophie and Becky



THANK YOU TO THE REAP  
SPONSORS AND SUPPORTERS



ROYAL NORFOLK  
AGRICULTURAL  
ASSOCIATION

J A KEMP



Innovate  
UK

Thank you to everyone who attended  
as speakers, exhibitors or delegates.  
See you at REAP 2024!



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