FARM TECH CIRCLE

# Newsletter

**Issue 2: 2022** | Keeping you up to date with the latest agri-tech developments

FARM TECH CIRCLE

powered by the AGRI EPI CENTRE

## What does 24 hours in farming look like for Agri-EPI network farmers?

Last month we celebrated #farm24 by showcasing a day in the life of the amazing farmers we work with in our Agri-EPI farm network.

We are thrilled to bolster the innovation and fantastic mindsets of the UK farmers we work with and we appreciate them endlessly for the work they do to help feed us in ways that are increasingly healthier for the planet, the animals, and our bodies.

With our farm network, we are able to collaboratively demonstrate the scientific validity of new on-farm technologies, support the commercial potential of new innovations, foster relationships between farmers and agri-tech developers, identify key issues in the real-world implementation of new technologies, and discover and share new opportunities in agri-tech.

**Thank you farmers of Britain!**

**Watch the video**

# Agri-EPI Centre welcomes Defra Automation in horticulture review

Agri EPI-Centre has welcomed the publication of Defra's review into automation in horticulture and supports its recommendation that the UK Government lead and fund a mission-led approach to accelerate development in the sector.

The recommendations of the independent review, co-chaired by Secretary of State for Environment, Food and Rural Affairs, George Eustice, and Professor Simon Pearson of the University of Lincoln include establishing a consortium to bring together government and industry to drive adoption of proven technologies, adopting a mission-led approach to fast-track new technologies, and the horticulture sector setting up working groups to share novel harvest practices.

Agri-EPI Centre, which pioneers agricultural engineering, precision and innovation for UK farming, is working hard to improve collaboration and facilities in the sector and asks that the government use the evidence in the report to help the industry in these efforts. Agri-EPI Centre's Farm Tech Circle and farm and membership networks bring farmers together with developers to address the high-level issues facing agri-robotics and other technological solutions; it is also working with multiple partners to develop agri-robotics test facilities, subject to funding.

Duncan Ross, Agri-EPI Centre business development manager crops, said:

"We support the report's recommendations as collaboration and additional funding in this area are needed. Agri-EPI Centre is creating a collaborative framework around agri-robotics and building development facilities so that people can come and build their systems. The UK is not alone in experiencing worker shortages and any solutions we can create will help domestic and global markets.

"Following the success of the Innovate UK automated lettuce harvester led by Grimme – which was funded through 'Robotics for a more resilient future' we are also looking at selective harvesting of broccoli with funding from Defra FIP.

"A common theme across our current robotic projects is monitoring to optimise existing processes such as spraying and harvesting. In orchards and vineyards we are developing more accurate ways of monitoring blossoms, pests and disease and potential yield which can also optimise actions, such as where to send staff to harvest. The next stage will be about in-field logistics.

"Dedicated government funding can de-risk technology development, encourage further private investment and speed up technological solutions around areas of harvesting which are harder to achieve but will have greater impact on labour resource availability."

**Read Defra's automation in horticulture review**



## RTU v4 robot

**Key benefits:**

**Sustainable**

> Fully electric and lightweight for low damage

**Autonomous**

> Simple pre-planned autonomy with object detection

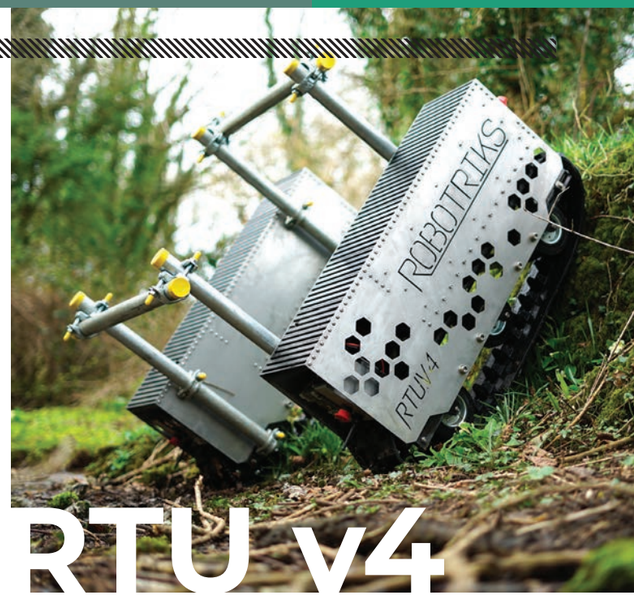
> High-level autonomy with ROS compatibility

**Extendible**

> Open architecture for adding new sensors and end effectors

**Adjustable**

> Interchangeable truss frame for multiple scenarios




The RTU (Robotic Traction Unit) is an autonomous agricultural platform designed to be an adaptable platform to aid in developing agri-robotics components. It is fully open for developers to test their new technologies in the field without needing to develop their own robotic platform. This capability will help open the doors for a vast range of novel agricultural systems which maximise the benefit offered by robotics.

As a lightweight agricultural robot, the RTU represents a new approach to the farming cycle. Rather than having the size and power to pull up an entire field, light robots can conduct per-plant farming operations with minimum soil damage, maximising yields whilst minimising environmental impact.

Agri-EPIs RTU fleet have three control methods available depending on the need of the developer. At its simplest, the units can be manually controlled using an intuitive remote-control system. As a middle ground, they include an advanced autopilot system meaning the robots can drive themselves around using pre-planned routes with collision avoidance. Finally, the systems also include a powerful on-board computer running ROS, which has been configured to send control commands allowing intelligent autonomy to be quickly integrated.

These robots have also had a range of sensors integrated with them to allow for high level autonomy, mapping and collision avoidance. This includes RTK-GNSS for initial localisation, a Velodyne LiDAR for 3D point mapping and front and rear facing ZED 3D cameras for local obstacle detection.

Built almost entirely out of aluminium with mounting surfaces on the top, front and rear of the traction units, the RTU was built to last when out in the elements. Featuring a low centre of mass and a wide footprint thanks to its tracked design, the RTU can drive in any orientation on surfaces up to a 54-degree incline.

Connecting the traction units is a truss frame made entirely out of 48.3mm scaffolding pipes. By using such a standard material, it means the robot becomes very easy to configure for multiple agricultural scenarios. If a wide wheelbase is needed to cover more rows or tall frame to navigate vineyards, the truss can be simply adjusted to the requirement. With this flexibility it also broadens the realm of modularity.

These robots have been created for the needs of Agri-EPI Centre and our partners as a highly flexible and modular platform and will be gradually improved over time as a collaboration between ourselves and the manufacturer. For information on renting out our technical assets please contact team@agri-epicentre.com


# Autonomous and robotics solutions for agriculture and horticulture

**By: Duncan Ross**

Farming has been embracing evolving autonomous technology for many years. Milking robots are now commonplace and accounted for 30% of all new installations in the UK in 2015 (Heyden, 2015). By that time, robotic milkers had been adopted by 5% of UK farms (ibid.).

Satellite navigation and variable rate application of fertiliser and seed, and chemical spraying using “green on brown” (only spraying green weeds identified in stubbles) or more latterly “green on green” (identifying target weed species in grass leys), are developments that have been based on existing machinery platforms which growers are comfortable with as they are seen to be familiar.

The leap to the next level of robotics and autonomy is a step most growers have yet to take, as barriers to adoption including integration, costs, and skills which all hamper uptake. Despite this, Agri-Tech developers are keen to move their products forward in their capability, learning from grower experiences and interactions, and breaking down those barriers.

One of the major reasons for robotics adoption is access to labour, both seasonal and full time, with rising wage pressures and competition from other sectors in the economy. This is especially apparent in the horticulture sector with many operations still requiring large numbers of people.



There is a vast range of alternative robotics solutions being created which can be categorised into different types:

**Large autonomous platforms** that perform the same functions as conventional tractor/implement combinations but without a driver, such as those from John Deere and CNH and a smaller offering from AgXeed. TAFE are developing an autonomous electric drive train tractor, and Hands-Free Farm have been converting conventional Iseki tractors to be autonomous during research projects at Harper Adams University, both adapting conventional smaller machinery.

**Scouting** for incidence of stress (heat, pests, disease, or weeds) has led several companies to develop combined or standalone solutions. Companies are also investigating how to mount sensors on robotic platforms to capture more representative data from pest and spore traps that are currently left in one position in a field.

**Weeding** such as Small Robot Company’s combined solution using two separate robots, one to map a field and another to treat it with low powered lasers. Standalone solutions from NAIO, BAKUS use machine vision and AI to identify and cultivate weeds, whilst Earthrover uses light systems for control. FarmDroid works in a different way as it plants crop and maps the precise location so that it can return post establishment and weed around the plant. Nissan have developed a Duckrobot that swims in paddy field and removes weeds.

**Spraying** of orchards with the GUSS robotic platform which is a direct replacement of tractor and driver. Robots that can identify pests and disease with artificial intelligence and on-the-edge processing will allow those infected areas to be treated and not the entire crop, saving significant cost in agrochemicals as well as being more environmentally sustainable.

**Crop scouting** being developed by Antobot to count fruit numbers in orchards and strawberry tunnels, assessing maturity and yield, providing data beneficial for resourcing of staff and accurate prediction of produce to marketing cooperatives and retail supply chains.

**Soil sampling** on robotic platforms from E-Nano and GMV NSL will give far greater granularity on soil nutrient status and possible organic matter content. By precision mapping a field, a robot can return to the same spot several years later and sample again, to ascertain how regenerative management practice may have improved soil health.

**Harvesting** is probably the hardest area to crack but also the greatest need for growers to save labour input. This could be picking top fruit with developments by Tevel, Octinion, Agrobot and RootAI, soft fruit with SAGA, Dogtooth and Field Robotics, asparagus with Muddy Machines, and broccoli with Earthrover. Currently the degree of computer processing power needed to replicate human hand-eye coordination means all the platforms are slow compared to existing picker rates and need further development and refinement before they can gain parity and be considered a viable alternative to an experienced picker.

However, an area that is seen as really labour saving is the logistics platforms being developed by BurroAI, Antobot and Fox Robotics, where the harvested fruit is moved around the plantation by a robot, delivered to a central point and returning to the harvesting location with empty trays. This prevents the need for harvest staff carrying fruit to the central point and allows them to do what they do best which is keep on picking, thus maximising use of available labour.

Automation and robotics will have a wide impact on the agriculture and horticulture sector in the future, replacing humans in menial tasks, simultaneously creating higher skilled jobs attractive to different people. Data capture and processing will allow growers to have far more visibility of their growing crops, providing information for better decision making on targeted interventions of irrigation, fertiliser, Agro-chemicals, and labour resource. This will enhance financial and environmental farm businesses and assist the drive towards a net-zero agricultural sector.

# Agri-tech expertise yields results for robotics firm

Harvest has come to an end with our farmers. An agri-tech company from Essex is helping farmers overcome labour shortages and practice precision agriculture, thanks to support from the Agri-EPI Centre.

Antobot is developing two robots which will help farmers target valuable resources in the most productive areas, as well as taking some time-consuming tasks off skilled workers.

The Agri-EPI Centre has supported Antobot with knowledge and their network in agriculture, increasing understanding of the sector and facilitating connections with growers, research organisations and other companies.

They have collaborated on multiple grant funding applications with successful joint bids to develop agri-tech innovations. The Agri-EPI Centre's invaluable knowledge and networking has helped Antobot to develop their business and market potential, contributing to their successful £1.2m seed round in 2021.

Agri-EPI Centre helps develop profitable and productive solutions to empower more sustainable farms and aims to support projects which will generate economic growth and help tackle the global issues of sustainability and feeding the world. They work with farmers across the UK to trial agri-tech for this purpose.

There are four centres across the UK, dedicated to innovation.

Antobot has created a modular robot system which can be adapted for different purposes. The first two applications being developed are Insight, a scouting robot, and Assist, which is used for logistics.

Insight is currently in field trials on partner farms, primarily with strawberry and apple crops. It can collect and process data about crop growth and ripeness so precious worker resources can be directed to the areas where yield is likely to be higher.

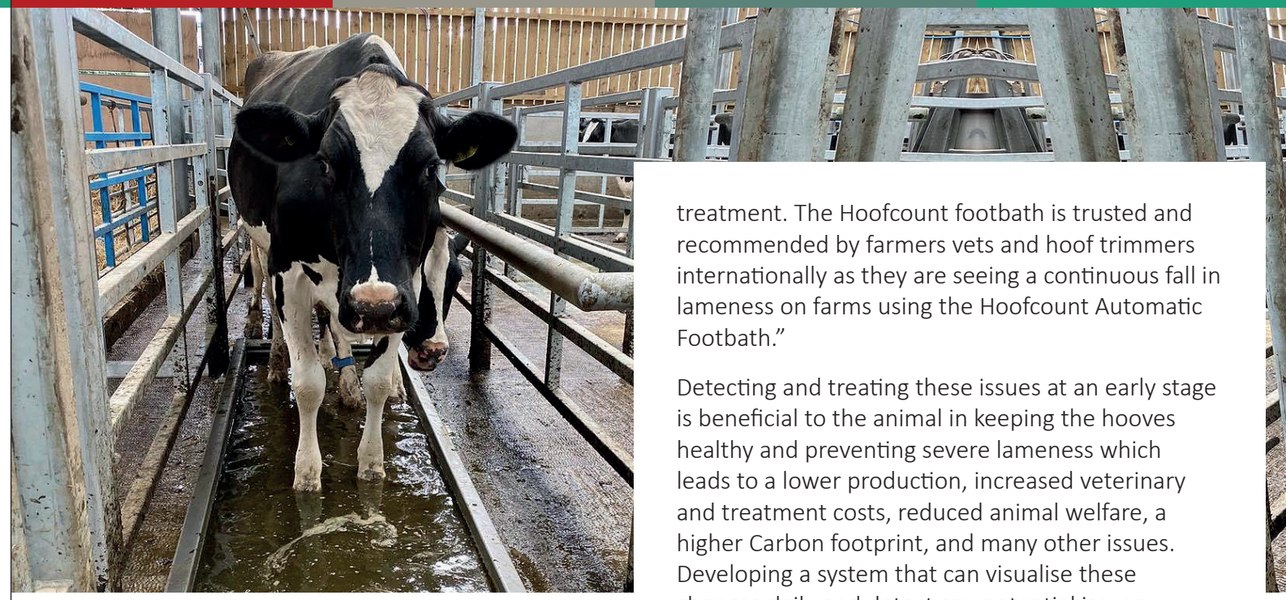
## What's happening on farm?

Harvest came to an end with our farmers reporting good crops despite the dry summer months this year. Autumn sowing has been well under way at Bielgrange, and wheat is in through the ground with Rob Addicott & Jeremy Padfield in Somerset

With grass being in short demand due to the dry weather, supplementary feeding has started earlier this year with most of our mixed farms. Cattle prices are remaining at reasonable levels but the introduction of feeding will bring margins down. Lambs are selling well north of the border but there are a lot of learner lambs due to the weather.

Richard and Hazel Hoskins are finishing some lambs inside due to the grass shortage at Maiden Castle, Dorchester. Store lamb sales have started, and prices are up on the same time as last year. Also at Maiden Castle, Richard and Hazel Hoskins have had another successful year with their Sunflower Walks, with proceeds going to local charities that are close to them as a family.





# Small family business becomes market leader in hoof health

An innovative project leading the way in hoof health has won nearly £250,000 in innovation funding.

Hoofcount is a 10-year-old family business, focusing on how to keep cows' hoofs clean and healthy. Their project is aimed at using vision to develop an early detection lameness monitoring system. It has won funding from UK Research and Innovation (UKRI), part of Defra's Farming Innovation Programme, for feasibility studies combining innovation with research and collaboration with farmers and growers.

Hoof health is a prevalent issue in agriculture, particularly in the dairy industry, as it is one of the main factors leading to poor milk production. Dairy cows are susceptible to a range of hoof issues including Digital dermatitis, sole ulcers, white line disease and overgrown hooves. These generally show a visual change in the underside and back of the hoof. These issues can develop initially without the animal showing visual signs in its gait.

John Hardiman, Software Engineer at Hoofcount explained:

"Lameness is a key issue in dairy herds, with conservative estimates of 25% of dairy cattle suffering from lameness and each lame cow costing more than £300 in loss of production and treatment. The Hoofcount footbath is trusted and recommended by farmers vets and hoof trimmers internationally as they are seeing a continuous fall in lameness on farms using the Hoofcount Automatic Footbath."

Detecting and treating these issues at an early stage is beneficial to the animal in keeping the hooves healthy and preventing severe lameness which leads to a lower production, increased veterinary and treatment costs, reduced animal welfare, a higher Carbon footprint, and many other issues. Developing a system that can visualise these changes daily and detect any potential issues early will be of huge benefit to the national herd. Utilising computer vision and machine learning is Hoofcount's preferred method for monitoring and detecting these issues.

"Collaboration with farmers is core to Hoofcount's continued innovation and leading reputation in reliable foot-bathing for heard hoof health. Agri-EPI Centre has bolstered our collaboration, with the introduction of The Centre for Machine Vision (CMV) at University of the West of England Bristol and successful application for Innovate UK funding (IUK). CMV has a track record of successful computer vision within agriculture. Agri-EPI has been instrumental in the project funding application and continues to support the project organisation with its network of research farms."

"As with our automatic footbaths, we know that we will never get rid of Digital dermatitis and hoof health issues completely, however we want to do everything we can to minimise the effects of them and reduce the spread."

Agri-EPI's Head of Dairy, Duncan Forbes said:

"This is a great example of the sort of practical collaborations we seek to create, bringing together innovative companies like Hoofcount with leading research experts like the team at CMV at UWE Bristol. Early detection of lameness is vital to meeting the challenge of delivering a substantial reduction in lameness prevalence in dairy herds. UK milk producers will very much welcome the benefits to cow welfare and cost reduction that this emerging technical solution will deliver.

# Paraguay SMART Farm Project:
## Adapting Origin Digital's Contour Platform to the South American climate

Agri-EPI Centre has been leading the Innovate UK-supported SMART Farm project in Paraguay since January 2018. It has involved partnering with a farming business to demonstrate UK agri-tech in the agricultural economy of Paraguay.

The farming business, GVASA in San Pedro, spans 85,000 hectares and incorporates cattle, maize, soybean and rice production enterprises. This phase of the SMART Farm project has focused on implementing Origin Digital's Contour platform across GVASA's arable fields, providing the farmer with in-depth soil health information, effective crop growth models, and enabling variable rate application.

The economic outcome of introducing UK technology means more profitable farming systems, reduced environmental footprint and improved economic sustainability.

Origin Digital produces digital tools for the agricultural industry, and has undertaken several research and development projects – leading to exciting remote sensing technology.

Its most recent project stands to benefit the whole food chain, from farmers to retailers and government to corporations across South America.

Origin uses radar and optical satellites, as well as weather information, to capture data and marry that with customer statistics to produce growth models, which can be used at both corporate and farm level. This data will help businesses to make informed decisions on cropping, yield predictions and maximising outputs.

Growth models have been produced for both plant growth and climate, specifically looking at soya and maize. These growth models can be applied to any country with a similar climate.

This is all encompassed into a precision tool, Contour. It enables farmers and advisers to improve input efficiencies, save money and increase yields by creating a management plan for each field. Growers can spot issues early, apply the right products in the right places and in the right amounts.

**The project**

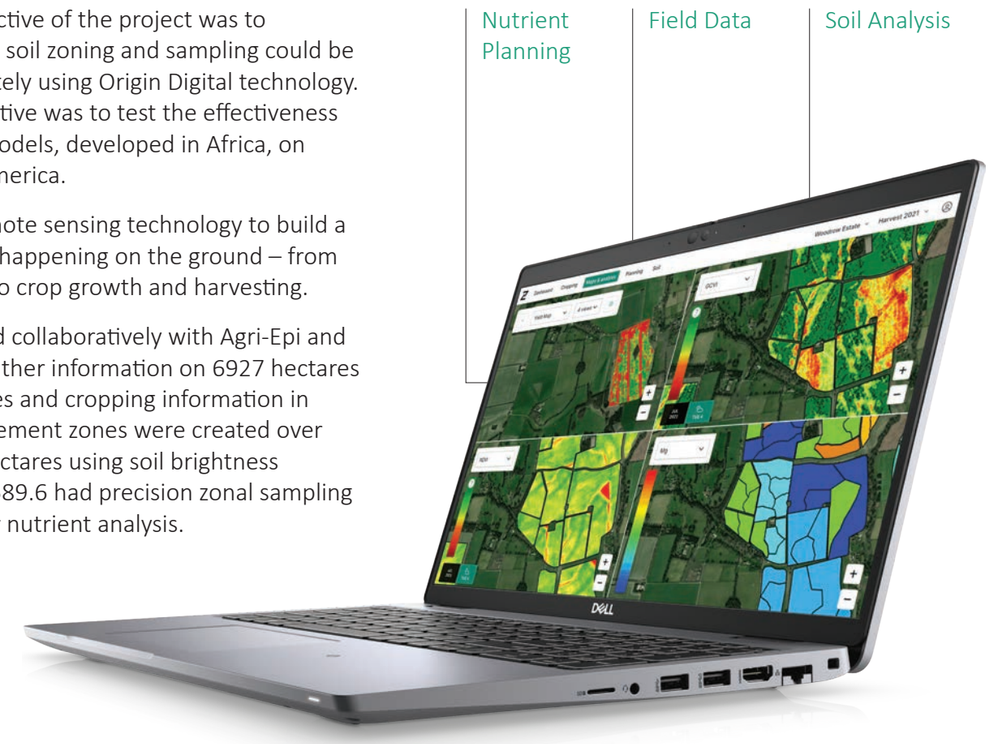
The primary objective of the project was to demonstrate that soil zoning and sampling could be carried out remotely using Origin Digital technology. The second objective was to test the effectiveness of crop growth models, developed in Africa, on farms in South America.

Contour uses remote sensing technology to build a picture of what's happening on the ground – from the soil through to crop growth and harvesting.

Origin has worked collaboratively with Agri-Epi and Innovate UK to gather information on 6927 hectares of field boundaries and cropping information in Paraguay. Management zones were created over 1,661 of these hectares using soil brightness technology, and 589.6 had precision zonal sampling done on them for nutrient analysis.

Using crop growth model rulesets developed for Africa, the team were able to deploy these models in Paraguay with high levels of accuracy. Minor localisation of the models further increased the accuracy confirming the localisable value. These models include crop growth stage and yield predictors.

A particularly useful outcome is variable rate fertiliser recommendations, which can lead to significant cost savings, increased soil health, and improved efficiencies, yield and profitability.



## Scaling the data

AgSpace evaluated the growth models developed in Africa for a South American environment. And the satellite imagery provided farmers with the ability to plan, target and predict weaker areas of their fields. The growing seasons are similar; generally the summer and winter crops are planted at the same time, and local weather is also comparable.

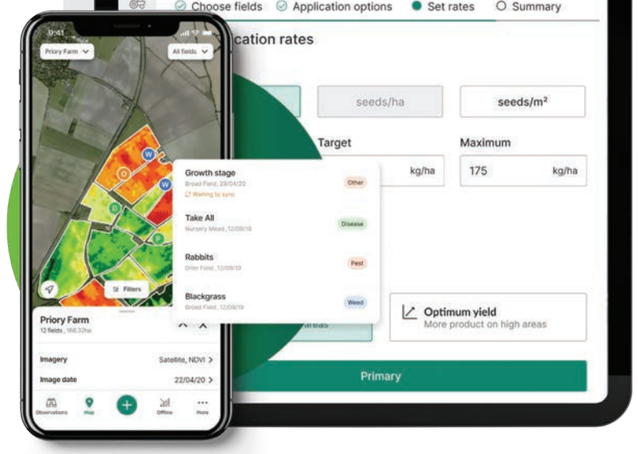
**Recording crop growth data remotely is a very powerful tool for the entire farming ecosystem.**

## Benefits

- > Risk modelling
- > Benchmarking
- > Real time information
- > Food security
- > Sustainability
- > Maximise efficiencies
- > Minimise inputs, maximise profitability
- > Accurate forecasting

With advancements in remote sensing and agricultural technology over the past decade, it will clearly play a vital role in food security in the future. The ability of remote sensing data to predict and alert farmers about issues at soil and crop level – which farmers can then tackle- through to forecasting crop failure for governments and corporations, is valuable.

Although remote sensing can never replace the tools on the ground, it can assist in providing accurate and reliable tools throughout farming, as resources continue to deplete.



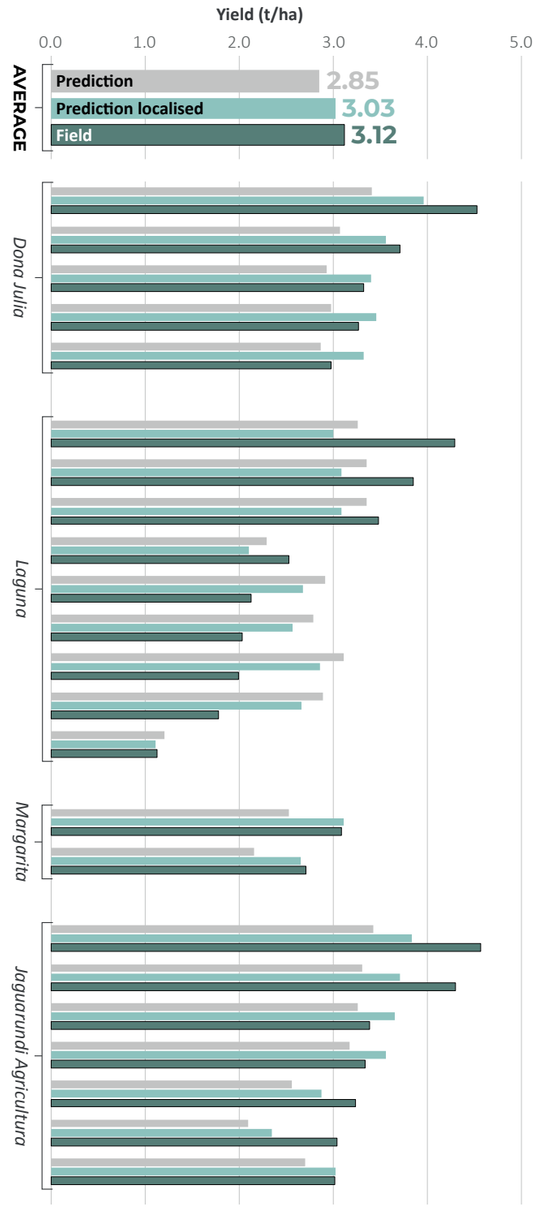

**Weather Data** | **Satellite Imagery** | **Soil Variability Mapping** | **Soil Analysis** | **Yield Maps** | **Cropping & Observation Data**



## Results

The **African models** showed a strong correlation with **actual South American yields**, says Dan Wood at Origin Digital. "And accuracy improved further when **adjustments were made to the models to begin localising them further to South America**, showing that our crop growth models can be successfully deployed in this geography."

*Soya yields compared to predicted and "adjusted" yields, by farm field*




Agri-EPI aims to support innovative solutions to help farmers and businesses within the agricultural supply chain become more sustainable and profitable. The Agri-EPI Centre is one of four Agri-Tech Centres that help to bridge the gap between the industry and academia – not only in the UK but globally. Agri-EPI works to develop international links to establish key industry partnerships and relationships as well as supporting projects in technical expertise, grant and project management.

"It has been a pleasure to manage the Paraguay SMART Farm project, particularly facilitating Origin Digital's successful adaption of the Contour platorm to the South American climate," says Emily Laskin, farms technical coordinator at Agri-EPI.

"Seeing British technology provide efficiency and sustainability benefits to farming practices internationally shows us how we can make a difference and is a source of pride for the entire team at Agri-EPI."

# On-farm conference provides unique discussions around sustainability in farming

Sustainability, technology, and innovation in farming were the focus of Agri-EPI Centre's Annual Conference last month at Shimpling Park Farm in Suffolk. The event brought together over 100 guests from across the agriculture sector, from farmers and growers to tech developers, academics, and other sector representatives, for a day of discussions and networking.

The day, entitled 'The path to sustainable farming continued: the role of precision technology', began with introductions from host and farmer, John Pawsey, Agri-EPI's CEO Dave Ross, and journalist and conference chair, Anna Jones.

Dave Ross said:

"It's a relief to get back in person. There's nothing better than actually meeting people face to face to have networking discussions, discuss the problems that are topical, and think about solutions to those problems."

Fabia Bromovsky, Director of the Global Farm Metric at the Sustainable Food Trust took the floor as the conference's keynote speaker to discuss the question: what exactly is sustainable farming? She explained that we lacked a common understanding and that where definitions exist, they often overlooked the interconnectedness and diversity of our farm systems. She set out the need for a common language, a framework that recognises this holistic system and identifies where impact occurs.

She acknowledged the important role of technology to support farmers with this. Farmers already collect lots of data, but with a consistent set of measures, in-common to all farm assessments, technology can provide solutions that make it easier to collect. Technology can enable farmers to protect their data, share data between consenting users, improve performance, and reduce time and costs.

She maintained the power of a common framework is it would provide a consistent baseline of data, the DNA of the farm, that can underpin supply chain transparency, green investment, and food labelling. Governments, markets, and the financial sector can then reward producers who are delivering genuine benefit to the environment and public health and shift the balance of financial advantage towards more sustainable systems.

The farmer speakers were up next, with a panel made up of four of Agri-EPI's innovation farmers, including Sophie Alexander from Hemsworth Farm, Jo Franklin from Kaiapoi Farm, John Pawsey from Shimpling Park Farm, and Ian Beecher-Jones from JoJo's Vineyard.

They discussed the challenges within the agriculture sector including resilience to weather events, net zero goals, and price volatility, and how uncertainty in policy can affect the ability for some farmers to innovate as much as they would like to. Other topics discussed included how sustainability is inextricably linked to profitability, the need for a business mindset as a farmer, and the methods the farmers use to progress towards their sustainability goals.

The tech panel included developers Howard Wu from Antobot, Jack Wrangham from DroneAg, Jim Wilson from SoilEssentials, and James Brown from Earth Rover. Their discussions centred around how to make technology accessible to farmers, how to better understand farmers' priorities for innovation, and how to attract more youth to agriculture with the use of technology.

Lastly, bridging the gap between the farmers and the tech developers, the final speaker panel included Calum Murray, Head of Agriculture & Food at Innovate UK and Agri-EPI speakers including CEO, Dave Ross, CTO, Trisha Toop, and Head of Engineering, Eliot Dixon.

Calum Murray explained:

"What we do at Innovate UK is try to make things happen that wouldn't normally go ahead. First and foremost, we have to understand what the challenges are. We need to identify those areas that will deliver the greatest impact and give us value for money and give value to the UK economy".

Dave Ross said:

"We are in an industry that has huge challenges and huge opportunities."

**Watch the video**