



# Thinking big

## Smart Farming

Smart technology in agriculture is progressing at a rate of knots with new innovations promising to optimise workflow, streamline processes and utilise every ounce of data available. *CPM* digs into some of these unfolding technologies.

By *Melanie Jenkins*

**It could be argued that the future of agriculture is being forged in the form of smart agri-tech, with AI, multispectral satellite imagery and real-time ground sensors promising to open up a new world of productive farming.**

Here's an insight into some of the latest innovations, developments and advancing technologies that could reshape the industry.

### Kuhn

Following on from the innovative success of Kuhn's Aura, an autonomous self-propelled mixer, the firm unveiled its latest autonomous concept at Agritechnica in 2023, Karl. Designed to meet the requirements of progressive crop production systems, Karl is an ambitious step from Kuhn toward automated crop production.

*“Field crop production is evolving significantly with farmers aiming to lower soil compaction and reduce chemical inputs, while maintaining food supply.”*

According to Kuhn's Edd Fanshawe, Karl is an autonomous solution dedicated to plant production which the firm is convinced will offer many advantages to growers. "Field crop production is evolving significantly with farmers aiming to lower soil compaction and reduce chemical inputs, while maintaining food supply. This focus will likely increase the number of operations, and agricultural robotics can help in a big way."

Karl uses a hybrid diesel/electric power source with a 175hp Volvo engine running an electric generator. The drive of the tracks and implement is solely electric, which offers a smooth drive engagement along with the ability to make incremental adjustments to the implement.

The machine has a level of intelligence to detect errors, blockages and breakdowns by sending an alert signal to Karl if there are issues, something that isn't possible with a conventional implement with no communication method.

A 2.5m Kuhn HR 2520 e power harrow has been tested with Karl for several hundred field hours. The width was selected due to the ease at which it can be loaded on standard trailers for transporting between fields without requiring additional licences. Kuhn is currently exploring soil engaging and shredding implements, along with additional tools from the firm's portfolio that can be available for use with Karl in the future.

"Although Karl isn't ready for commercial production yet, we hope that a five-year timeframe is realistic as more field tests in

real-world conditions take place over the next few years.

"Karl shouldn't be considered a replacement for the tractor, but a different concept entirely, with the potential to run a fleet of Karl autonomous tools to adapt to different farm sizes and labour restrictions faced by farmers across the world," concludes Edd.

### FarmDroid

Innovation isn't always about the development of a completely new idea, sometimes it appears in the tweaking and gradual upgrading of existing products. One such innovation is the upgrading of the solar-powered FarmDroid to a four-wheeled version. Until now the autonomous seed-and-weed robot has only been available in three-wheeler format, limiting its ability to operate in certain specialist applications such as with salads and herbs grown on narrow row-spacings.

The four-wheeler aims to change all that. With pairs of wheels running in the same tracks front and rear, the unit is able to straddle the rows of crop, enabling it to plant seed into flat beds and return subsequently to weed between the seedlings without running any crop down.

Ultra-precise RTK-corrected GPS guidance means the FarmDroid can work autonomously, returning to the same wheelings time and time again with less than 5mm deviation from the original line of work. This same technology is what makes it possible for the machine to record exactly where it plants each seed, enabling its knife-shares to weed to within 5mm of each seedling.

Having a wheel at each corner also means this latest version is more stable on sloping ground, according to the firm. By reducing the opportunity for a shift in weight distribution when the unit is traversing inclines, the extra wheel means traction is maintained and reduces the requirement for extra ballast to retain grip in tough going.

This latest development is the first of a number of innovations set to widen the FarmDroid's scope of operations in the UK.

The Danish firm is working on a range of new technology that'll give its machines even greater appeal to a wider audience, particularly those looking to reduce pesticide ▶



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► use, move towards energy independence and automate certain operations.

## Agrovista

It goes without saying that most people wish they could predict the weather, and it's

something the technological sector is constantly striving to achieve. In efforts to help farmers get ahead of this most unpredictable of challenges, Agrovista has launched a suite of new and updated on-screen features to its weather station services to help optimise crop management following an extensive overhaul of the company's data platform.

Several hundred weather stations provided by Agrovista are in use across the UK measuring a range of parameters including rainfall, air temperature, soil temperature, soil moisture, relative humidity, leaf wetness, solar radiation and wind speed, depending on which option growers choose.

Each station provides location-specific data that's transmitted to a central server for processing, providing a range of high-quality

weather-based information that individual growers can access via their own online dashboard on a range of devices.

This information includes live weather data, weather forecasts, crop disease predictions and irrigation management (in combination with soil moisture sensors).

The most obvious change to the service is the new dashboard design which presents a wide range of data in a cleaner, more accessible format via an app that works across different devices, says James Martin of Agrovista Weather. "The modernised dashboard display will be especially useful for smartphone users, helping them to easily access all the information they require."

Weather and disease forecasting for all crops including arable, potatoes, vegetables and fruit, as well as a forecast for spraying conditions, are now included on the same platform, says James. "Before they were on a separate system – now we've embedded them, improving access."

Up-to-the-minute weather data helps growers to make immediate decisions, while detailed short- and medium-term weather forecasts aid planning. These forecasts, along with additional measurements such as leaf wetness, are also used to model accurate disease forecasts for precise integrated pest management planning.

In addition, access to rainfall measurements in the local area for the past 24 hours and previous seven days provides a valuable overview for growers who irrigate. "This is particularly useful for crops further away that are covered by a weather station," explains James. "Growers with moisture probes can also find out which areas require irrigation, and how much."

The update also includes an irrigation probe dashboard with a soil forecast, indicating where moisture might be after seven days without rain. Additionally, the dashboard shows rain amounts, soil moisture levels and temperature measurements, as well as EC measurements for soft fruit growers.

"We're also working on water monitoring for irrigation pumps so growers can record water usage and pressures within the dashboard," he says. "In addition, we provide a similar feature for polytunnel systems."

New crop development indicators have also been introduced — growing degree days for all types of crops, growing degree hours for soft fruit crops and cooling degree hours for crops like blackcurrants which require a certain amount of chill over the winter. "Using these, growers can obtain thresholds for key management decisions

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A four-wheeled version of the FarmDroid has been launched to allow it to straddle rows of crop, enabling it to plant seed into flat beds and return subsequently to weed between the seedlings without running any crop down.

and inputs," says James.

The overall result is a more comprehensive tool that enables growers to connect swiftly and easily to their data, he says. "It pools relevant data from different sources and delivers a lot more value for money, putting real-time weather insights into growers' hands."

## Hyperplan

From earth-bound weather stations to space-based satellites. Hyperplan, a French company operating in France, Germany and Spain, is looking to bring its predictive insight business to the UK. Targeted at agri-businesses and agricultural cooperatives, the firm's platform uses satellite data about the crop canopy, weather and soils and combines this with crop yield models to anticipate supply volatility.

This type of technology is aimed at improving reaction times to changing situations for commercial and marketing teams so that opportunities can be seized as early as possible.

According to the firm's Rémi Banquet, volatility in agriculture can make it difficult to gain an objective assessment of situations as they occur, such as crop area, performance and potential yield. "With Hyperplan, our clients can determine what's grown, where, the volume, and monitor the stage of maturity through the season."

Working with French company, Arvalis — an applied research

organisation that works with cooperatives and input firms, as well as feed, food and non-food industries – Hyperplan uses its own knowledge and statistical modelling to develop hybrid models and optimise information from its satellite imagery.

Using multispectral satellite imaging, Hyperplan identifies crop type and monitors development of the crop canopy and vegetation cover. It has access to Meteo weather data and Lucas Soil, Europe's largest topsoil database, with real-time information made available through a single, easy to use platform.

According to the firm, there's great potential to use this technology to offer greater insights at a field level, as this would enable it to offer farmers and growers more personalised services.

"Being able to provide a customised service is particularly important in the transition to regenerative farming, where there's a focus on effective rotations and improving productivity with fewer inputs," explains Rémi.

"For agribusinesses, it means that their reps aren't going in cold. They have a sufficient level of knowledge to start engagement with the farmer to have a proper discussion and fine-tune the response.

"They're trying to sell the most efficient products that'll help the farmer gain better performance and improved margin, for ►



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▶ example, a particular variety that grows well in their soils. This includes using historical data on rotations to look ahead to the next season and advise on suitability of follow-on crops.

"We're helping our clients to anticipate the market for the year, and this is invaluable to

allow them to plan their budgets and marketing operations very early."

## PES Technologies

An electronic nose aimed at determining soil health through smell, with results delivered 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 10 weeks to provide results.

"Our electronic nose could potentially be trained on more indicators than the ones that we'll offer on launch, and we're keen to explore what people are looking for," explains the firm's Jim Bailey.

Having secured £2.4M in funding, PES Technologies is looking to build on the successful commercial trials it carried out with large agronomy companies and farm businesses in 2022, according to the company's Andrej Porovic. "This enables PES Technologies to complete product development, power product launch in 2024 and hire the key commercial and administrative staff needed to turn our

potential into a commercial success story."

## Plenty Sense

Using sensors, PlentySense is able to provide real-time monitoring of soil nitrogen availability under growing crops.

Around 50% of nitrogen applied to crops isn't taken up and can leach into the environment, but sensors developed by PlentySense — a spinout from the 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 and Professor Tony Miller are working on adjusting the sensor chemistry to quantify other nutrients, including potassium (K) and phosphate (P).

According to Yi, 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's too late — yield has already been affected.

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

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