

Dealing with droids

Joining Opico's extensive portfolio is a completely new development in autonomous robot technology. *FMJ* was on hand to witness the UK debut of the FarmDroid FD20 in Lincolnshire

WORDS AND IMAGES SIMON HENLEY

In Opico's first post-pandemic press launch the company announced both a new business partnership and the debut of a new development for precision seeding and inter-row hoeing. The event was heralded as a technological turning point for Opico, which serves as the UK's largest independent agricultural machinery distributor.

"The FarmDroid FD20 autonomous robot is the first of its kind," says Opico managing director, James Woolway. "Opico prides itself in listening to our farmers and customers. We have been looking closely at robotics for some time, however I didn't think we would be

involved with this type of technology quite so soon.

"Opico is now the official UK distributor for FarmDroid. The FD20 autonomous robot is the first of its kind. The technology it incorporates makes it unique, both in how it operates and what it does. This is the beginning of a new chapter for Opico and FarmDroid in the British agricultural industry."

Danish development

Farmdroid is a Danish company established by a farmer's son named Jens

Below inset: "The FarmDroid FD20 is the first of its kind. The technology makes it unique," says Opico MD James Woolway



Warming. Having spent time on the family farm hoeing sugar beet, in 2011 Jens decided there had to be a more efficient and less back-breaking way of eradicating weeds in the growing crop.

His idea was to build a robot that could not only plant the crop but also hoe around the growing plants without damaging them.

Although developed for organic sugar beet production, subsequent developments necessitated the machine be suitable for various types of crops and satisfy the requirements of both organic and non-organic

Right: Headland turns are performed automatically. The FD20 makes its own plan for seeding the field



commercial growers. Moreover, it also had to be completely autonomous and only use solar energy.

By 2018 Jens had been joined by his brother Kristian. Together with robotics expert Esben Østergaard, the team established FarmDroid ApS and in 2019 began to produce the world's first fully automatic lightweight solar-powered robot capable of both sowing and mechanical weed control.

How does it work?

Just like any piece of robotic equipment, technology plays a very important part in the operation of this machine. The FD20 has been designed to operate with an ecological and CO2-neutral methodology, specifically to eliminate both carbon emissions and the risk of doing structural damage to the soil.

The clever part of the FD20 is the FarmDroid software. When set up for planting the crop, the robot uses seed location technology to identify where it has placed each seed within the field. By using a high-spec RTK guidance system (supplied with the robot), it is not only able to plant each seed with exceptional accuracy, it will remember exactly where each seed was (or was not) planted when it returns to hoe/weed the field. Furthermore, it can store the data from 20 different field locations.

Setting up the FD20 for work is a surprisingly simple process. The three-wheel robot features a three-point hitch, which allows it to be carried on a tractor's three-point linkage. The first process is plotting the field boundary. This is done by carrying the robot round the field headland to identify corner points, which are marked as a boundary

"We have been looking at robotics, however I didn't think we would be involved so soon"

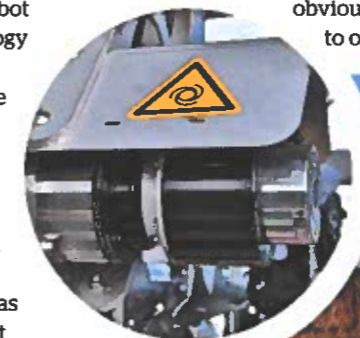
within which the machine will operate. Any obstacles such as trees or power poles can also be marked.

The next step is to select the desired number of headlands and plot the headland width. The operator then chooses the sowing distance (between the crops in the row) and sets the sowing depth. The robot is now ready to start planting.

Because of its clever technology, the FD20 does not require cameras to identify its position or to find its way between the rows of growing crops. There's no need for leaf recognition technology, because this machine weeds and hoes totally blind, using only the seed location data stored at the time of planting.

Benefits for farmers

There are numerous obvious benefits to owning a



FarmDroid. Firstly, it's suitable for a wide range of crops that require precision seeding. This includes sugar beet, onions, kale, spinach, oilseed rape and even commercially grown flowers.

It's lightweight (1050kg) and herbicide free, so it's also insect friendly, which makes it suitable for organic growers and also means it will get plus points with the supermarket fraternity.

Arguably the greatest advantage it brings to the table is that it significantly reduces the need for casual labour required to hoe and weed the crop fields. Let's face it, hoeing is a tiring job and finding reliable field workers is an issue. FarmDroid claims a single robot can recover its £60,000 investment cost in two years, just by reducing the



Left inset: Electric wheel motors are powered by four solar panels (this picture) delivering up to 1.6kWh to four batteries

TECH SPECS

- FarmDroid FD20**
- Working width** 3.0m
- Working speed** 950m/hr
- Travel speed** 1.1kph (manual mode)
- Rows** 4, 6 or 8 rows (active and passive)
- Row widths** 22.5-75.0cm
- Seed capacity** 6.0 litres per box
- Operating temperature** 0 to 40C
- Max pitch** 8% (working)
- Max roll** 5% (working)
- FD20 price (MRP)** £59,500 (six-row robot)
- RTK base station Price (MRP)** £4243



Above: The FD20 is equipped with an operator control box for set-up and manual operation. It requires an RTK base to operate but one base will operate multiple machines



Above and right: Seed hoppers are removed from the active trawlers for weeding. Metering units are blanked off to prevent dirt ingress

Below right: An app enables the user to monitor the FD20's operational output/location. It also provides notifications and records data



field labour requirement.

A single robot can manage up to 20ha. That's based on a repeat weeding cycle of seven days, which can be orchestrated as a pre-emergence weeding programme thanks to seed location software.

The actual process of weeding is performed mechanically using 'traditional' tillage tools including tines, knives and wires mounted on trailing arms (trawlers) attached to a toolbar.

Capable of weeding both in between the rows and between each plant, it travels at a maximum velocity of just 950m per hour, working the soil at a depth of around



0.5-1.0cm (depending on soil type and seedbed conditions). This low-speed, low-impact technique significantly reduces soil disturbance and compaction, in addition to reducing soil-engaging component wear, which equates to lower maintenance costs.

The process of precise weeding ensures that the crops have optimal growth conditions without having to compete with weeds for nutrition and sunlight. The low operating speed of the FarmDroid also requires less

power. Four batteries are charged by four overhead solar panels. They deliver up to 1.6 kWh (the equivalent to 20kWh a day). With an energy requirement of just 400-600 Watts, in summer its solar panels can maintain a full battery charge during the daylight hours, leaving enough in reserve to keep it moving at night.

If it does run out of juice in the middle of the night it stops. When the sun comes up the next day, as soon as it's exposed to enough photons of light to charge the batteries it will resume its work. Solar panels need daylight not sunlight, so the FarmDroid will keep working even on cloudy days.

For those farms that might want to start drilling in the twilight months of February and March, there is the option of a spare battery pack, which can be charged by a 240v 13-amp plug and be quickly exchanged to keep the wheels turning when it's cold and grey.

The FarmDroid even has a rain gauge, which it uses to measure precipitation. Should the combination of too much rain and a measured increase in energy to keep the wheels turning become excessive the robot will stop.

In short, it does not need monitoring. If the FD20 stops by itself it sends an email to the farmer as notification of any stops or deviations. For example, when the FD20 is planting seed it is constantly monitoring the seeding units. If the machine misses a seed, has a blockage or runs out of seed, it will notify the farmer.

Watching and monitoring

For operational peace of mind, the FD20 features a camera that can be set to watch different parts of the machine at work. In terms of security,

Above: Trawling arms are mounted on a toolbar at the front of the machine. All parts are made from laser-cut stainless steel

Above right: Precision seeder units are a bespoke design developed for FarmDroid. Seed metering wheels are 3D printed. They can be customised to crop types or plant spacing requirements (right inset)

Below inset: Besides supporting the seed metering units, the powered active trailer provides a mounting point for the weeding knife, which moves back and forth as it hoes between the plants

all FarmDroid units are continually monitored remotely from the company HQ in Denmark. This enables the company (with owner consent) to monitor data and remotely make software changes as required. It also allows FarmDroid to shut down/track a robot that has been tampered with.

A real-time monitoring app is available that enables users to monitor every aspect of the FD20's operational output, including its location and working progress, in addition to providing messages and data recorded by the machine.

To date, more than 250 FarmDroid FD20 robots have been sold in 18 different countries. FarmDroid now has 16 international distributors, and additional trials are currently underway in Canada and California.

The need to produce carbon-neutral robotic machines that can replace costly manual labour and work around the clock

is increasingly essential for modern food production. By using time-honoured hoeing and seeding principles, the best solar energy components on the market and some extremely clever software, you cannot be anything but impressed by what this machine can do.

The biggest mistake we could arguably make at this point is to consider the FarmDroid FD20 as a glimpse at farming in the future. This is not about the future, it's about what's happening today.

By bringing FarmDroid to the UK, Opico has introduced a revolutionary new product in response to a global quest to produce herbicide-free, carbon-neutral and sustainable food. To that end, we think the FarmDroid is a development in farming technology that could potentially tick a lot of boxes for an increasing number of UK farmers and growers.



Left: The FarmDroid uses two trailing arms or trawlers (active and passive) for each row. The powered active trailer is used for seeding and inter-plant hoeing. The passive arm is for inter-row tools only

Above: The trailers can be adjusted and balanced using pressure springs mounted by the toolbar. Easily adjusted, they are locked into position using a removable key

"Solar panels need daylight not sunlight, so the FD20 will keep working on cloudy days"

