

Dealers become part of the robot revolution

It may be self-propelled, but it has no engine, no complex transmission and no cab with associated creature comforts and controls. That doesn't sound like the sort of machine that will require much support from a dealer, yet a number of the trade's biggest names have signed up as agents for Opico's FarmDroid. MARTIN RICKATSON attended its launch earlier this year to find out more

Not long ago, autonomous or robotic agricultural vehicles, particularly those for field work, were the stuff of prototype areas on stands at big international shows, or demo zones at field events. The question of market-readiness was something many manufacturers seemed to stall when asked.

However, over the past year or so, the time to market of such machines seems to have shortened from 'soon' to 'now'. Conventionally engined robots are already working on UK vegetable farms' weeding duties, as reported previously in Service Dealer. Now, though, the principle has moved yet further forward, with the launch earlier this year of a new solar-powered robot that can not only handle simple weeding tasks, but can also plant crops beforehand. And this time it's being sold and supported through an established UK dealer network.

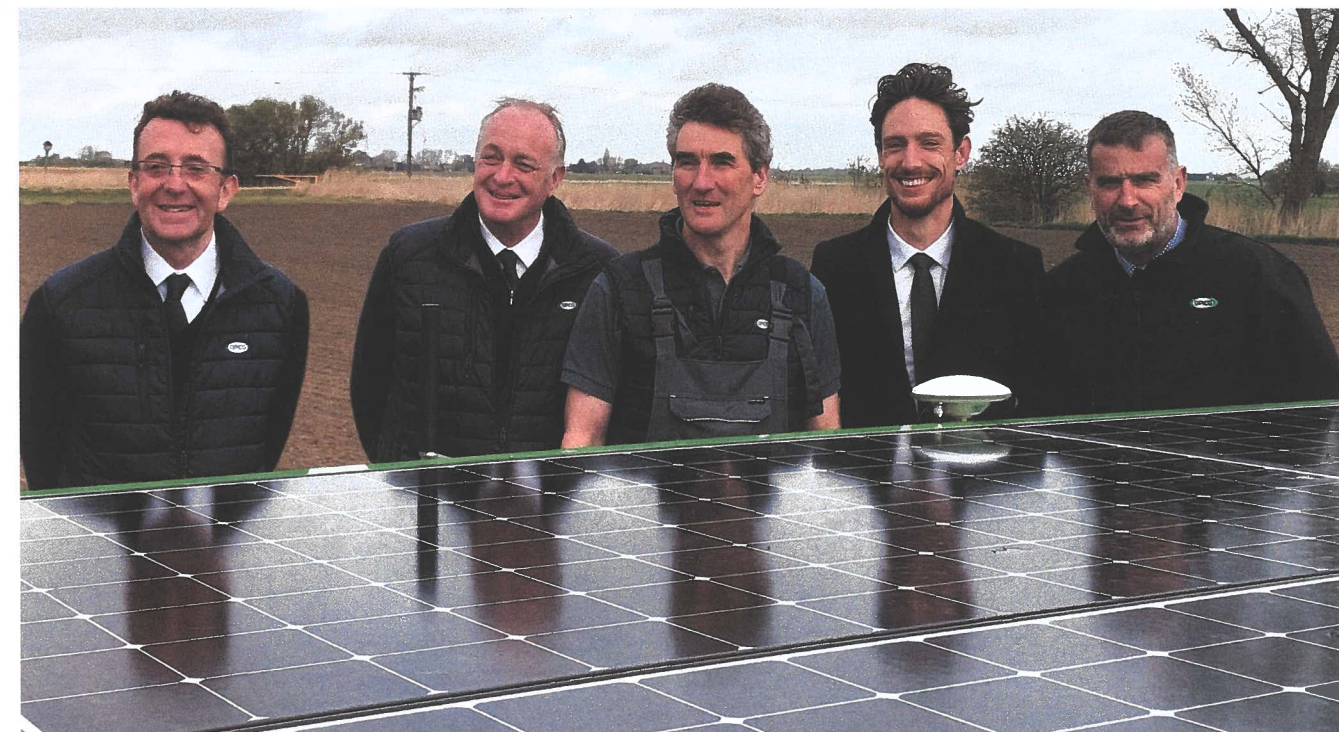
Development of the FarmDroid FD20, which is now being imported by Lincs-based Opico and sold through a selected network of its dealers, began in 2011 on a family farm in central Denmark. Jens Warming first began to investigate the idea of a simpler, more time and fuel-efficient and less labour-intensive way of inter-row weeding sugar beet. Joined subsequently by his brother Kristian, and by specialist robotics engineer Esben Østergaard, the three set out to create an autonomous machine for seeding and weeding of sugar beet and other row crops – such as herbs, salads and oilseed rape – based on the principle that a machine using ultra-high-precision placement based on RTK for planting crops would then be able to use recorded placement data to

weed not just between plant rows, but also between plants themselves in each row, all without the need for camera systems. A further principle was that of harnessing solar energy to propel the vehicle, which they felt was a practical proposition given the relatively low energy requirement of a machine that, because it is aimed mainly at vegetable growers, operates largely on light, flat land.

After designing and building the first prototypes in their farm workshop, the Warming brothers then tested, trialled and developed these over the next eight years, until a first-generation production version was ready for launch at Agritechnica 2019. By now, with a team of 30 people working from a new manufacturing complex, the business had a dozen machines on Danish farms the following year, before an updated model was developed for autumn 2020, and production was ramped up to 60 units, with six international distributors appointed. Today, FarmDroid is represented in 18 countries with over 250 units sold, six of which were in the UK by spring 2022.

How it works

The FarmDroid is powered via four solar panels that charge two lithium batteries on the machine. Two further spare batteries can be charged remotely, if required, although charging takes place during daylight operation whatever the light level, with 24-hour operation possible from battery storage of solar-generated power. Should it run out of power in the night, the machine will simply begin moving again when the sun rises and the solar panels again become active. It also features a rain sensor that will stop the machine if a certain



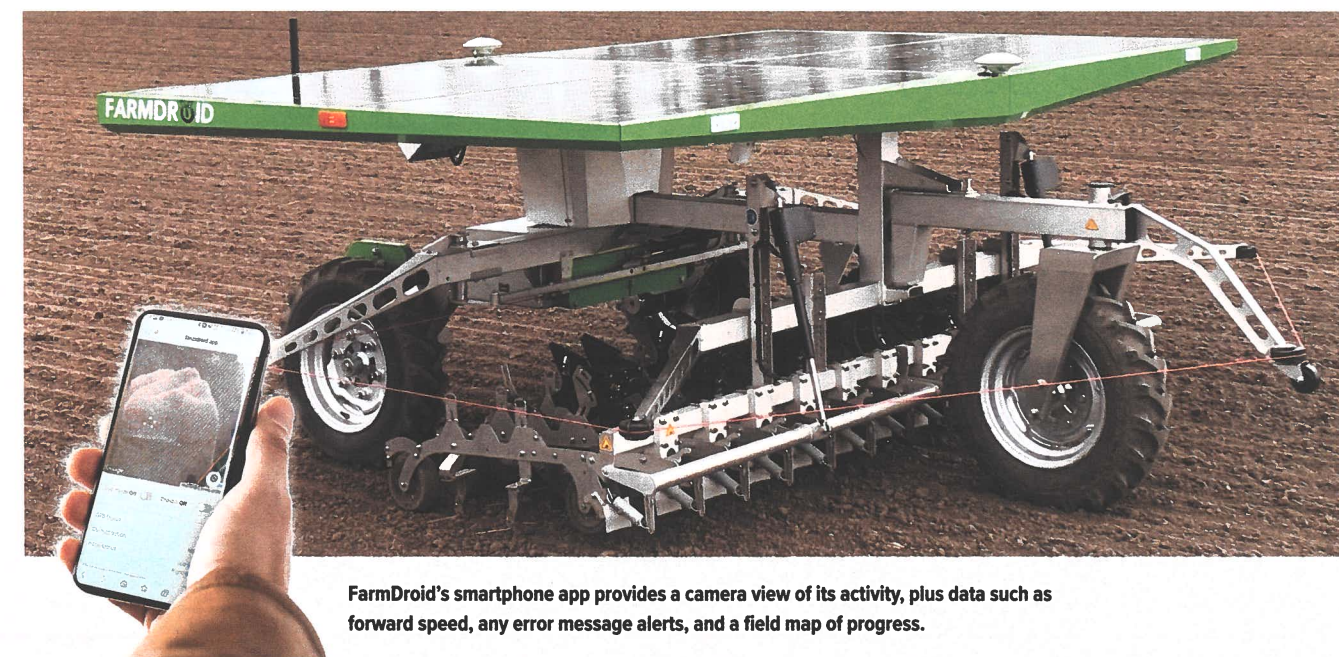
Opico has set up a specialist FarmDroid team, working with selected dealers. L-R: Opico's James Woolway, Charles Bedforth, Angus Steven, FarmDroid's Eddie Pedersen and Opico's Harvey Sherwin

amount is detected, or notify the owner's app so a decision can be made as to whether or not to cease operations.

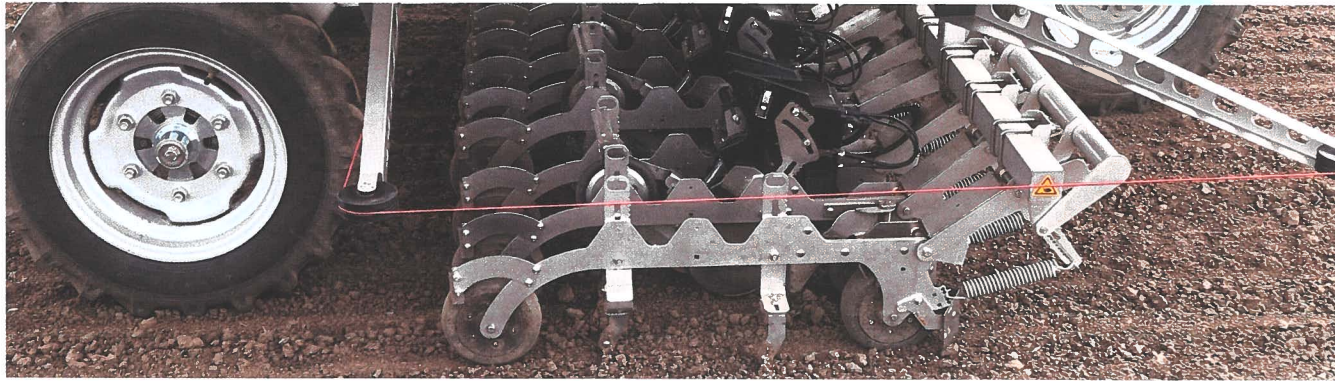
Propulsion is via a 400W electric motor on each wheel, and operation is therefore fuel and emission-free, and CO2-neutral, something the firm points out will particularly aid farmers whose produce buyers are pressuring them to fulfil environmental demands along with crop supply contracts. Electric motors also engage and power the seeding and weeding units. Steering is via drive motors on the front wheels, which work constantly at different forward speeds to keep the machine on a straight

course. There is a single wheel at the rear. The majority of the machine's working parts are stainless steel, with Hardox used for the weeding wires and seed couler.

The 3.0m FarmDroid can be equipped with four, six or eight precision drill and inter/intra-row cultivation element sets, both having been developed and manufactured in-house. Although cameras are not required for guidance, one unit is fitted to provide the person monitoring the machine via FarmDroid's smartphone app, to provide a view of its activity. The app also provides data such as forward speed



FarmDroid's smartphone app provides a camera view of its activity, plus data such as forward speed, any error message alerts, and a field map of progress.



The machine uses a combination of weeding wires and blades to remove weeds between and within rows, based on records of each seed's sown location

and any error message alerts.

The 900kg machine (without attachments) is transported between fields by tractor, and because it operates at less than 1.0 km/hr (working speeds can be set from 450-950m/hr), and is fully equipped with safety stop and smartphone app alert features should it come into close proximity with an object or person, it is not subject to any further safety legislation during operation. The maker suggests that, where practical/required, it can be left in the field for the season, and calculates that despite its sedate pace it has a 6.0ha/24hr potential workrate. Although the machine does not work deeply, slower working speed minimises required downforce and therefore power and torque, says the firm.

In the field, the FarmDroid is guided around the perimeter to record the corner points, thereafter setting a geofence from this so that it knows the field boundary, and the headlands can be set. In addition, any obstacles, the number of headland bouts and the seed spacing are set at this point. From this, the machine calculates the best path plan for work. All of this is recorded via FarmDroid's own RTK system, which works to a repeatable accuracy of 0.8cm, using front and rear machine-mounted antennae communicating with a farm-installed fixed base station, which must be within 10km of the field. This enables the FarmDroid to work up to within 5mm of each seedling between the rows, and 20mm in the row.

"If we can seed it, we can weed it," says Eddie Pedersen, FarmDroid's sales manager.

"To enable inter- and intra-row weeding without cameras, we had to design a high-precision seeding system. For drilling, once those field parameters are set, it's simply a matter of programming in the required plant density and spacing, and setting it off.

"Roller disc pairs are followed by a furrow opener that creates a V-shaped slot. The individual six-litre seed hoppers each supply an electrically driven seed motor, feeding individual seeding discs with a range of interchangeable units 3D-printed in-house. These also feature different hole diameters, disc thicknesses and disc diameters for different seed types. Gravity feed is preferred over a more complex pressure or vacuum system, and a mark in each disc provides monitoring of positive seed disc drive. A light sensor at the base of each unit requires a beam to be broken to show a seed has passed and been placed. The



An on-board controller is used for initial machine placement within the field. RTK receivers front and rear work with an on-farm base station

last element of the seeding set-up is individual pressure wheels to firm the soil over the seed.

"Then, as the machine remembers where each seed has been placed within a variation of 0.8cm, once drilling is complete, the tool units can be changed over – the seeding units simply flip up out of work and the weeding ones drop down. The FarmDroid can then be set up for pre-emergence or 'blind' weeding soon after drilling, and for repeated passes at intervals in the weeks afterwards to catch weeds as – or even before – they chit. And while the weeding wires remove all weeds between rows, separate weeding knives interject between each plant, based on the known seed positions.

"The number of selective herbicides available to farmers is shrinking, as is the availability of labour for manual or even tractor-operated hoeing, whether a farm is producing organic or conventional crops. This machine can overcome those issues in crops up to 40-50cm in height, at row widths of 22.5-90.0cm."

Angus Steven, Opico technical director, reckons that, having been involved in UK agriculture for over 55 years as an importer of various technologies, the business has the expertise and knowledge to back up and support this type of new technology.

"Via our grain dryers, we've been involved with automated products and those that work around the clock since the early 1990s, and through that experience we also have sound knowledge of equipment that uses remote connectivity.

"Those in our technical team working with FarmDroid will be involved from the start in helping dealers to install the product on-farm with a customer, and our selected FarmDroid

dealers have also received thorough product training. In addition, we have a team at Bourne able to support these machines remotely, as well as with the manufacturer's help. There will also be strong online support and advice via the FarmDroid app and website.

"We have already stocked £20,000 of parts for Farmdroid at our Bourne HQ, and added 500 new pallet location spaces."

Harvey Sherwin, Opico's FarmDroid product manager, says weeding is best done in relatively dry conditions, which will allow the uprooted weeds to desiccate and die.

"The inter-row hoeing is passive, in that it is in work all the time, and when the machine is set up, the row width is fixed," he explains.

"Conversely, the active intra-row hoeing, with the knives moving in and out between plants, can be altered down to 10cm spacing, according to crop type and stage."

Dealer involvement

Opico is now selling and supporting the machine through a small specialist network of dealers totalling around 60 depots. MD James Woolway says the company had been keeping an eye for some time on autonomous vehicle developments, seeking to be in from the start in a sector which he believes suits its specialisms.

"We believe robotics will form the backbone of the next major

step in technological development for agriculture," he says.

"The technology is not so radical – many farmers are already working with remote monitoring, RTK and automation. But the potential savings in herbicides, fuel, labour and machinery costs, including depreciation, maintenance, tyres and capital tie-up, are what make me believe this technology is here to stay, and we want to be in from the beginning.

"The financial argument for FarmDroid is strong, especially as the purchase price and ongoing running costs are a fraction of those associated with traditional equipment used for these tasks when establishing row-crops. On that basis we expect some growers to see a return within two years."

The four-row FarmDroid FD20 retails at £59,022 (with additional rows at £3469), with an additional £5,225 required for an RTK base station. The maker and importer suggest this could be recouped in two years through reductions in labour, herbicide and other machinery costs. Grants may be available to help customers fund a proportion of this, notes Opico.

Mr Woolway says dealers who have signed up as FarmDroid agents include Ernest Doe and Chandlers.

"Installation, support and advice will be an important part of getting these machines onto farms working at their best. We have hand-picked a group of dealers who we think are best placed to do this, and they have got off to a flying start with the product."

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