

Sustainable solutions



Machinery Sustainable farming

As COVID restrictions continue to limit travel, John Deere recently held its first 'Sustainability Day' — livestreamed from Mannheim — to discuss how technology could play a key role in the future of sustainable farming. CPM joined the launch from the UK.

By Charlotte Cunningham

Whether sustainability drives your ambition or fills you with dread, the reality is that making decisions based on sustainability indicators looks set to shape the future of farming in the not-too-distant future.

As with everything, operating a 'sustainable' business encompasses an array of factors — from the crops we grow, to the inputs we choose, and what type of machinery we use to do all of those jobs.

It's fair to say that manufacturers have taken this shift in tactics on board over the past couple of years, with many offering their versions of solutions to sustainability — including lower disturbance kit or

reducing the emissions of the biggest gas guzzlers.

And to highlight its commitment to a sustainable future, John Deere recently hosted its first virtual Sustainability Day.

"Though farmers have been feeding the world for a long, long time with success, never has the industry been under such pressure as it is now — with everything we do examined under a microscope," says Markwart von Pentz, president of John Deere's Ag Division. "In terms of social policy, agriculture has to master many challenges. Being a farmer today isn't easy at all — you're under economic, social, and ecological pressure. However, this is why there's an opportunity to drive further sustainability — something that we at John Deere believe is a great opportunity, in fact."

Markwart says that the challenge comes with balancing customer demands and environmental responsibility with economic efficiency. "There is also the issue that farming globally is presented as a problem maker on the sustainability front, but the problem-solving abilities of the industry are often overlooked.

"So we have been looking into how farming can solve some of the fundamental problems we face, through the use of technology.

"Digitalisation is a key enabler to make farming more sustainable. It also provides better transparency through enhanced

documentation. In this way, farmers will be able to regain consumer confidence."

During the event, John Deere identified three areas that have a particular impact on the sustainability of agriculture, and explained how digital technology could provide a welcome solution to some of the biggest challenges faced in industry:

- Soil protection – protecting the soil with modern design concepts.
- Fertilisation – using digital nutrient measurement to upgrade manure and slurry as a valuable organic fertiliser.
- Crop protection – reducing the use of agrochemicals by more precise applications.

Increased soil protection

Soil protection is mainly about using larger machinery footprints, which helps to avoid damaging soil compaction. This ensures



John Deere reckons it offers a soil-saving solution with its 8RX tractor.

“Digitalisation is a key enabler to make farming more sustainable.”

greater soil fertility while increasing porosity and the soil's capacity to store more nutrients and water and the livestream headed over to The School of Agricultural, Forest and Food Sciences (HAFL), part of Bern University of Applied Sciences, Switzerland to find out more about the impact of machinery on 'harmful compaction.'

"Half of the soil consists of pore cavities and if we press too hard or there's too much weight on the soil then we get compaction," says Matthias Stettler, lecturer in agricultural engineering. "And if we do that to too many pores, the soil won't function, and we call this 'harmful compaction.'

"Harmful compaction limits the function of soil — namely, stopping the exchange of air, water and nutrients — and these days we know this can cause



With the John Deere HarvestLab sensor, the precise nutrient content of manure can be accurately measured.

10-20% yield losses.

"The solution to this is distributing weight to a larger contact area but the challenge is to find technical solutions that facilitate this."

Matthias has developed the Terranimo model — a free-to-use online modelling tool which allows growers to configure machines so farmers can see what is happening within the soil when their specific bit of kit is being used — illustrated by pressure bulbs.

This can be simulated on a per-tyre basis, with farmers then able to make variations based on how it effects soil pressure, for example, he explains.

But in a world where machinery seems to be getting bigger and bigger, does this actually mean smaller, more lightweight tractors are the answer?

"The fact that larger machines have larger wheel loads and can therefore compact soil more densely cannot be denied in principle," explains Roger Stirnimann, lecturer in agricultural engineering.

"However, with larger machines it means we also have larger working widths and modern tractors also have suspension options to counteract impact as well.

"Now large volume modern tyres can increase contact area, which in turn reduces the impact on the soil. So it is possible that larger machinery could be more beneficial."

With these theories in mind, John Deere reckons it offers a soil-saving solution within its 8RX tractor, says Simon



The new John Deere four-track 8RX has a huge footprint of 4.6m², so the contact surface pressure is very low at only 0.4kg/cm².



The 8RX's larger footprint also means less track depth, which reduces compaction in the deeper soil layers and reduces roll resistance.

Schwalter, product marketing manager, large tractors. "In recent years, tractors have undoubtedly become heavier. Nevertheless, soil compaction has steadily decreased due to the use of larger tyres and the ability to work with low inflation pressures. ▶

The 8R series

The 8R series is claimed to be the first range of standard tractors to offer three different drive concepts: the 8R Series wheeled tractors, 8RT models with two tracks and brand new 8RX versions with four tracks.

The 8RX Series has been developed with the aim of maximising soil protection without compromising performance, says Simon. "The tractor is extremely manoeuvrable while also minimising any noticeable soil scuffing effect when turning.

"Compared with common industry two-track designs, the 8RX is significantly more stable on hillsides and performs well in more challenging soil conditions due to its superior self-cleaning ability. The tracks are available in widths from 16 to 30in (41 to 76cm), providing a total ground contact area of over 4.5m²."

These latest 8R Series tractors boast John Deere's existing 9-litre PowerTech PVS & PSS

engines, with an increase of 40hp on the 8RT 410.

New features include a Visco radiator fan and relocation of the engine auxiliary systems to the front.

Due to the new design and less heat exposure, it has been possible to further reduce the costs of wear and maintenance. Established transmission options include the 16/5 PowerShift, which is now available up to the 8R 340 model, the modern e23 with Efficiency Manager and the stepless AutoPowr.

The rear brakes have been massively reinforced, so front brakes are no longer necessary even at 50kph, although additional front brakes can still be ordered. The 8R Series tractors are now optionally available with a 1500 standard front axle, which is designed for special applications.



ExactApply technology uses pulse width modulation to spray at a constant pressure and enables growers to control each individual nozzle, independently to the pressure.

▶ “For example, a modern 22t tractor only puts a pressure of 0.6kg/cm² on the ground, while a 3t 75hp tractor built in the 1970s applies much more weight, at 1.5kg/cm².”

“Tracked tractors are even gentler on the soil and the new John Deere four-track 8RX has a huge footprint of 4.6m², so the contact surface pressure is very low at only 0.4kg/cm².”

Deere has assessed the

differences in configuration of the 8R series in the field over the past 18 months, with the tracked version coming up trumps. “In my opinion, the most interesting result was from an analysis of the water filtration capacity of the soil under the different configurations,” explains Simon.

“Where the 8RX tracked model was used, water was shown to seep into the soil three

times faster than where the single wheel configuration was used. This is beneficial as it means less erosion on the top layer, and with more water contained within the soil, it means a better supply to crops, resulting in overall better yields.”

A larger footprint also means less track depth, which reduces compaction in the deeper soil layers and reduces roll resistance. Less roll resistance means lower fuel consumption and therefore fewer CO₂ emissions, he adds.

“Tests have shown that fuel consumption can be reduced in this way by 10%, so this innovative driving concept can make an active contribution to climate protection.”

Accurate fertilisation

Fertilising farmland with manure is often the subject of critical public debate.

But with concerns over the environmental impact of synthetic fertiliser, there's no doubt that slurry is an incredibly valuable organic source of nutrients.

However, this only works if the farmer is able to determine the nutrient demand of the crop as well as the nutrient content of the manure, explains Deere's Alexander Berges. “Today, both can be measured accurately by taking soil and plant samples. The results allow farmers to

create application maps, which make site-specific fertiliser applications possible.”

With the John Deere HarvestLab sensor, the precise nutrient content of the manure can be accurately measured, providing a solution to one of the biggest sustainability concerns, he explains. “We believe this is game-changing technology. The sensor's NIR technology identifies the exact amounts of nitrogen, phosphorus and potassium, even when the values vary.”

Controlled in real time by these active measurements and the application map recommendations, the tractor and slurry tanker are able to adjust the application rate automatically.

“This ensures the exact amount of organic fertiliser is applied according to the specific needs of the crop,” notes Alexander. “Over- and under-fertilisation is prevented, which avoids both air and water pollution, and the use of mineral fertilisers can be significantly reduced. Ultimately the environment will also benefit, since the production of fertilisers uses a lot of energy and generates a lot of CO₂.”

“While we don't see organic fertiliser completely replacing mineral sources, it can be a really useful supply of nutrients for both livestock and arable farmers.”

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While not available in Europe, Deere's See & Spray technology can identify weeds and apply a herbicide at specific locations across the field, using AI and high-speed cameras.

Targeted crop protection.

Crop protection is another area which has come under a great deal of public scrutiny, though it's fair to say that growers have been working for some time to minimise overlaps and overdoses — for both financial and environmental reasons. "It's worth pointing out firstly that the UK and Europe has some of the highest standards and strictest regulations when it comes to crop protection, and many growers are already being very efficient," notes segment manager, Jorgen Audenaert.

But now, technology is making that even easier, and Deere's solutions include accurate GPS-controlled driving with AutoTrac, intelligent SectionControl and the firm's ExactApply individual nozzle control. "With SectionControl, we're using the GPS information on the sprayer — we know exactly where every nozzle is working and where it has previously worked," he says.

"It automatically switches on and off every nozzle — at high level precision — to minimise the overlap and when the machine is entering boundaries/buffer zones. We estimate this saves between 5-10% of chemical usage."

Meanwhile, the ExactApply pulse width modulation innovation offers a new alternative to traditional application rate technology. "Most common technology controls application rate by changing the pressure — as speed changes, pressure is adjusted to maintain rates. But this also effects distribution — if you drive too fast you get issues with drift, and if you drive too slow, you get coarser droplets which means sub-optimal distribution.

"However, the recent technology we've

developed uses pulse width modulation to spray at a constant pressure and means growers can control each individual nozzle, independently to the pressure."

At the same time, there is a growing trend towards the use of site-specific or even individual plant treatments instead of uniformly spraying complete fields.

Drones or satellite images, for example, can measure crop density and related disease pressure, so the necessary fungicides can be applied.

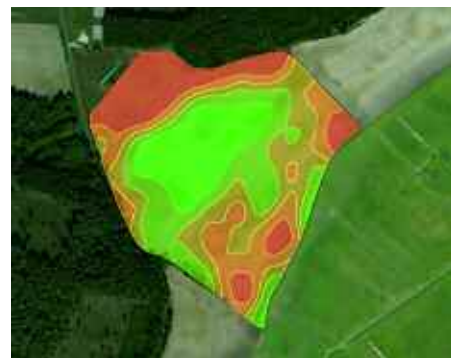
Again based on application maps, sections of the field are only treated where necessary. This approach can provide massive cost savings, depending on crop and field variations.

And while it's not commercially available for European growers at present, John Deere's new See & Spray technology is claimed to be even more precise. "High-speed cameras and artificial intelligence help to capture crop populations, and See & Spray Select can identify weeds and apply a herbicide at specific locations across the field," says Jorgen.

"The next step up is the advanced See & Spray system, which can distinguish between weeds and the growing crop. Again, only the individual weeds are treated, while the crop is not affected. See & Spray technology is currently developed for row crop applications, and herbicide savings of up to 90% are possible."

Mechanical weed control also benefits from the use of high-speed camera technology.

"The AutoTrac Implement Guidance system provides precise control of



Deere's overlap-minimising solutions include GPS-controlled driving with AutoTrac, intelligent SectionControl and the firm's ExactApply individual nozzle control.

mechanical hoes used between crop rows," he explains. "The system's accuracy allows the tractor to be driven at high speeds of up to 16km/h. For organic farms in particular, this technology offers a real efficiency advantage."

Even conventional farms can benefit by combining chemical and mechanical measures, and therefore significantly reduce the cost and environmental burden of herbicide use, reckons Jorgen.

"These technologies cannot on their own contribute to the total climate neutrality of agriculture. However, they can help to reduce fertiliser, agrochemical, and fuel costs, and significantly reduce farming's carbon footprint.

"Farmers are certainly willing to produce food and energy more sustainably. This approach calls for action by all participants to set a new course for European agriculture in such a way that a successful balance can be struck between economy and ecology." ■

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