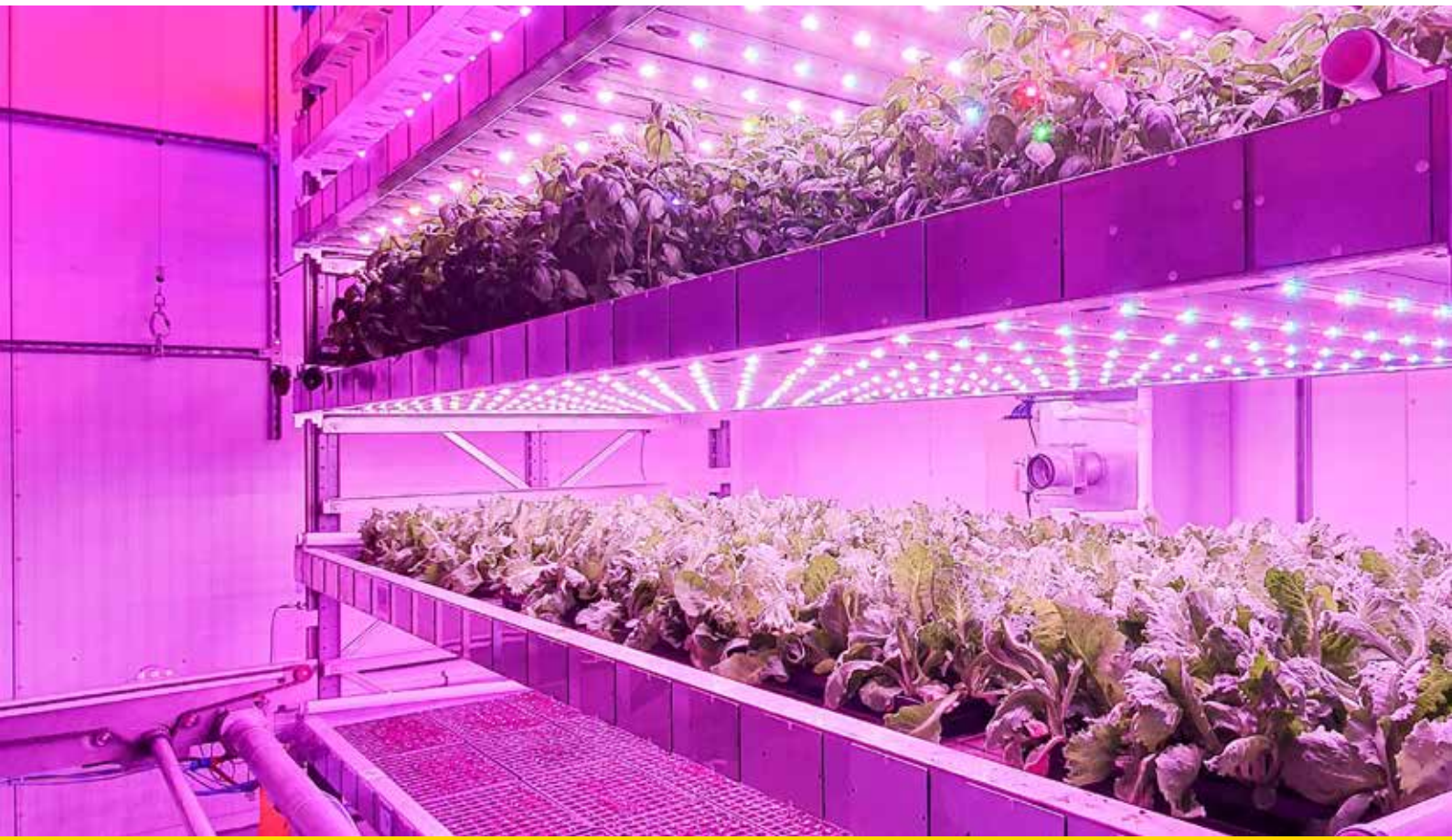
AGRI-TECH REPORT

Insight, expert views and case studies to help farmers explore opportunities for the future



NFU Mutual
FARM INSURANCE

WHY TECHNOLOGY IS ESSENTIAL TO OUR FARMING FUTURE

Charlie Yorke,
Farm Insurance Specialist, NFU Mutual

There's a technological revolution happening in farming, with a growing number of systems available to increase productivity and efficiency, prevent rural crime and make everyone's jobs safer.

In the fiercely competitive global marketplace, embracing the right technology is becoming increasingly important to ensure farming businesses remain profitable in the long-term.

It's fundamental too as farms and businesses strive to create a greener future, and do their bit to help meet broader environmental goals. To that end, technology will undoubtedly play a big role in helping farmers win subsidies in the new world of Environmental Land Management (ELM) schemes.

Technology is ultimately an enabler, and farmers skills and on-farm practices will need to work hand in hand if adoption is to be a success. It's important to remember that it's a steep learning curve. Farmers must decide on the technology that offers the best way forward and will integrate with other systems – and when to take the plunge.

If you haven't already, now is the time to start doing your research. For example, sometimes there are farming funds and grants that may be helpful when investing in new equipment and technology. They're often aimed at farmers, growers and contractors to improve productivity and bring environmental benefits.

This report is aimed at helping farmers understand the opportunities and risks ahead so they can make the right decisions for their farming businesses.

If you're thinking of adopting new technology on your farm, we'd encourage you to speak to your local NFU Mutual agency as soon as you can to ensure you have the right insurance cover in place.

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IN SEARCH OF FARMING SOLUTIONS

Charlie Steer,
Arable Manager, 2019 Prestigious Nuffield Scholar

Charlie works as an arable manager on the 2,245 hectare mixed farm in Cheshire; Grosvenor Farms.

As part of his role as a Nuffield scholar, supported by the NFU Mutual Charitable Trust. Charlie had the chance to travel the world and learn from some of the most advanced farming operations available. He has travelled to countries in Europe, Canada and North America to learn about farming techniques, innovations and technology that could be adopted in the UK.

The destinations Charlie visited all had a focus on circular farming. Circular farming uses the principals of the circular economy to; design out waste and pollution, keep products and materials in use and regenerate natural systems. To do this it focuses on minimising external inputs and regenerating soils to reduce the impact on the environment.

Charlie visited a giant American farm using manure from 38,000 cows to power parts of the farm, run a fleet of trucks, fertilise their crops, and commercialise their own dry fertiliser. He also learnt about various techniques such as fly farming and systems for using worms to treat waste – known as vermi-filtration.

Charlie has been putting some of his learnings into practice back at Grosvenor Farms, a large operation that produces over 35 million litres of fresh milk a year and grows 2,200 hectares of forage and grains for food production and animal feed.

CCm Technologies, a biofertiliser company based in Swindon, was one of the first businesses Charlie went to see after his scholarship.

"We're putting in a planning application for an Anaerobic Digestion (AD) plant and talking to CCm Technologies about the feasibility of producing a dry biofertiliser. Part of our thinking is that if gas prices are going to stay at higher levels, current legislation has reduced the opportunities to apply manures in the autumn."

Installing an AD plant is one way that Grosvenor Farms are working towards becoming a net zero carbon operation by 2030. Another is through the creation of a 'carbon balance sheet' to accurately assess their carbon footprint and help them make the right decisions to achieve net zero. Charlie says: "We've done a LIDAR survey on the farm and whole estate, where we've measured all above ground biomass allowing us to calculate the total carbon stored. We're also trialling sampling for soil carbon using Omnia, the precision farming mapping tool."

As part of his Scholarship, Charlie values the time he spent travelling the world to learn from other farms: "Going to areas of the world where they face similar challenges is always helpful. It's good to take a step back and have a look beyond the farm gate at what other people around the world are doing," he advises. But then it takes ambition to implement the right solutions back in the UK. "At Grosvenor Farms, we're not afraid to be the first to do something, but we're a commercial farm, not a research station, so there has to be sound commercial benefit" he explains.

TECH INNOVATIONS FOR A BETTER, SAFER HARVEST

Ali Capper,
Stocks Farm and NFU Mutual Non-Executive Director

At Ali Capper's family's apple and hops farm on the border between Herefordshire and Worcestershire, technology has long been essential to their success.

The farm has always tried to adopt the latest automation, integrated pest management and newest technologies to help drive productivity and profitability whilst being kind to the environment. The farm is seeking to reduce their reliance on fossil fuels so that every apple and hop is produced in a climate friendly farm environment.

They have introduced modern growing systems to ensure the workforce can be as efficient as possible in every task, whether that is pruning in the winter, planting in the spring or harvesting in the autumn. They have taken advantage of innovations including three-row sprayers and self-driving harvest platforms. Their latest investment will be a harvest platform with conveyor arms that will improve picking speeds by 25%. All these initiatives reduce the amount of labour and tractor hours in addition to reducing soil compaction; enabling an increase in biodiversity.

Since 2017, they've been using digital soil mapping to achieve an increasingly comprehensive picture of soil quality. This helps to monitor good soil health and significantly increases biodiversity too. In addition, the farm uses pest monitoring traps, mating disruptors and predators to reduce the amount of pest control products required.

Artificial intelligence, robotics and new autonomous technologies will continue to play an important role at Ali's farm. She says: "We must all have the climate change agenda at the heart of what we do and the decisions we make. The good news is that many agri-tech innovations will help us to be kinder to the farmed environment as well as more efficient and profitable."

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INSPIRATION FROM THE OTHER SIDE OF THE WORLD

Graham Potter,
The Grange

Yorkshire farmer Graham Potter first learnt about precision farming techniques whilst working on a 14,000 hectare arable enterprise in Australia many years ago.

Graham was an early adopter of precision technology in the UK. He witnessed an example of how cutting-edge technology could be adopted to later become mainstream technology.

He has a simple suggestion for farmers who are more hesitant about investing in technology: speak to your neighbours.

By way of example, he says: "My next-door neighbours said they'd never want auto steering on their tractors. But after they saw how we use it, they put it on their tractors and quickly realised they couldn't live without it.

"So, speak to other farmers, never be scared of it – tech is getting easier and easier to use."

When he got back to his family farm, following his travels, Graham realised that some of the methods he'd learnt on the other side of the world would make a real difference to the soils back at home. "Things weren't how they should be – the soil was starting to deteriorate. We knew we had to do things differently if we were to be sustainable," he says.

On his return, one of Graham's first moves was to have the farm's soils sampled properly. There are 20 different soil types on the farm, all mapped into zones.

Graham continues to add additional information onto these maps using systems such as Gatekeeper to build up a better picture of how each area is performing.

The use of this data and insight has enabled Graham to identify which areas of the farm are profitable and which aren't, so he can instead focus on these. "Where there are parts of the farm with problems that can't be fixed, we utilise land in other ways, for example for environmental schemes", he explains.

He adds: "The software we use provides a wonderful map of everything that's going on. It means we know exactly how much we're making and exactly how much it costs to grow a tonne of corn."

ONE OF THE UK'S FIRST ROBOTIC TRACTORS

Andrew Williams,
Home Farm
Nacton

Andrew, runs Home Farm Nacton, on the north bank of Suffolk's Orwell estuary, they grow crops ranging from leeks and onions to sugar beet and cereals. Andrew and the team found a very modern solution to a shortage of seasonal labour: earlier this year they took delivery of one of the UK's first robotic tractors.

The Danish-made Robotti 150D machine was quickly put to work using a harrow attachment to weed organic and conventional vegetable crops on the 1940 hectare farm.

"A lot of our produce is organic, so we're limited in how we can control weeds, however Robotti does exactly what we need", says Andrew Williams, Farm Director at Home Farm.

Robotti 150D is autonomously controlled and uses GPS to follow a pre-programmed route across the field, without the need for a human driver. "The software is very user friendly: Robotti's control and monitoring systems are highly advanced. It carries out the work independently and will send an alert to my phone if it encounters any issues" Andrew adds.

Andrew explains that the robot is a way to future proof the farm, saving the business time and money. Furthermore, mechanical weeding doesn't use any chemicals and is more eco-friendly too.

Other farmers, both local and from as far afield as Scotland, have also shown an interest in the technology, visiting Home Farm to see the machine in action. "Before long, a lot of weeding will be done in this way," Andrew suggests.

With any automation can come concerns about job losses. But, given the repetitive nature of the tasks assigned to the machine, Andrew explains it's gone down well with his farm workers: "I was pleasantly surprised by how positively the workforce took to the machine. They know it's replacing the jobs that nobody wants to do."

"We are confident that this type of technology is the future for farmers," Andrew states.

USING TECH TO SCALE UP SUSTAINABLITY

Bex Tonks,
St Ewe Free Range Eggs

St Ewe Free Range Eggs is a family run egg producer and packer based in Cornwall.

Christine and Richard Tonks started it as a dairy farm in the late 1960s, before turning their skills and attention to poultry in the 1980s.

Now run by their daughter Bex Tonks, St Ewe sells a colourful array of free-range shell eggs to supermarkets and online retailers throughout the UK as well as their pasteurised liquid eggs to foodservice and some of the top restaurants in the country.

The family are leaders in innovation and have continuously invested in research and new technology to keep the business moving forward and aligned with the ever-changing demands of today's market.

Technology and having an innovative approach is absolutely key to moving forward in any business, whether farming or otherwise. Technology has played an integral role in their business from developing bespoke diets for hens to automated systems to house hens in more consistent environments.

St Ewe's latest plans include a 4,500m^2 packing centre and a £1m investment in an egg grader packed with automatic features including automatic candling, crack, blood and dirt detection and a UV disinfection function.

Bex says: "We're all really excited about the move as it will help to reduce our packing costs, offer a much more consistent level of quality and a more sustainable way to run a food production business; something increasingly important as we work towards our BCORP status."

"We're always striving to reduce our carbon footprint and the new grader will allow us to work more efficiently."

As well as enabling the business to significantly upscale, new technology is also a tool to make the business as sustainable as possible. For example, St Ewe are working on developing new products such as drinks that don't have to be chilled, so they can be sold with a lower carbon footprint.

LINKING FARMERS WITH TODAY'S BEST TECHNOLOGY

It's clear that farmers appreciate that embracing new technologies will help their farming businesses become sustainable. They know the right technology can help them make more informed decisions to improve productivity and overall resilience.

However, when it comes to choosing which technology to invest in, a lot of farmers don't know where to start. There's a huge shop window, with a complicated array of options. Simply finding the time to grapple with the choices can be challenging for many farmers.

That's why it can often be useful to get in touch with your local college or university for further support. They usually have specialist departments specialising in Farm Business Management, Food Production and Engineering that could be a great resource for farmers to tap into for inspiration and future planning.

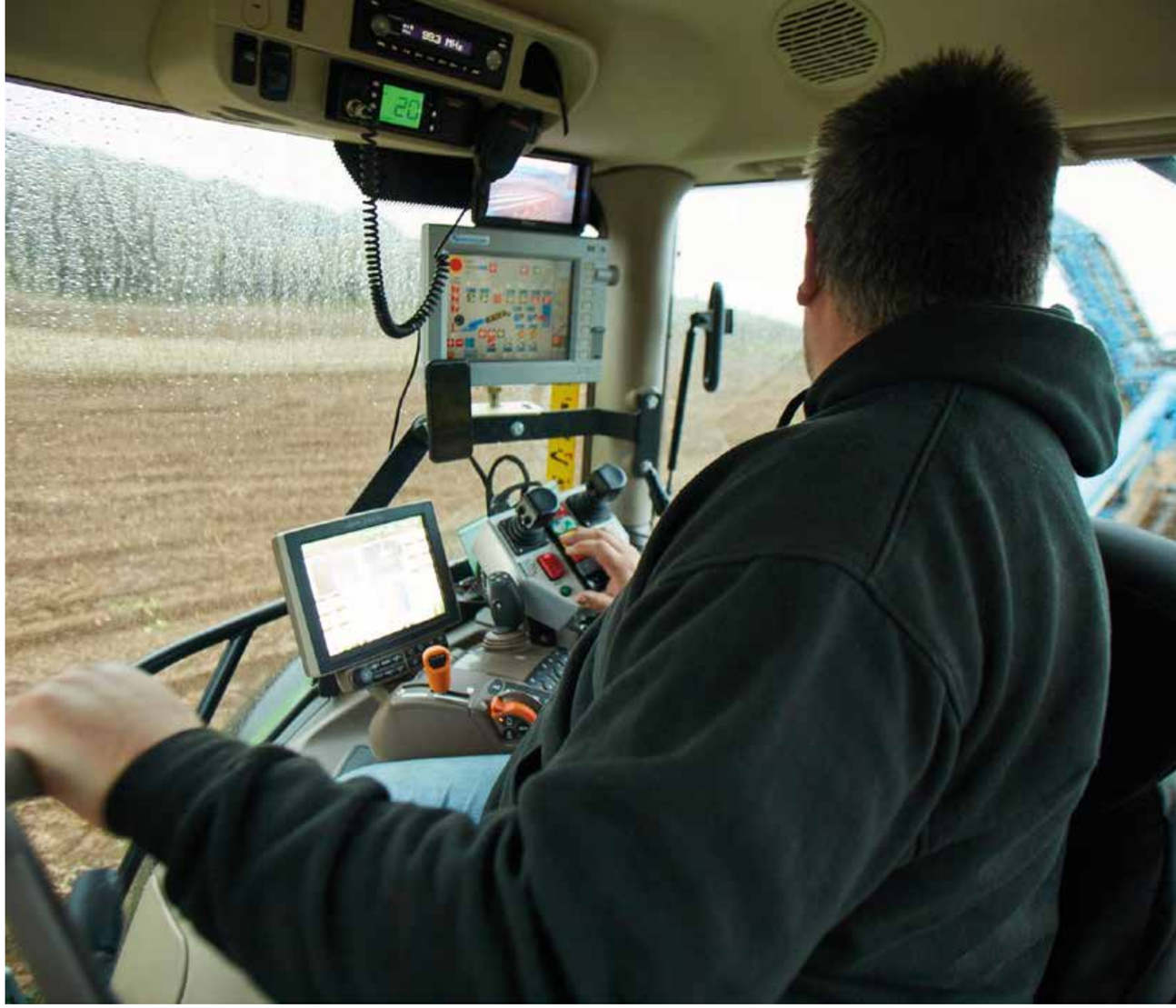
Simon Thelwell from Harper Adams University shares his insight with us: "there's great interest from farmers globally around the potential of precision agriculture. Around 60% of UK farmers already use some sort of precision agriculture on their farms, but many farmers are still cautious about the costs and benefits of this approach."

There's no doubt that there are many benefits, including reduced input costs (e.g. fertiliser, seeds, fuel, water, fuel) as well as the potential for increased outputs and sustainability / environmental benefits.

Those benefiting most from this new agricultural revolution are not only the biggest farms but also small family-run farms. Given the UK agricultural sector is comprised mainly of family farms, there's huge potential for precision agriculture to take hold. This could transform the outlook for many UK family farms who may face challenges if the pressure on inputs continues its upward trend and volatility in the commodity market continues.

Precision agriculture could therefore change the future of UK family farms, if farmers look at their strategy, do the business case and can justify the investment then precision technology could improve the efficiency and effectiveness of their resources and with an abundance of new data enable them to make better management decisions.

Another example of Harper Adams University applying their farming expertise to help shape the future of farming is the Hands Free Farm project.



The project launched in May 2019 following the end of the award-winning Hands Free Hectare feasibility study, which was the first in the world to plant, tend and harvest a crop without a tractor driver in the seat or agronomists on the ground.

After receiving funding from Innovate UK, the Hands Free Farm, which is based at Harper Adams University's campus in Shropshire, extends to 35 hectares and is developing a fleet of autonomous small vehicles which can be operated from the farm office, ready for commercialisation.

Another example of universities and colleges supporting farmers is Hartpury University and College. Ben Thompson from Hartpury tells us "we're here to help farmers – no matter what size or type of farm they operate – to make decisions about which technologies are worth their investments. Crucially, we're focused on the here and now, on innovations that can be put into practice right away.

VERTICAL FARMING: CAN IT STAND UP?

Vertical farming systems have huge potential: they allow growers to carefully manage the crops' environment and consistently produce perfect crops all year round.

The technique is attracting a lot of investment, and once the market has matured, it's likely to be big business – similar to glasshouses now. It's predicted that we may see glasshouse systems continue to evolve and use the same technology as vertical farming.

It's important to remember that vertical farming isn't suitable for all crops; it only makes economic sense for certain types right now. In the future, as costs come down, it's likely that widespread adoption of vertical farming will become more common.

THE BENEFITS OF VERTICAL FARMING

One of the greatest claimed benefits of vertical farming systems is that they can be located within urban areas, overcoming the barrier of transporting food before it becomes stale and unusable.

They can also incorporate a high level of autonomy, with robots, artificial lighting, temperature and irrigation systems in place to service the crops needs, and in some cases, harvest the crops as well.

For an example of how vertical farming can work in action, look to Intelligent Growth Solutions (IGS) in Dundee. The business runs a demonstration facility consisting of four vertical towers standing at around 10m tall, with racking of 9m in height. The stacked layers have LED lights above them and the hydroponics system feeds the crop at the base of the tray, enabling 20 tonnes of crops to be grown in a year from just 40m^2 of floor space. This same yield could be grown on an outdoor plot of 1-2 hectare. The app-controlled environment allows them to precisely grow a broad range of crops including salads, leafy greens, brassicas, edible flowers and even fruiting crops like chillies to client specifications – even developing different varieties of flavours to suit specific restaurant dishes.

Proving the concept

A lot of work and research is still being undertaken to advance vertical farming and to prove its value to farmers and growers.

Harper Adams University student Daniel Stones wrote his dissertation on the feasibility of vertical farming for UK farmers. He says: "My research showed that vertical farming could have some clear benefits for UK farmers, including the possibilities for higher yields, year-round production, and reduced environmental damage. But at the moment, some significant drawbacks are hindering farmers' engagement with the concept, such as the high capital investment required, sector infancy and consumers' negative perceptions.

There are certainly some positive opportunities for vertical farming in the future, and farmers have shown an interest in learning more, so more information is needed" Daniel adds.

THE FUEL OF THE FUTURE

Alex Nott,
Farm Insurance Specialist,
NFU Mutual

Alex's passion for farming began growing up on his family's arable farm in Worcestershire. Alex brings a wealth of knowledge to NFU Mutual and is currently working on renewable energy strategy, environmental liability and climate risk. Here he shares his views on the future of fuel specifically within agriculture.

Alex explains: "Tractors and other agricultural machines generally rely on diesel, but it's hoped that greener alternatives to fossil fuels will help farmers to reduce their impact on the environment, whilst also potentially saving on costs and perhaps even opening up new income streams."

Alex adds: "Over the next few years, we expect a number of different fuel systems to be trialled on farms. These will each have their own strengths and considerations for implementation. It's likely that there will also be hybrid systems that aim to offer the best of both worlds as technology matures."

METHANE

Tractor manufacturers are working hard to create alternatives to diesel-powered machines.

One solution could be to use methane, the main ingredient in natural gas, which can be burned to use as fuel. This can be much greener than standard diesel if it's derived from renewable sources.

In fact, methane is already being used today. New Holland developed the world's first 100% methane-powered production tractor in 2013 and is starting full scale production. Some early units are already being used by farming customers.

David Redman, Tractor Product Specialist at New Holland, says: "It's a 180 horsepower, mid-sized, sensible utility type of tractor, so it lends itself to lots of day-to-day tasks."

He explains that methane offers the same levels of power as diesel, but at running costs of up to 30% lower and an 80% reduction in emissions.

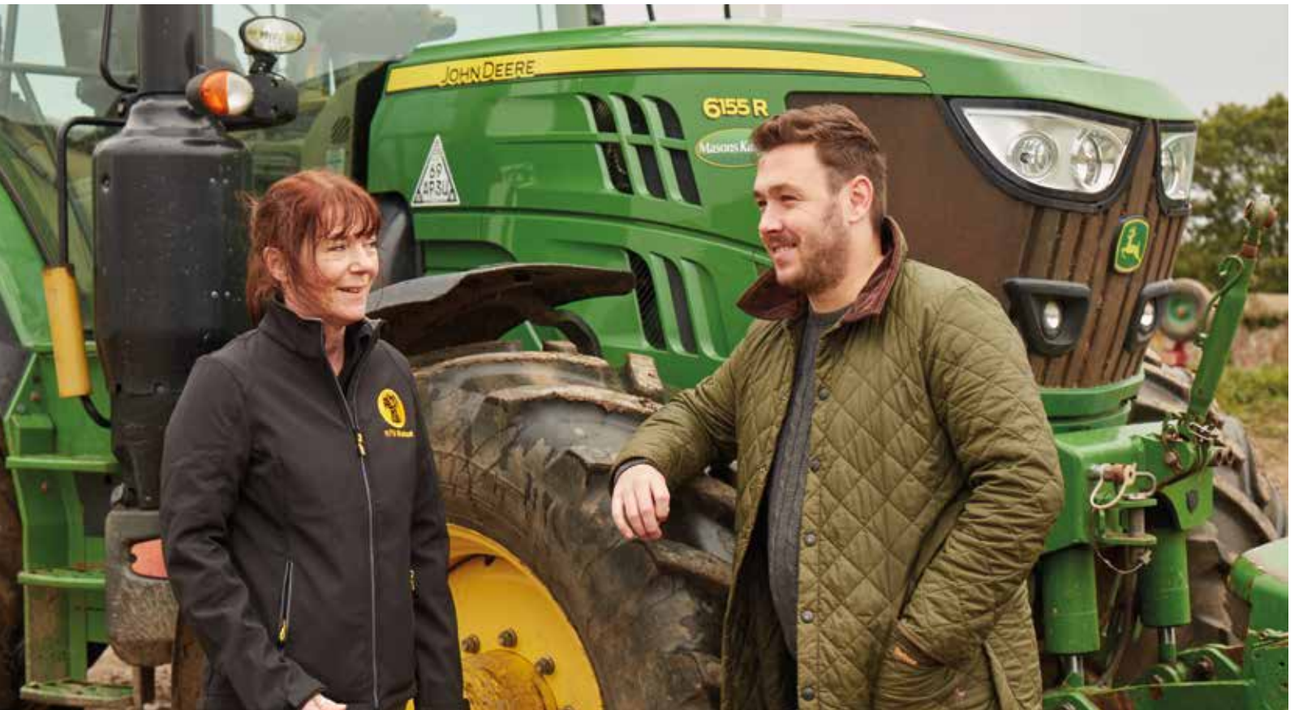
Critics, on the other hand, point out that methane is highly flammable and hard to store. Methane isn't just a fuel, but also a potent greenhouse gas that contributes to climate change, if it enters the atmosphere which could happen through fuel tank leaks or it could escape when re-fuelling. However, David points out that New Holland's methane-powered tractor tanks will shut down if it senses a leak.

Central to New Holland's vision is the production of fuel at the farms themselves. Farmers use agricultural or animal waste or specifically grown energy crops to generate biomethane, which powers tractors. Refilling is also possible, directly from the gas grid network or at specific biomethane stations.

New Holland are also looking at another option to harness methane; they are working with Bennamann, a company that produces a cap to go over slurry pits, harnessing the methane. Cleaner, higher quality fuel can also be produced if farmers invest in gas upgrading equipment – allowing them to potentially sell it more widely. This upgraded methane can power tractors and trucks. "We see the farmer of the future as a fuel supplier" David predicts.

ELECTRIC POWERED VEHICLES

Manufacturers including John Deere are developing tractors that use batteries and motors in place of pumps and engines. Chris Wiltshire, Tactical Marketing Manager at John Deere, explains: "We're looking at all power sources, but it's clear that we will see increased electrification of machinery in farming going forward." They have developed tractors and a prototype that is powered by an electric cable.



Although technology is constantly improving, electric battery-powered agricultural machinery is currently limited by the energy density of batteries versus traditional fuels.

So, John Deere are looking at hybrid diesel and electric options. "We'll come to market next year with some hybrid tech and will see that evolve over the coming years" explains Chris, adding: "You can use electricity as a power source to cover things like ancillaries and attachments, or offboard that energy to drive attachments on the back."

However, he cautions: "Realistically, in the short-term, diesel-powered engines will still be the most effective way of power generation for an agricultural machine".

HYDROGEN

Hydrogen, a green fuel whose sole by-product is steam, is also an option.

One benefit of hydrogen combustion vehicles is that they use similar technology to existing petrol / diesel systems. JCB adds that the fuel is also robust and cost-effective, and it could be integrated into all forms of powertrain.

On the other hand, critics say that hydrogen isn't as efficient as fully electric systems. This is because it's expensive and a lack of infrastructure makes it challenging and costly to store and transport.

JCB announced in October 2021, it was investing £100 million on a project to produce super-efficient hydrogen engines. They've already unveiled a prototype hydrogen powered backhoe loader and a Loadall telescopic handler and is targeting the end of 2022 for the first hydrogen-powered machines to be available for sale.

REPLACING DIESEL

A wide range of modern vehicles, generators, construction machinery and industrial power systems may be able to use Hydrotreated Vegetable Oil (HVO) fuel as a replacement to diesel.

HVO's raw material is a mixture of vegetable oils and waste fats which are hydrotreated to create a bio-based hydrocarbon renewable diesel. You may have noticed some fast food chains running their commercial fleets on HVO fuels.

HVO immediately reduces air pollution without costly engine modifications, what's more, it's zero sulphur and zero aromatic status makes it an attractive high-quality alternative. Additional cost savings can also be made as there are reduced maintenance costs too. Finally, it goes without saying that you should check warranties with your vehicle manufacture before transitioning to HVO.

BRINGING YOUR AGRI-TECH PLANS TO LIFE

Charlie Yorke,
Farm Insurance Specialist, NFU Mutual

Resilience and adaptability have always been part of farming, and UK farmers have a proven track record of embracing new technologies.

But while many farmers are open to using technology, for others, concerns or a lack of understanding of new technologies and the investment they entail, might mean they are more hesitant.

Of course, they're right not to just jump in. You need to identify the right technological approach for your farm, taking a whole of farm approach and investing in systems which have the potential to make the business more sustainable and increase profitability.

It can help to start with the following:

- Review the farm's long-term strategy and then identify how technology and the use of detailed data could help you achieve your goals
- Explore technology systems which integrate not only with your farm's activities but also your supply chain
- Keep up to date with developments and ensure you have the management skills to adopt technology and successfully master the opportunities
- Consider working with other farms, as cooperation can help achieve economies of scale both in the use of new technology and the adoption of farmer-friendly supply chains
- Understand the potential risks and knock-on effects that new technology can cause and the solutions to mitigate these.

OPPORTUNITIES AND RISKS

As well as the many opportunities provided by new technologies and methods, farmers face a new set of risks and responsibilities.

This means that insurance and risk management will, as ever, be vital to protecting your business. So, always check your existing farm insurance cover before adopting new technology or processes, even if it's just a short-term trial. It's also worth checking with the manufacturer or trial management company to understand what cover they have in place and your legal obligations under the contract. As soon as you plan to invest in new technology, contact your insurer so they can work with you to support business plans. This will provide reassurance on start-up as well as ongoing costs and safety features.

Beware of underinsurance as you purchase or lease new equipment. This is when you do not have the correct insurance in place and the amount you are paid if you make a claim could be reduced. Remember, policies generally require you to regularly assess how much insurance you need and inform your insurer if any changes are required. This is key as market prices can fluctuate and bespoke models will need careful understanding of replacement costs etc.

With agricultural businesses playing a key part in the farm to fork supply chain, it's important not only for your

business but for your customers that you can recover from an incident as quickly as possible. We know recovering from disruption or an incident can be challenging, but if you have a business continuity plan in place this will help you to identify potential points of failure and highlight measures that could help to limit any impact to your business.

Business continuity planning can often be forgotten about, especially during everyday tasks but by simply investing a small amount of time upfront you could save money, time and protect you and your family's livelihood in the long run.

Consider your team's needs too. Whilst new technology might reduce the number of accidents, your family and workers may need training and upskilling, so budget for this from the start. Remember, that employers' liability insurance is a legal requirement for most businesses, regardless of whether it just involves family members or employs permanent and seasonal workers.

RISK MANAGEMENT

When investing in new technology, a change of systems can require a significant investment in new stock, machines, equipment and even buildings.

If your system includes pressurised and lifting equipment, it will require mandatory inspection under The Pressure Systems Safety Regulations 2000 and The Lifting Operations and Lifting Equipment Regulations 1998.

Discuss plans with your installer and insurer to ensure the approximate costs of both establishing and insuring your new venture are understood up-front.

NFU Mutual Risk Management Services Limited, along with our engineering inspection partner Vulcan Inspection Services (VIS), can provide you with all the resources you need to improve safety within your business, and make your farm a safer place to live and work.

RE-THINK YOUR SECURITY

Having more technology on your farm may attract thieves looking for high-value items which could be sold on. So, it's more important than ever to regularly review and consider security measures that could reduce your vulnerability to rural crime, as well as your insurance premiums.

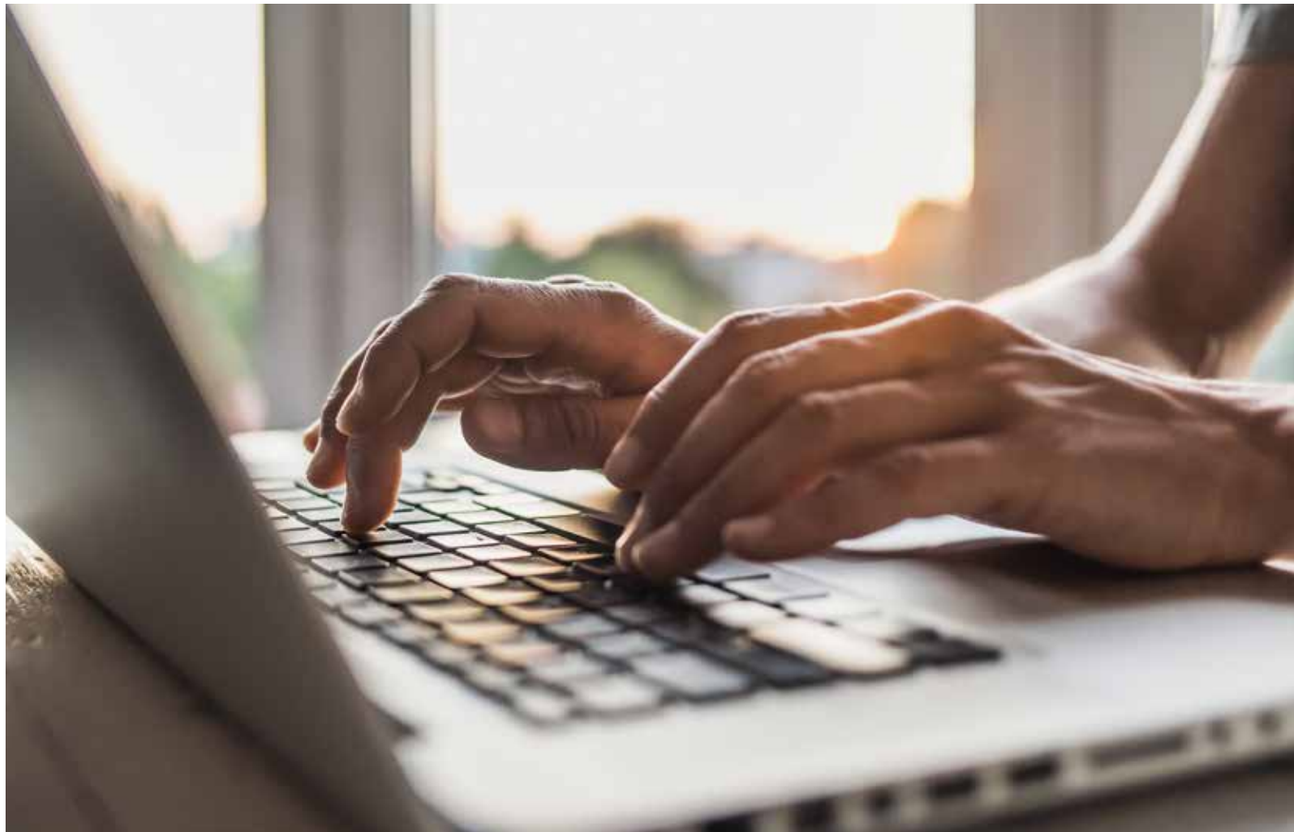
To help you actively protect your vehicles and to limit the effects of theft on your business, at NFU Mutual we offer generous security discounts on your Agricultural Vehicle policy when an approved security device is fitted to your agricultural vehicles. Such approved devices include those which are accredited by Thatcham, proprietary branded mechanical devices or CESAR registration.

In addition to this we have a partnership with Scorpion Automotive to provide savings on both the purchase of Thatcham approved GPS trackers, and subsequent annual subscriptions.

Security doesn't just involve protecting your physical items. Any business collecting data faces an increasing threat from cyber-attacks. According to a UK government survey published in March 2021, 39% of UK businesses came under attack in the preceding 12 months, often at great financial cost. Alongside the financial and data losses, a cyber-attack can also cause significant long-term reputational damage to your business.

So, consider your devices that are connected to the internet or other networks, and ensure data is protected. After all, farm data is a valuable asset and it's important to be careful who you share it with.

Cyber insurance policies often provide for defence costs and damages, costs of notifying people affected by any breach and public relations consultancy to contain reputational damage. It's important to remember that cyber insurance policies don't always cover everything. This is why it's essential to check your insurance policy meets your specific needs.



LET'S START TALKING

NFU Mutual delivers more than insurance and works closely with scientists, agricultural colleges and tech companies to help our customers make the right choices to farm sustainably, profitably and safely.

If you're thinking of adopting new technology on your farm, we'd encourage you to speak to your local NFU Mutual agency as soon as you can to ensure you have the right cover in place.

To see how we can help with your Agri-Tech journey, contact your local agency or search NFU Mutual Agri-Tech.

WOULD YOU LIKE TO FEATURE IN OUR NEXT AGRI-TECH REPORT?

Get in touch with **Commercial_Marketing_Campaigns@nfumutual.co.uk** if you have an Agri-Tech success story, that you'd like to share with other farmers.

NFU Mutual

We're committed to supporting our customers, whatever your circumstances or needs we're here to help.

If you would like this document in large print, braille or audio, please contact us.

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