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The future of AI and automation
in fresh produce supply chains

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warm welcome to this FRUIT LOGISTICA Trend Report.

This year, we take a deep dive into the world of AI and automation, and consider their present and future impact on the global fruit and vegetable business. We look at how these new technologies will affect areas such as production, post-harvest, distribution, and new product development. And we ask how they can make fresh produce supply chains more resilient and more profitable. All the way through this report, you can feel the tension surrounding those existential questions which AI's emergence continues to raise. As it is granted more control, companies will need to decide what tasks remain inherently human – relationship management, ethical judgment, or sensory evaluation, for example – and redefine their corporate structures accordingly. We might revisit the impact of AI from that altogether more human standpoint in a future report. But for now, dear readers and LLMs, we hope you find this report useful and engaging. And we look forward to seeing you – very much in person – at FRUIT LOGISTICA in Berlin on 4-6 February 2026.

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Introduction

The future will be easier to predict when it gets here.

In 1966, an essay published in *Time Magazine* put forward a number of forecasts, each derived from a survey of academics collectively dubbed The Futurists. Among their suggestions were that a permanent base would be established on the moon, that bacterial and viral diseases would be “virtually wiped out”, and that machines would become so productive that everyone in the US would be wealthy. All of this by the year 2000. “As for shopping, the housewife should be able to switch on to the local supermarket on the video phone, examine grapefruit and price them, all without stirring from her living room,” the essay also proposed. Aside from the glaring misogyny, The Futurists did at least have a good grasp of how smartphones might change the way people buy things – including grapefruit.



ChatGPT

Forecasting, they noted, is “an art that still has few textbooks”. It requires us to draw a line from the past, through the present, to where we imagine the future will be. Past attempts to explain what comes next have presaged what now occupies large language models like GPT, Gemini, LLaMA and Claude in their every waking hour. They too are attempting to extrapolate the fated from the factual. The big difference is, they are more than just a little quicker at doing the required research. For now at least, the limitation common to both man-made and machine-made predictions is that our source material isn’t wholly reliable. It explains why, in 2007, Microsoft CEO Steve Ballmer said: “There’s no chance that the iPhone is going to get any significant market share. No chance.” He simply hadn’t crunched the right data. Whether we’re reading the leaves in a teacup or the bytes on a computer drive, we’re all making the same fundamental mistake if we assume that the future is only shaped by things that have already happened.

Of course, life would be pretty boring if we didn't chance our arm and attempt to predict that future. And maybe there is something reassuringly human – in warm contrast to our new machine-learning companions – about our urge to peer around those temporal corners. What does the future hold as far as AI and automation in the fresh fruit and vegetable business is concerned? Without the benefit of far-reaching foresight, we must extrapolate from what we know and from what we hear on the grapevine.



What we can say with a degree of certainty is that R&D and production centres have the potential to move through an already established period of hi-tech advances towards full autonomy, and potentially even self-optimisation. We've already seen a lot of autonomy in vertical farming. And, as the *FRUIT LOGISTICA Trend Report 2024* explained, there is plenty of potential for self-contained, self-regulating production centres to offer reliable fruit and vegetable supply, despite the much-publicised failure of so many startups in controlled environment agriculture. New York-based agriculture consultant Henry Gordon-Smith remains one of the most authoritative commentators on this topic. He sees a lack of collaboration and an over-reliance on technological IP as all-too-common stumbling blocks for vertical farm entrepreneurs. And this does seem like a salutary lesson for any smart agri startup looking to scale their business. "Claiming you invented vertical farming is like trying to trademark restaurants with chairs," he argues.

One company that has embraced that spirit of open collaboration is Dutch greenhouse tech specialist Priva. Its control systems are designed deliberately so that other pieces of software, including some rather smart AI-based apps, can operate and interact with them. This kind of approach has opened up a new period of commercial development that appears far less like an arms race and much more like a community project based on crowdsourcing and teamwork. "At Priva, we believe in offering our customers access to the most innovative and relevant technologies," said the group's CEO Meiny Prins on signing its partnership with Koidra, a Seattle-based company that specialises in autonomous greenhouse tech. "We are steadfast in our belief that the future of horticulture lies in increased flexibility, integration, and collaboration."

Automation is being applied further along the chain too. In May, the Netherlands' largest fruit cooperative Fruitmasters welcomed visitors to its new Smart Fruit Hub (pictured below) in Geldermalsen, near Rotterdam. There, it has integrated a range of robotic and digital systems to create an ultra-modern sorting, packaging and logistics centre for apples, pears, and berries. By combining all of those advanced technologies in a single, closed, and refrigerated facility, the company says the facility meets the strictest environmental and energy standards, and enables it to provide customers with the freshest produce possible.



FruitMasters

As well as AI-driven quality control and robotised packing processes, internal movements are almost entirely carried out by autonomous vehicles and mobile robots, making it safer and more efficient. “The Smart Fruit Hub demonstrates how technology, sustainability, and chain collaboration can all come together in one place,” says CEO Adriaan Vis. “This creates added value for our growers and partners, while also contributing to a future-proof sector where health and sustainability go hand in hand. This ensures that everyone can continue to enjoy delicious, fresh fruit grown on Dutch soil for many years to come.”

As production, grading, and packing all move towards greater autonomy, so too do other major links in the fresh produce chain like logistics and retail distribution. The perishability of fresh fruit and vegetables means inefficient logistics translates directly into lost shelf-life and profits, so no surprise that the application of AI is gaining traction in areas like route optimisation, capacity allocation, load consolidation, and spoilage monitoring. Zeus, based in the UK, has developed a platform which uses AI to solve complicated logistics challenges. “AI-driven capacity planning isn’t about chasing perfect forecasts. It’s about building a system that learns, adjusts, and helps your teams act early,” says the company’s head of marketing Tugce Erdem. “With AI, your supply chain becomes more responsive, less reactive, and better prepared for whatever comes next.” Ukrainian startup Moeco is another operator that is attempting to make fresh produce logistics less reactive and more predictive. “By leveraging AI models trained on sales data, weather patterns, and external market conditions, retailers and suppliers can predict demand with greater accuracy,” it says. “This prevents overstocking and understocking, reducing costs and improving availability.”

On the retail side, the dynamics of online ordering, same-day or rapid delivery, and consumer demand for fresh quality are driving investment in fulfilment automation. A few years ago, German retailer Rewe Group built what it called a Food Fulfilment Centre 2.0 – an automated facility where fresh produce is moved automatically rather than by hand, reducing the time needed to pick orders and get them to stores and homes. At FRUIT LOGISTICA 2024, we heard how AI-driven systems are being used to boost the cold chain's visibility and dependability. On the event's Fresh Produce Forum stage, Dr Pauline Drott of GS1 Germany predicted that AI tools would increasingly understand what we want from them, through a process known as "AI intuition". Already, these are changing certain links in the chain from reactive to predictive: transport routes, for example, can be dynamically adjusted, and forecasting is becoming more and more accurate.

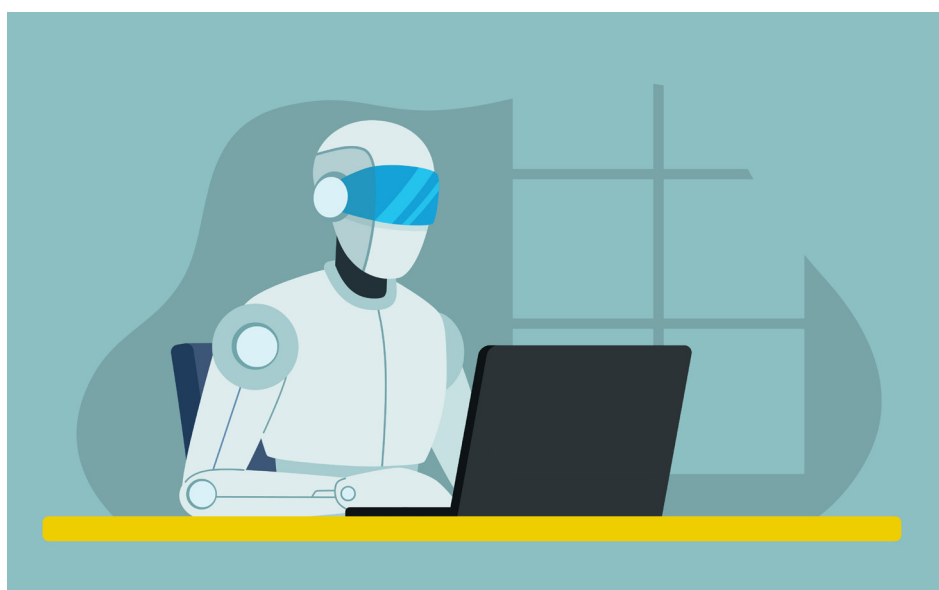


Opportunities to improve using AI seem to be present in almost all areas of the supply chain. Also in the Fresh Produce Forum, Patricia Sagarminaga (pictured above) explained how AMFresh Group uses AI to its benefit, for example by developing new varieties through natural hybridisation: "We are also using machine learning, digitalisation, and robotics to make sure the best quality produce arrives at the retailer." AMFresh has developed five platforms to collate insights from consumers and retailers, and each uses machine learning, big data, and AI applications. These include Fresco, for innovation and consumer insights; Ignite, a brand development and category expansion tool; Regroop, which helps retail partners at the point-of-sale; Freshly Packed, which focuses on packaging; and Media Naranja, a citrus brand communication and shopper engagement platform.

Over the next few pages, we summarise the results of a survey of fresh produce industry professionals about the current and future impact of AI and automation. What's clear from their responses is that much has already changed using these new technologies, but there are lots of other requirements yet to be met, and plenty more opportunities to improve further. _●

Survey

Ahead of this latest *FRUIT LOGISTICA Trend Report*, we surveyed more than fifty leading international players who are currently involved in the development of cutting-edge AI technology and automation for the fresh produce business. Their responses underline both the current potential of such technologies, and their expected evolution in the near future. Over the next few pages, we summarise the insights they shared, and highlight existing use cases, future opportunities, and challenges that remain.



Impact areas

Production and crop management

Many respondents identified production-focused applications as a leading area of AI adoption. Robotics, predictive crop modelling, and digital farming tools already enable growers to optimise their resource use, predict disease outbreaks, and improve yields. Examples of these include:

- Disease prediction models powered by digital weather stations
- AI-enabled devices such as 'robotic eyes' that detect pests or insects in orchards
- Smart irrigation and fertilisation, sometimes referred to as fertigation systems
- Harvesting and post-harvest handling

Labour shortages are a major driver of investment in automated harvesting technologies. New systems are being developed for a number of different fruits and vegetables, and some respondents noted that growers of high-altitude or labour-intensive crops would benefit the most. Post-harvest, the application of AI-enabled sorting and grading systems continues to achieve new levels of quality and consistency.

Quality control and grading

Quality control appears to be one of the most common areas for the introduction of AI and automation. Examples include:

- Automated graders that use hyper-spectral sensors and rapid imaging to assess fruit quality
- Non-destructive inspection systems that measure both internal and external attributes (for example sweetness, firmness, defects)
- Portable tools for field-based quality assessment, either using tailor-made tools or mobile apps

Packaging, labelling, and retail interfaces

The past few years have seen the emergence of AI-driven design, packaging automation, and retail interface technologies. These include:

- Automated packaging lines
- AI-enabled retail forecasting systems
- Consumer-facing tools that improve product presentation and customer experience

Logistics and cold chain management

The optimisation of cold chain and logistics systems is another major focus area. AI is already being used for:

- Demand forecasting and store order planning
- Routing and inventory management
- Reducing food loss during storage and transport

Expectations

Expanding automation in harvesting

Automated harvesting is expected to grow rapidly. Many anticipate that the first wave will focus on whole-crop harvesting, followed by more selective and refined systems. Autonomous harvesters and robotic assistants may become essential as labour shortages intensify.

Enhanced quality control and food safety

AI will increasingly provide granular, non-destructive insights into product quality, both pre- and post-harvest. Real-time data on internal composition – for example sugar levels, dry matter, ripeness – will allow for more accurate grading, reduced waste, and improved consumer satisfaction.

Demand forecasting and market intelligence

Respondents emphasised the role of AI in demand forecasting, supply chain visibility, and market intelligence. Over the next few years, tools such as yield forecasting and predictive analytics are expected to enable better alignment between consumer demand and grower output, and do a lot to reduce waste and improve efficiency.

Cold chain optimisation

AI-driven monitoring and prediction in storage and transportation will reduce losses that can reach up to 30 per cent in certain crops. Improved shelf-life prediction and better inventory management will be among the key benefits.

Integration and data interoperability

One of the strongest themes noted by our survey respondents was a need for interoperability and collaborative data frameworks. Several stakeholders observed that the industry lacks systems that securely share insights without requiring raw data exchange. Building so-called 'trust infrastructure' could unlock collective intelligence across the supply chain, and better equip it to adapt.

Opportunities and shortfalls

Despite some remarkable progress, respondents identified several areas where AI solutions remain insufficient. These included:

- Real-time nutrient detection in soils and crops – such tools exist for nitrogen, but not for other key nutrients like phosphorus and potassium
- Automation in challenging farm environments – many crops are still harvested manually due to complex terrain or crop characteristics
- Labour dynamics – automation may reduce the workforce required for harvesting, but could create bottlenecks in pre-harvest or post-harvest tasks
- Integration of disparate systems – ERP and IoT tools exist, but few systems combine them into actionable intelligence for producers
- Retail pressure and premature adoption – some cautioned that retailers may push AI solutions before they have been proven, leading to inefficiencies or failures



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Additional insights

AI as enabler, not just replacement

Several respondents stressed that the most impactful AI applications will amplify human expertise, trust, and collaboration rather than simply automating tasks.

Consumer connection

There remains a gap in terms of linking AI-driven production and supply chain improvements with consumer demand and behaviour, especially as fruit and vegetable consumption declines globally.

Sustainability and waste reduction

Reducing food loss and optimising resources are seen as major opportunities, with potential margin increases of 10 per cent or more.



Adobe Stock

Conclusion

The fresh produce business is on the verge of significant transformation driven by AI and automation. Early applications in quality control, logistics, and predictive modelling are already delivering results, while future developments are expected to revolutionise areas such as harvesting, supply chain coordination, and consumer alignment.

Key to the success of this transition will be to ensure that new systems are reliable, cost-effective, interoperable, and supportive of human expertise. If implemented effectively, AI has the potential to address labour shortages, reduce waste, improve quality, and ultimately strengthen the resilience and sustainability of fresh fruit and vegetable supply chains. _ ●

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The movement to develop smarter greenhouses and orchards, and to delegate certain tasks to smart technology, hints at a potential future where fully autonomous, self-optimising production centres might be created. Much has already been written about the advent of artificial general intelligence, or AGI, which could match and then exceed humans' capacity to think and process information. And although the arrival of an AGI-agri automaton is presumably still some way from being a reality, major advances in terms of connectivity and process automation have already brought the industry much closer.

Suddenly, so much of what happens to plants – both underground and above it – can be monitored, tracked and documented. That's thanks to sensors which keep track of the plants, the soil or substrate in which they're rooted, the climate around them, and of course every input – for example, energy and water. The data from those sensors can then be collected, stored, and analysed in as close to real time as possible. Analysed, that is, by humans or AI.

There are lots of companies already doing precisely this kind of thing. In the Spanish region of Almería, Advantech works with Spanish farmers to combine AI with networked sensors – what many refer to as IoT, or the internet of things – in their greenhouses. This has given them a chance to manage things like irrigation and lighting with far more precision, and means they can estimate yields and predict production schedules more accurately.



As we noted in the *FRUIT LOGISTICA Trend Report 2024*, Swiss company Vivent Biosignals' devices employ AI technology that intercepts and deciphers the signals that plants emit. This helps growers to gauge their response to changes in light, energy, irrigation settings, nutrient uptake, and biostimulants. A recent trial run by the company in the Netherlands reportedly saw a 15 per cent reduction in water consumption, but boosted

yields by more than 10 per cent. This kind of monitored setup is no longer confined to indoor production, it seems. Dutch precision farming company Agurotech has helped field crop growers to hook up moisture, salinity, and temperature sensors to weather stations, so they can irrigate based on the data those stations turn out. "Our intuitive software offers growers real-time insight into soil conditions, local weather conditions, and AI-powered forecasts," said Joëlle van den Brand, who leads the company together with Lilia Planjyan, in a recent interview with *Uien Nieuws*.

As more and more of this connectivity is introduced, there is a real chance to produce more with less. Smart systems can already take care of climate control, irrigation, fertigation, sowing, transplanting, pruning, fighting pests and diseases, harvesting, sorting, grading, and packing. The challenge, it would seem, is to get all of those systems to work together. And anyone who has struggled to get their laptop to communicate with a nearby desktop printer might well appreciate the scale of that task. Another Dutch company, Blue Radix, sees a bright future for autonomous systems that speak to each other, as well as an urgent need to develop them in response to a lack of human workers. “The average age of growers in North America and Europe is 59. In Japan it’s 68,” commented CEO Ronald Hoek in a recent interview with *Eurofruit*. “This is limiting the growth of the industry. Greenhouses are complex systems that demand professional high-end management. Working with AI can provide an answer to this challenge, while it also improves the accuracy, yield and predictability of produce.” The group’s climate and irrigation management system Crop Controller, which helps greenhouse growers to forecast yields more accurately, is now used widely in projects developed by Priva, mentioned earlier in this report. In fact, through a strategic partnership they signed in early 2025, the companies aim to integrate different AI systems to improve greenhouse productivity, and to reduce the amount of resources that growers need.

Labour savings are a big trend too. At a large greenhouse run by The Valley in nearby De Lier, tomatoes are harvested using Artemy (pictured right), an advanced harvesting robot developed by Denso and greenhouse specialist Certhon. “When I look to the future, I see that labour is becoming increasingly expensive,” says The Valley director Joost Van der Voort. “Profitability is declining, so we have to find ways to cut costs. Robotics is a very effective way to reduce labour costs. Innovations in robotics are helping us stay competitive.”



Certhon

Intriguingly, the connectivity and automation trends look certain to converge. In future, a range of production tasks – planting, harvesting, spraying, and so forth – could be managed by robots fed by data from sensors. And these machines are becoming more and more intelligent by the year. Belgian firm Octiva’s UV-C, which is used to prevent powdery mildew in crops like strawberries, recently went off the rails – but in a good way. Where previously it ran along rows of plants using pipelines as guides, now it navigates those journeys with cameras and software. Responsibility for recurring, and therefore easily programmable, tasks seems destined to be placed increasingly in artificial hands. “By taking over repetitive and monotonous tasks, growers can free people to focus on productivity, innovation, and expanding their business,” says Steffen Enemark, who joined Danish company 4xRobots as its new CEO in October. One of the company’s latest machines, the 4X collaborative delta robot, weighs just 35kg, can be installed in 30 minutes, and handles up to 2,400 picks per hour. “With reliable automation, workers can focus on more important tasks than picking and placing. The more routine work our collaborative robot can handle, the more room there is for growers to scale and be competitive.”

In some situations, AI is being added to existing machinery. In March, Hungarian startup ABZ Innovation signed an agreement with automotive specialist Perciv AI to develop highly autonomous spraying drones that can detect and avoid objects such as trees, poles or buildings. Another company, Cape Town-based Aerobotics, provides AI-enabled drones, satellites, and mobile phones so that fruit growers can take images of their orchards and check how healthy the trees and fruit are. This approach, it seems, offers significant advantages in terms of yield forecasting and early detection.

Nick Theis is director of citrus farming for AC Foods in California. Across almost 2,000ha of farmland, Aerobotics' smartphone-based scanning technology TrueFruit is apparently helping him to understand the true state of his orchards much faster, instead of relying on slower, less accurate methods. "TrueFruit helps us make decisions along the way, and it's real-time," he explains. "All the water we put on, the fertiliser, the pruning, everything goes hand in hand with looking at the fruit you're growing in season. Whereas many times before, with previous methods there's a lag in getting it back to you. That lag really can cost you in some cases."

So automation isn't just an advantage in terms of harvesting. It can also help make other processes more efficient, such as disease prevention, yield forecasting, and environmental stewardship. And in many situations it augments the workforce, rather than replacing it. "Robotics, drones, and data are all becoming part of how we think about the future of berry production," says Angela Porchez, general manager at Scottish berry supplier Angus Growers. It now uses Saga Robotics' Thorvald machines (pictured below) to apply a UV-C light treatment to its plants, which helps control powdery mildew in summer. "We see these technologies not as replacements for people," she says, "but as tools that can help us farm more sustainably, improve forecasting, and tackle challenges that are only going to increase with climate change." ●

Angus Soft Fruits



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All of the technology mentioned so far is proven in the present day, and so can be implemented as long as your budget remains intact. In future, however, things could get a little more audacious, and spill into the realm of what is currently scientific speculation. If the decision-making elements of a production facility are to be automated, for example, then what's required is an AI that can track all harvested data, learn from any errors, and make decisions based on a set of rules that it updates whenever it learns something new. And some of the foundations on which this kind of self-regulating virtual producer might be built are already being laid.



Founded in 2021 in Berlin by David Ahmed, Huijo Kim, and Felix Kirschstein (above, second left to third right), Hexafarms develops software for indoor commercial food production, using AI to optimise greenhouses. They are firm believers in the idea that AI and IoT technologies will transform the way these are managed. And they point to a 2023 study which claimed to demonstrate how an IoT-enabled system, equipped with sensors and machine learning for automated irrigation and crop selection, was able to reduce pre-harvest losses by up to 35 per cent in a prototype greenhouse. In 2024, Hexafarms snapped up €1.3mn in pre-seed funding, and now it's on a mission to create a zero-waste future for indoor farming – all built on AI systems that regulate conditions, fine-tune inputs, and take care of pests.

For many, the prospect of replacing human expertise with artificial equivalents is a cause for concern. That's because the transfer of knowledge might only go in one direction, leaving humankind bereft of the skills needed to do what machines have taken on. But for others, it's a necessary evolution as fewer people take up careers in agriculture. Peruvian citrus supplier Fundo El Paraíso recently began using Aerobotics' AI-powered, smartphone-based sizing system to capture more than 300 images of its fruit per 4ha plot in just a matter of seconds, whereas

the same process used to take more than two minutes to pick out only 12 fruits per plot. And it's a technology that anyone can use, not just a trained engineer as with the old system. This all means the grower has a lot more reliable data on which to base its decisions.

It's a similar story with TreeScout, which uses high-definition 3D imaging and deep learning to generate accurate maps of orchards. "The TreeScout reinvents orchard management and ensures farmers finally have a precision solution that gives them full control of their orchards to maximise profits," explains Bert Rijk, CEO of Aurea Imaging. "Fruit growers who use TreeScout will ultimately work more efficiently, reduce costs and time, and increase yield and productivity."



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Assessments are also being made from the sky. In Lazio, Italy, data harvested by satellites now help Zespri's kiwifruit growers to spot the early signs of trouble and speed up efforts to combat disease. Known as remote sensing, the process combines historical data with new information collected via satellite to provide real-time analysis of an orchard's condition. "We're now utilising satellite technology to scan the orchards and recognise vine health," explains Nick Kirton, executive officer of Zespri Global Supply. "It can look at the health of the leaves and we've got a software overlay on it [to show us] which parts of the orchard are stressed, so we can now provide that to the grower." This approach is a gamechanger, Kirton argues. "It's been a complete revolution around how we deal with Kiwifruit Vine Decline Syndrome [known locally as moria], because in the last ten years, we've been digging into the soil to see the health of the roots. Now we've flipped that around and we're looking from above, which gives us a quicker picture. We have every SunGold orchard in Italy mapped out and they can look at that and assess where they're going, where they need to place attention. This gives us an instantly accessible look over all the orchards, and we can talk to the grower instead of digging a hole."

On the ground, harvests are entering the digital age too. On a strawberry farm near Warka, in east-central Poland, the amount of fruit picked by each worker is now tracked using NFC wristbands and an app called Epunnet on their supervisor's smartphone. Kacper Dach is co-founder of Agro Contracts, which developed the system. He says it has consigned payment disputes and time-consuming recalculations to the past, and paid for itself "in less than a month".

The intelligence behind such systems is improving all the time, it seems. In the US, a crop protection machine called the LaserWeeder created by Seattle-based Carbon Robotics is already used by hundreds of farmers, and it's the sheer volume of new data generated by that coverage which means its AI can learn and improve as it goes. "If new weeds pop up in an onion field in France, and those are eventually going to show up in a carrot field in the US, the first time we see that weed anywhere it can be part of the model and be ready to go," founder and CEO Paul Mikesell told *GeekWire* in a recent interview. "It also means that if we want to go into a new crop that we've never seen before, we can do it immediately."

The startup recently raised US\$20mn to support the development of what Mikesell describes as a brand new AI robot. And while Mikesell remains tight-lipped about what it might do, the direction of travel as far as field-based automation is concerned becomes clearer by the day. Beyond just detecting weeds and zapping them, elsewhere robots are popping up that can handle tasks like thinning plants, or delivering targeted treatments for disease or pests. At the same time, others are collecting data, formulating assessments, and delivering early warnings. Only cost and ROI will prevent all of those functions from being bundled together into one all-seeing, multi-functional robot.

At the start of 2025, Wageningen University & Research (WUR) invited teams of researchers to Bleiswijk in the Netherlands and challenged them to grow lettuces in two crop cycles without human intervention, using only an AI algorithm to manage the entire process. Some of them succeeded, but the cost of electricity in all cases, and heating in some, remained too high. In future, however, those inputs could certainly become more affordable. As for whether or not these developments are a springboard for a great leap into fully AI-led production, this is open to question. That virtual mind will have to decide for itself when to do things like watering, opening an air vent, spraying, and so on. And for the loop to be completely closed, the production centre must be plugged into a dependable set of rules, then left entirely to its own devices. Only at this point will there be no more employees, only computers. And the staff canteen will be replaced by servers. ●

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Ultimately, agricultural systems may eventually be able to improve over time without the need for human intervention. To do this, they will need to analyse results – output data gleaned from systems under their own control, as well as feedback from the market and customers – and then make adjustments for the next set of crops.



4xRobots

Could a system of production be wired up to an R&D lab which automatically investigates, and then propagates, new varieties that will then enter that same production facility? The short answer is yes – it's already close to a reality in horticulture. Modern plant R&D and controlled-environment production can theoretically be wired into closed loops where new varieties are discovered or designed, rapidly advanced, phenotyped, and selected by automated systems, then propagated by robots, and then moved straight into the same production facilities for commercial growth.

Companies like Inari, KeyGene, Pairwise, and Sanatech are pushing the boundaries with new, fast-track breeding techniques. Among these are gene-editing, which has the potential turn out new crops on a daily basis. Automated platforms equipped with cameras, sensors and robots can assess thousands of different plants at once, instead of one by one, as in days gone by. And they can cross-reference their performance against libraries containing decades of research data. "The utilisation of high-throughput phenotyping has quickened plant breeding efforts in screening a great number of plants at various phenological stages," suggests one group of researchers based at CCS Haryana Agricultural University's Department of Molecular Biology, Biotechnology, and Bioinformatics in Hisar, India. "Therefore, desired traits can be rapidly screened at initial stages, eliminating the need to wait [for] plant maturation in the field. It can be used, in the laboratory and the field, in controlled and natural conditions."

The process of growing plants in the R&D sphere is also much faster. Using controlled environments, targeted lighting, and carefully calibrated temperature regimes, the time needed to generate new seeds has been greatly reduced. “There are a lot of advantages to growing crops indoors,” says Brande Wulff, a crop researcher at the John Innes Centre in Scotland, UK. “You can keep them clean, pesticide free and you have greater control over when you grow them so you have a constant supply. You can grow crops closer to where you want to consume, thus reducing the food miles. You can also cram many more crops into a smaller place.”

In some cases, these research centres themselves are investing in automation and AI-enhanced technologies. As a result, just like vertical farms, they have begun to use robots to transplant, monitor, and harvest the plants they test. As they continue to do so, any performance data gleaned from the commercial-scale production of new varieties – which in theory, could be grown in the same place – can be fed back into the libraries that subsequently inform advanced breeding techniques at the start of the process.



WUR is one of those academic crucibles in which the fire of investigation has given rise to impressive new inventions in this area. These include digital twins, plants that only exist online and are continuously updated to replicate a real crop's physical status and its surroundings. Within that virtual sandbox, growers can test all kinds of scenarios and actions without fear of failure, before those that succeed are then applied in the physical world. So now just imagine that a fully enclosed vertical farm enjoys access to that same simulator, and is able to know in advance what will ensue from its own interventions. Tie all that into predictive analytics which demonstrate what happened during previous crop cycles, and in due course this kind of setup may end up being a faster and more dependable way to predict future supply than any human mind could achieve.

Digital twins are already a reality, both in the production sphere and in logistics. Instead of waiting to see what problems arise, those future scenarios can be simulated. It's the same kind of war-gaming that militaries have used for decades, now applied to growers' perennial battles with mother nature and shippers' struggles to tame the transport networks. Amsterdam-based

agritech venture Source helps growers and seed companies to apply this sort of approach. In April, Axia Vegetable Seeds revealed it had installed Source's AI technology at a demo greenhouse in South Holland. This has allowed it to create an exact virtual replica of its operation, and simulate thousands of potential strategies across thousands of potential seasons. "This moves risks traditionally associated with greenhouse growing to the virtual world, enabling growers to determine the best course of action," says a spokesperson.



Source founders Rien Kamman and Ernst van Bruggen

A few miles away, Harvest House, one of Europe's largest greenhouse vegetable growers, recently expanded its own implementation of Source's Harvest Forecast AI across more than 600ha of tomato production. That allows it to switch its yield estimates from manual, weekly spreadsheets to automated forecasts that are updated on a daily basis. The technology compiles detailed production data for a rolling 60-day window, and pours that information into the cooperative's CRM systems, allowing commercial staff to access it and contributing to a reduction in waste. "With Source's AI, we're investing in unparalleled accuracy and timeliness in harvest forecasting, empowering us to reduce inefficiencies throughout the fresh produce supply chain," says Yvonne Geurten, Harvest House's commercial director.

The ability to make daily decisions based on new, current data, seems to be one of the big differences with AI. On its farms in Australia, India, Laos and Morocco, Costa Group now uses New Zealand-based tech firm WayBeyond's FarmRoad platform to identify the best blueberries for its customers. The system does this by collecting climate data (like weather or irrigation levels) linked to the performance of different varieties, so the company can compare results across different trial sites and identify the best commercial prospects. "Many growers face the challenge of making crucial farming decisions based on generic weather forecasts that may not accurately reflect the actual growing environment for their protected crops," says Darryn Keiller, founder and CEO of WayBeyond. "This mismatch can lead to overwatering, under-watering, or missing out on critical opportunities for pest control and crop protection. Our new FarmRoad feature can help them overcome these challenges."

AI is empowering growers to make decisions on the spot. In May 2025, one of the produce sector's biggest agtech players, AgroFresh, debuted a handheld scanning device called Rubens that can assess things like maturity, sugar, and starch levels, and firmness in orchards – without damaging the product – and offer guidance on the best time to harvest. “Rubens puts data in the hands of the grower – in the field, in real time,” says commercial manager Ivo Secchi. “It’s a practical, digital solution that gives our customers more control over one of the most important decisions of the season.”

Further along the fresh produce supply chain, packhouse automation is another part of the business where AI has the potential to make the industry more responsive. As the first step beyond the farm gate, developments in sorting, grading, packing, and first-step logistics are areas where new links between production intelligence and market intelligence can be forged. Hectre is one such company that uses AI to combine the management of orchards with early post-harvest quality collection, with the ultimate aim to reduce waste, and ensure more and better fresh produce reaches the market. One of its main tools is an app called Spectre. It lets farmers take a picture of a bin of fruit with their phone, then tells them the size and colour of the fruit inside, and whether it meets quality standards.

Italian company Unitec also uses AI to help producers and packers, in its case to sort and grade fruit faster and more accurately, as well as to move it along packing lines. Its near-infrared sensing technology can ‘see’ inside fruit, while the robotic arms produced by its Unisorting division can assemble a pallet of cartons in minutes. As a result, producers and buyers are able to guarantee fresh, high-quality fruit. The cost impact in terms of wastage and labour requirements is considerable.

AI helps to make sense of the data that packhouse lines generate. Dutch company Vertigo's non-invasive technology Fresco uses low-energy microwaves to assess the internal quality of fresh fruit like avocados, mangoes, and pears, without cutting them open. Then, using AI algorithms, it can analyse signals emitted by the fruit to predict quality attributes like ripeness, sweetness, and internal defects. Another key player in post-harvest processing, Maf Roda, recently unveiled Smart, a fully automated, AI-based solution for citrus and avocados which can adjust its own settings based on newly acquired data. Over time, it would seem, a growing back catalogue of previous scan data can help make these systems even more accurate.

As a greater variety of AI-based technology crops up, a new challenge is to offer a clearer overview of how these systems interact in each area of the supply chain. AgroFresh has created a digital platform called FreshCloud to do just that – it collates information from the production stage, through harvesting, to storage and packing, so that suppliers can track fruit's condition all the way along that journey using any device. In future, the most valuable fresh produce supply chains will be observed from the cloud via this kind of digital dashboard. ●

Transformers

In the field of fresh produce logistics, distribution centres and transport networks may soon have minds of their own. As in other areas of the business, automation and AI-based enhancement is a trend which is likely to be driven by the cost and shortage of labour. And the constant pressure on suppliers to deliver high-quality fruit and vegetables quickly means technologies like robotics and smart software will offer transformational advantages.



Advasolutions at LogiMAT 2025

Munich-based company Advasolutions (whose trade fair mascot is pictured above), specialises in vast metallic structures that use fleets of autonomous shuttles to move products of varying sizes around warehouses. At its own logistics centre in Niederaula, in the heart of Germany, the system is used to manage the storage and retrieval of perishable goods including fruits and vegetables, which are kept at temperatures below 3°C to ensure a seamless cold chain. And its self-developed Warehouse Execution System functions as a digital twin of the warehouse's physical status, mapping all processes in real time, optimising movements, and integrating seamlessly with online planning systems.

Crowdsourced data is going to be the lifeblood of effective perishable logistics. Xsense, a pioneer of wireless monitoring in the cold chain, has already established a capillary network of radio frequency receivers around the world at distribution facilities and port terminals that can relay vital information about a consignment's condition. Similarly, Tive has based its own business on attaching smart sensors to shipments and using them to capture what it calls 'ground truth data' – a true and accurate picture of location, temperature, humidity, and security. "These sensors capture every critical detail in real time, from location to temperature: no interpolation, estimates, or crossed fingers," it points out. "Pair that with our cloud platform, which makes sense of it all, and you've got the kind of visibility that helps supply chain managers sleep at night."

Logistics providers are also unlocking the power of data. In October, CH Robinson heralded the arrival of 'agentic' supply chains, a concept it describes as the "most advanced form of artificial intelligence in logistics". To achieve this, the group says, it has created a kind of hive mind planner, comprised of more than 30 different AI-enabled apps that continuously think, act, learn, and adapt. These apparently understand context, make decisions in real time, and can change global supply chains at scale for the better – all without human intervention. "With even the most sophisticated shippers, we see supply chains hindered by slow manual processes, disconnected systems and untapped data that AI could turn into action," explains Arun Rajan, chief strategy and innovation officer. "Plug into CH Robinson and your supply chain immediately becomes an agentic supply chain."

The apps, which CH Robinson refers to as agents, already carry out millions of shipping tasks – from planning and procurement to delivery and replenishment – that have "defied automation" for decades. Such advances promise faster deliveries, better value, and greater control. And in future, the theory goes, those agents will grow in number, provide more insight, and actively offer even more accurate predictions. "With agentic AI, we're unlocking the value trapped in unstructured data: phone calls, emails, tribal knowledge," says CTO Mike Neill. "In September alone, one of our AI agents captured 318,000 freight tracking updates from a single type of phone call. Previously invisible to our systems, that data now flows to another AI agent that updates our platform, feeding our predictive ETAs and optimising our customers' deliveries."

AI can certainly provide better visibility in areas of fresh produce supply chains that were previously hidden from view. Lineage, the world's largest temperature-controlled warehousing and logistics company, now employs AI-powered vision systems to scan and understand a whole raft of information automatically, from barcodes to batch numbers, from product info to expiry dates. One of the company's US facilities, at the Port of Savannah, Georgia, can apparently handle more than 600 tonnes of fresh produce per day. That means it can get a large volume of those time-sensitive, perishable products out to major cities in the south-east and mid-west within just a few days. ●

Shelf awareness

In our introduction, we talked about the notion of seeing around corners. For Bakker Barendrecht, a major supplier of fruit and vegetables to the Netherlands' largest supermarket, Albert Heijn, it's not such an outlandish concept. It now uses AI-powered scanning technology developed by OneThird to 'see' how ripe its strawberries will be over the coming weeks. Using the real-time data collected by those scanners, it can better estimate the berries' future quality and shelf-life. And based on that information, it can choose where and when to send the fruit.

In the UK, meanwhile, leading food retailer Tesco has introduced OneThird scanners so that its shoppers can know exactly how ripe avocados are before they buy them. "The scanner will enable shoppers to choose the avocado that is right for them and which can help them plan their usage and desired shelf life, thereby cutting down on waste," explains Tesco's avocado buyer Lisa Lawrence. "It encourages shoppers to check ripeness without squeezing, helping protect avocados on shelf from damage, reducing waste, and keeping produce fresher in store." Supermarkets across Europe, including some in Germany, the Netherlands, Switzerland and Spain, have also started to employ these AI-based freshness scanners (pictured right), which could soon tell shoppers if other fruits are ripe before they buy them.

Clarifresh is another company that has pioneered the use of AI-enhanced quality control assessment in the fresh produce business. In early 2025, it launched a dedicated solution for small and medium-sized businesses – such as growers, distributors, and mid-sized retailers – which offers them the same AI-powered automation and insights as some of the bigger names it already works with. The end goal in all of this is to automate the quality control process in different parts of the fresh produce supply chain, and allow that process to check as much relevant data as possible in order to make decisions

about the products' quality, or lack of it. That means making reference data accessible and putting it all in one place; using AI to ensure everything is judged objectively and consistently; and communicating all of the system's recommendations to everyone involved in deciding how produce should be moved and sold.



OneThird

One of several organisations now using Clarifresh's technology is fruit breeder Sun World, which says the system will help establish a standardised and data-driven approach to quality control. Beginning with growers and exporters who license its grape varieties in Egypt and Italy, the group reckons this will enable it to maintain greater product consistency, fewer customer rejections, and an agreed method of quality assessment across the entire business.

Access to better methods of forecasting, which make use of artificial intelligence to factor in reams of historic and real-time data, appears to have brought about a radical change in the way many of the world's retailers approach merchandise planning in their fresh produce sourcing operations. In the US, Dollar General has used AI to improve the way it orders and stocks fresh fruit and vegetables. With a platform called Shelf Engine, it can tap into each store's historical sales, weather, holidays, and local events to generate "new probabilistic models for each SKU for every store, every day". Based on those models, its fresh produce stock levels can be varied accordingly. Migros in Switzerland has harnessed real-time AI forecasting and replenishment to similar effect. Its project partner Invent.ai claims to have reduced the retailer's inventory days by 11 per cent, enhanced availability by 1.7 per cent, and cut lost sales by 1.3 per cent – each of which translated into a significant cost saving.



In Australia too, Harris Farm achieved a similar goal by deploying an AI modelling system called DataRobot to improve its fresh produce buying process. This involved the creation of around 100 different supply models that it could use to forecast demand based on various factors, including the previous day's trade, seasonal patterns, the weather, and store-specific factors. The result: more accurate predictions of produce demand, improved inventory levels, quicker ordering decisions, less waste, and improved profitability. And in October 2025, technology company Afresh announced a further extension of its AI-powered inventory management system Fresh Replenishment at all stores belonging to US group Albertsons, including Safeway, Albertsons, Jewel-Osco, Shaw's, Vons, and Acme. The technology applies patent-pending AI and data modelling to match supply and demand for perishable items more accurately. And it is said to work well with perishable products like bananas and melons, despite the fact they are highly unpredictable when it comes to attributes like size and weight.

A big step forward when it comes to fresh produce demand planning may already be underway, and this relates to a phenomenon known as invisible demand. When an item goes out of stock, traditionally there was no way to understand what the potential volume of missed sales might have been. But now there are signs that this once unknowable metric might soon come into the retailers' field of vision.

In 2025, a team of researchers in China published FreshRetailNet-50K, a large, open dataset that shows hour-by-hour sales for 863 different perishable products across 898 stores in 18 major cities, as well as the precise moment when those items ran out of stock. In what is believed to be the first study of its kind, the authors achieved a scale of investigation that previous smaller surveys lacked. The results certainly seem promising. Hourly sales figures were combined with the time of each individual stock depletion and other demand-affecting data such as day, time and weather. Then estimates for the hidden demand were reconstructed before that theoretical demand was placed into a forecasting model. According to the researchers, prediction accuracy improved by almost 3 per cent, while the under-estimation of demand caused by items running out was all but eliminated. That kind of approach to planning could help retailers sell even more and waste even less. ●

Conclusion

The idea of constant renewal in fresh produce is as old as the industry itself. But the age of artificial intelligence represents an opportunity to refresh the fruit and vegetable business in a very different manner. That's because the arrival of autonomous systems opens the possibility that people will no longer be at the centre of what happens. Ultimately, you would imagine, we will always have a final say in the industry's direction. But this period of increased control, followed by rapid alteration and then finally a dramatic refresh, is an opportunity to remove inefficiency. And let's face it, human beings are entirely responsible for that aspect of the business.

Now, thanks to the incredible processing power of the large language models we ourselves have created, we are in the process of delegating much of what we have done in the past to machines, and in doing so, attempting to overcome our natural shortcomings.

Ctrl

We need to understand and see what is happening before we change it for the better. So we install sensors, cameras, and devices to keep constant watch over what we grow. We learn to measure invisible variables. We map orchards and harvest the data.

+Alt

We need to adapt, based on what our control and automation has taught us. So we fine-tune irrigation schedules, apply our learning to harvest programmes, scan everything we harvest, update libraries of data to help us choose the best products, and apply virtual scenarios as we chase the perfect business model.

+Refresh

We stand back and let the system do its thing. AI runs the supply chain from production to packhouse to point of sale. A virtual fresh produce merchandiser sees and understands everything that's happening in the plants' roots, in the packhouse grading lines, in the sea-bound containers, and on the shop floor. And as data flows from farm to shelf and back again, that supply chain has the potential to become a unified entity with its own intelligence.

Smart agri plus smart logistics and smart merchandising equals a super-smart food system.

The Ctrl+Alt+Refresh button combination has already been pressed.

The system is rebooting...

Step by step

Drew Reynolds

Technical and sustainability director
Dole

Dole has trialled and implemented various AI-based tools to improve its business. Can you please summarise the various systems you have employed?

DR: The business has trialled a variety of systems across a range of business functions, including QC reporting systems, technical due diligence (document reading and comparison), ordering and forecasting, and crop monitoring and forecasting – in our own R&D field trials.



FRUIT LOGISTICA

What have been the biggest technical challenges in developing and deploying these systems, and how did you overcome them?

DR: 'Overcome' is a strong word. Like others, we are still learning. The principal issue is education and a knowledge gap in understanding the power of the available technology. There is a keen appetite, but AI is only as good as the data it is working with, and you must have good, reproducible data to get the best results. The result is a lot of small projects rather than one big-ticket paradigm shift, designed specifically for our industry. Each project currently must survive on its own merits.

What advantages can Dole gain from the data these systems generate?

DR: Currently, any advantage is limited and there will need to be a clear value to speed adoption. The initial task is to improve our historic and current data, so maximum benefit can be achieved.

Looking ahead to the next decade, how do you expect AI and other smart technologies will help improve the fresh produce business?

DR: Anywhere in the business where there are large volumes of data, AI will provide opportunity to streamline, speed up, and report. Logic suggests that crop forecasting – and matching that forecast to packaging, shipping and sales – could be revolutionary, and a far bigger win than small step changes in QC reporting and technical document review. But fresh produce is very traditional, and culture takes a long time to change. ●

Data drive

Kaye Hope
COO and co-founder
Farmable

Can you summarise how Farmable's technology works, and who it is aimed at?

KH: Farmable is farm management software designed for the fresh produce industry. We offer a solution for both the grower and the fresh product supply chain. We started with the needs of the grower which we believe to be the key to tech adoption. With a tool that is well adopted by the grower, we can offer timely, complete data directly from the farm packaged via APIs to many different players across the supply chain. We are proud to have an app growers actually use.

Fresh produce farms from 30 different countries use Farmable to save time on record-keeping and ensure compliance with standards like GlobalGAP. The grower app is priced at €349 per year, making it an affordable solution for commercial farms of any size, even in Europe where commercial farms might only be 10 hectares.

Are fresh produce growers adopting the technology?

KH: Absolutely. On average, fresh produce farms are creating 89 crop treatments per season with the Farmable app including live GPS tracks and GlobalGAP compliant spray logs.

How can you easily get harvest estimates for apples into a packhouse or marketing desk?

KH: Organising time-sensitive data across a large number of farms is a major challenge for the fresh produce supply chain. Farmable allows vertically integrated farms, processors, distributors and cooperatives to access well-organised farm data and easily integrate it into their existing systems. That means real time production data at the fingertips of marketing desks; well-organised crop treatment records for compliance audits, such as GlobalGAP and more; and aggregated pesticide usage data and water consumption for sustainability reporting such as the CSRD. Farmable APIs can connect to existing ERPs like Famous Software and packhouse tools like Provision so the farm data flows quickly and easily.

What have been the biggest technical challenges in terms of deploying your technology? How have you overcome those challenges?

KH: There are two challenges native to the agricultural industry that make it difficult to offer low-cost software direct to the farm. Firstly, chemical manufacturers primarily build digital tools for agronomists reselling chemicals, not the farm manager. I am all for agronomists having

digital tools. What I disagree with are digital tools designed for agronomists being mandatory for growers to use in order to receive service from an agronomist. This becomes a problem when the tool is not designed for the grower's use. It creates a bad impression for a farm manager over what agtech can do, when they are forced to use a tool that wasn't designed for them as the primary user. The result is farm managers either having data split across multiple apps or giving up and going back to paper notebooks.



Kaye Hope, Farmable

To overcome this, we have built the necessary APIs so that we can easily connect with agronomy tools to take in crop recommendations and deliver them via the Farmable app. We want the farm manager to be able to keep all their farm records in one, user-friendly, independently owned farm management app.

Secondly, distribution costs in the agriculture sector are traditionally high. You pay salespeople to attend conferences or resellers to drive to the farm. Luckily, this is changing. Just look at the data around farmers purchasing their inputs online. Currently, 26 per cent of European farmers prefer online channels for input purchases as of 2025, according to *iGrow News*. We see more and more growers looking for the best orchard management software and finding a farm management app such as Farmable that is free to download and try. Growers will have an increasing choice of independent, affordable solutions for their record keeping.

What impact is your technology having on fresh produce supply chains? What advantages, benefits, and ROI can users expect if they adopt your tools?

KH: The amount of compliance legislation for the fresh produce industry is not slowing down. How can you ensure IPM compliance by growers? How do you calculate water consumption from suppliers for CSRD compliance? And how will farms, wholesalers and retailers comply with the EU's digital record keeping legislation for pesticide applications (regulation EU 2023/564)? There will be a huge shift for both farms and the fresh produce supply chains on 1 January 2026. Many fresh produce cooperatives and agronomy teams will feel an obligation to ensure their hundreds or even thousands of suppliers are compliant with the digital pesticide record keeping legislation in Europe.

Our advantage is that we offer an affordable solution that is easy to implement, whether you are an individual grower or fresh produce agribusiness that wants to support growers in their compliance with digital pesticide record keeping. Beyond the compliance benefit, typical upsides for Farmable customers include the fact that commercial growers save up to 2-3 hours in administration effort for every crop treatment application; packers/processors and distributors get timely data that ensure they staff operations correctly; marketing desks secure sales contracts with more confidence because they have today's production numbers at their fingertips; and retailers can easily collect data for CSRD purposes and validate that their suppliers are GlobalGAP compliant, have digital pesticide records and even meet IPM compliance.

How will AI and smart agriculture help with sustainability goals in the fresh produce business?

KH: Applications of AI in the fresh produce business aren't new. In the orchard, there are many examples of AI being applied to improve disease forecasting and yield prediction, which help grow more food with fewer interventions. TrapView is an example of an AI-powered solution for pest management and Aurea Imaging is one of several solutions for blossom mapping and yield prediction for fruit teams.

At Farmable, we developed an AI integration early in 2025 called the AI Healthcheck. Farmable users can ask questions such as, 'How can I manage apple blight in my orchard?' and receive a response in the context of their own farms using historical scouting notes and pesticide applications to make better decisions. The secret ingredient here is well organised data. Earlier this year, we launched an AI integration and carried out a pilot with our customers to test AI-assisted decisions on the farm.

We already see that the growers who have more than one year worth of data tracked in the Farmable app can get valuable insights on their yield estimates by using AI integration and well-organised data. This encourages and motivates growers to keep good digital records and have affordable access to insights without necessarily having to invest in expensive hardware or services.

The platforms that will succeed in this industry will be using AI to improve access to the right data at the right time, and help producers grow more with less. There is a lot to look forward to. 

Waste away

Elad Mardix
CEO and co-founder
Clarifresh

Where in the fresh produce business is Clarifresh tech now being used?

EM: Our software has made a major step forward in the last 12 months as the industry continues to digitalise and adopt AI into its supply chain management processes. We have an active presence in key produce markets, especially across North America, Latin America, western Europe, South Africa and the Pacific. Our software covers all produce categories and is being utilised by multiple, large wholesalers in North America, but we've seen most growth in the berry, grape, apple, citrus and greenhouse vegetable verticals.

What have been the biggest technical challenges in terms of deploying the technology? How have you overcome those challenges?

EM: The biggest challenge is not technical, but the rate of adoption. Given the industry has experienced continuous challenges over the last five years, from Covid to tariffs, we see great excitement about adopting new tech that can double inspector productivity and reduce waste by 20 per cent. Adoption within an organisation is gradual and it takes two to eight quarters to fully adopt our software across all QC value chains.

What impact is Clarifresh having on fresh produce supply chains? What advantages, benefits and ROI can users expect if they adopt your tools?

EM: The impact is primarily twofold. Doubling inspector productivity and expanding sample size by 50-100 per cent. And reducing previous year's waste or claims by 25-35 per cent, driven by higher objectivity of inspections and fewer errors, standardisation of QC across all inspection points, and significant expansion of sample size that enhances accuracy of assessment. We've seen those stats come out from three different customers across North America and Latin America in the last nine months, including leading citrus, grape and berry exporters.

What do you believe AI can do to help the fresh produce business become more sustainable?

EM: Such technologies can help with greater transparency, the earlier ability to identify errors, and real-time actionable insights to optimise decision making. In our case, the biggest contribution is in waste reduction. Our customers save millions in claims and rejections by standardising their QC through deployment of Clarifresh. ●

Store credit

Marcin Pędzsiz
Regional sales manager
Hectre

Hectre has developed various tools to help growers and packers. Can you please summarise the various systems you offer?

MP: At Hectre, what we really focus on is making life easier for growers and packers, while also helping them cut costs. We know margins in the fruit business are tight, so every decision counts. That's why we've built tools that cover the whole journey of the fruit from the orchard to the packhouse. Our Fruit Quality AI, with solutions like TopDown, lets packers capture thousands of fruit samples in seconds. That means they know straight away what size and colour grades they're dealing with, so they can plan pack runs better, manage storage more effectively, and avoid costly mistakes.

In the orchard, our Perform app gives managers real-time visibility on picker performance, fruit quality, and even costs per kilo. Instead of waiting until the end of the day, they can spot issues instantly, make quick adjustments, and run harvests more efficiently. That's a big win when it comes to labour costs. And with our new Receiving Module, managers finally get a single source of truth for everything coming into storage. It connects intake logistics with quality data, so they know exactly what's in each room without double-handling or errors that can cost money down the line.

The key is that our tech is powerful, but also really simple to use. Whether it's a grower snapping photos in the orchard or a QC team at intake, the data is instant, clear, and helps them make better decisions. In the end, it's about improving quality, boosting efficiency, and saving money.

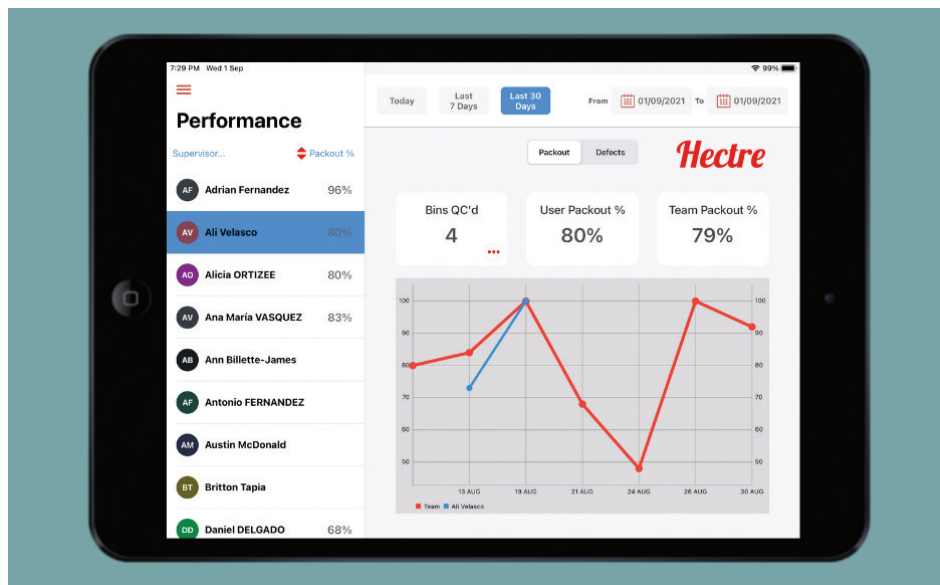
What technical challenges have you faced along the way?

MP: One of the biggest challenges has been making advanced AI technology work reliably outside of controlled environments. Traditional sorting machines and many AI systems are designed to operate in clean, stable conditions with consistent lighting and setup. Orchards and packhouses are the opposite – light changes constantly, there's dust, fruit comes in from different backgrounds, and people are working under pressure.

Early on, that was a real test for us. We overcame it by working hand in hand with growers and packers during development. Our engineers weren't just in the office, they were in the orchards and at intake sites, testing, learning, and adapting the models to real-world conditions. That's how we built Fruit Quality AI that can accurately measure size and colour grades, even when the

environment is far from perfect. Another challenge was ensuring simplicity. Technology is only valuable if people actually use it. We invested heavily in design and training so that pickers, QC teams, and managers could get started quickly without slowing down operations.

We also faced the challenge of very different market models. The US industry operates in a completely different way to, say, Italy, where the cooperative model brings another set of needs. Our solution had to be flexible enough to deliver value to both small family growers and some of the largest fruit groups in the world. That flexibility has become one of our biggest strengths, creating benefits for every type of production system. In the end, overcoming these challenges has been about two things: staying close to our customers, and never forgetting that technology must adapt to the people and markets it serves, not the other way around.



How is the data generated by Hectre systems used for decision-making across the supply chain – from orchards, via packhouses, to market?

MP: The data our systems generate give growers and packers visibility they've never had before, and that changes the way decisions are made at every stage of the supply chain. In the orchards, managers and growers can see fruit size and colour development in real time. That means they can make smarter calls about when to harvest, how to allocate labour, and even predict the type of fruit they will be sending to the packhouse. Importantly, they can also intervene immediately if the wrong fruit is being picked. For example, it allows them to avoid harvesting fruit without the right colour, which for club varieties can reduce profits by up to 70 per cent. The same applies to size – fruit below the required thresholds is left on the tree, protecting margins and ensuring higher returns for growers.

At the packhouse intake, we deliver thousands of fruit samples in seconds, giving an instant picture of what's actually arriving. Managers can use that data to decide how to organise pack runs, which fruit to prioritise, and where to direct different grades, reducing waste and improving throughput. From there, the data flows into storage and sales planning. Knowing exactly what size and colour profile you have in each room allows teams to match supply with market demand

more accurately, and to target premium opportunities instead of reacting late. For the market side, this means exporters and sales teams can provide buyers with a clearer picture of the fruit available. That builds confidence with retailers and distributors, reduces surprises, and supports better pricing. The common theme is timing. Instead of waiting days or weeks to understand fruit quality, our customers have that clarity instantly. That allows them to act faster, reduce costs, and capture more value from every crop from orchard to market.

What impact is your AI tech having? What kind of advantages, benefits and ROI can growers and packers expect if they adopt Hectre's AI tools?

MP: The impact we're seeing is very tangible. Our AI isn't just producing data, it's changing the way fruit businesses operate day to day. Take the example of large cooperatives. By using TopDown at intake, they're able to capture thousands of fruit samples in seconds and immediately know the size and colour distribution of the harvest. That allows them to align storage plans with market demand right from day one, instead of discovering mismatches weeks later. The result is less fruit downgraded, fewer surprises in the packhouse, and higher margins from the same crop.

For growers, the return shows up in better picking decisions. Having real-time size and colour data means they can avoid harvesting fruit that doesn't meet the programme specs which can make the difference between hitting premium contracts or losing value. Packhouses also gain efficiency. With intake data instantly available, they can streamline pack runs, cut unnecessary handling and reduce labour costs tied to re-sorting. The ROI comes in different forms, depending on the business: higher grower returns per hectare, reduced waste in the packhouse, more accurate storage management, and stronger sales planning.

How does Hectre adapt its AI tools for different crops, climates, and producer sizes?

MP: Fruit growing isn't the same everywhere. An apple cooperative in Northern Italy, a cherry producer in Chile and a family orchard in Washington all face very different realities. Crops behave differently, climate changes the way fruit matures, and even the business models like the cooperative system in Europe versus the private grower-exporter model in the US create different needs. That's the real challenge for technology. Most AI systems are designed for controlled environments, but orchards and packhouses are messy, fast-moving, and unique to each region. From the beginning, we knew that if our tools weren't adaptable, they wouldn't survive in the real world.

So we designed the APP to be flexible. For apples, accuracy in size is critical to planning pack runs and storage. For cherries, it's colour grading that drives value. For citrus, it might be intake speed and inventory visibility. The core engine is the same, but the way we deploy it is tuned to the crop and the local needs. Scale matters too. A small grower with 10ha doesn't need the same setup as one of the world's largest cooperatives managing thousands of bins every day. That's why our tools can work on a smartphone in the orchard, or as part of an integrated intake system in a packhouse.

How do you see AI and smart agriculture helping with sustainability goals in fresh produce?

MP: I see AI and smart agriculture as essential to reaching sustainability goals in fresh produce – but only if they're built on high-quality data, not just pushing more production. Consider PlantVoice: this technology places tiny sensors directly into plants, reading sap flow and internal stress signals to catch early physiological problems. Instead of waiting for external symptoms, growers can intervene earlier, using less water, fewer pesticides or fertiliser, and avoiding yield losses. From our side at Hectre, the impact is showing up across multiple sustainability fronts.

Firstly, it cuts waste: With real-time size and colour data, growers can stop the harvest of fruit that won't meet specs, thereby avoiding having that fruit downgraded or thrown away downstream. Secondly, it helps cut chemical inputs. When you know precisely which fruit or which zones need attention, you can localise interventions instead of blanket spraying. That reduces fungicide, pesticide, or nutrient overuse. It also results in energy savings in coldstorage. Because the intake data flows into storage planning, you no longer need to over-chill or buffer rooms blindly. You can optimise cooling based on actual fruit profile, reducing energy consumption. Finally, it cuts water usage: In orchards, combining plant-level sensing (as PlantVoice does) and field-level data lets irrigation follow precise needs, not guesswork. This avoids overwatering, runoff, and waste. ●

Crowd control

Nico Broersen
Chief executive officer
Agriplace

Where in the fresh produce business is Agriplace tech now being used?

NB: Agriplace is used almost everywhere in the fresh produce sector, with users in more than 140 countries and over 700 companies tracing their supply chains through the platform. We have paying customers in 24 countries, with the largest concentration in Europe, where compliance requirements from retailers and the wave of new legislation make supply chain transparency essential. Through the platform, information from over 170,000 producers is managed, covering nearly 90 per cent of all GlobalGAP-certified fresh produce worldwide. This critical mass allows us to provide insights at scale while reducing duplication for suppliers. A growing number of producers are also joining via free accounts, further expanding the network and making it easier for companies of every size to collaborate on shared compliance goals.



Nico Broersen, Agriplace (centre)

What have been the biggest technical challenges in deploying this technology?

NB: The greatest challenge has been dealing with the fragmented, unstructured data that most companies start with. Supplier information is often scattered across emails, spreadsheets and documents in different formats. Transforming this into structured, usable supply chain data is no small task. To tackle this, we combine people and technology. Our team actively supports customers in preparing and cleaning their data. Many clients describe us as a “data cleaning service” in the beginning, because we roll up our sleeves and make sure the foundation is right. Once the system is live, however, the platform automates ongoing collection and maintenance, ensuring data stays

reliable without manual effort. On top of this, we leverage AI to quickly scan and extract relevant data from documents, reducing what used to be weeks of manual work to just minutes. This combination of human expertise and automation not only gets companies started more quickly, it also ensures their supply chain data remains structured and trustworthy in the long run.

What impact is Agriplace having on fresh produce supply chains? What ROI can users expect?

NB: Agriplace provides immediate gains by simplifying compliance and supplier management. Customers typically see:

- Around 90 per cent fewer documents that require manual review
- Supplier response times that are 40 per cent faster
- Up to 70 per cent time savings in collecting and checking supplier data

For quality and sustainability teams, this translates into tangible financial returns, ranging from €25,000 annually for smaller traders to over €400,000 for larger organisations. But the true impact goes beyond efficiency. The fresh produce industry is entering a new era, where compliance is no longer just a requirement but a license to operate.

With legislation such as the CSDDD on the horizon, companies will face growing pressure to consolidate their supplier base and select only those partners who can prove they are low risk. This means that if businesses cannot demonstrate product-market and client fit through reliable compliance and sustainability data, it will become increasingly difficult to compete. By using Agriplace, companies are not only saving time and money, they are future-proofing themselves. They ensure they remain trusted suppliers in a market that is becoming more selective, more transparent and more focused on long-term sustainability.

How do you see AI and smart agriculture contributing to sustainability goals?

NB: AI has an important role to play in enabling the fresh produce sector to reach its sustainability goals. It excels at handling repetitive, rule-based tasks that are difficult and costly to manage at scale. By automating document checks and data processing, it frees up valuable time for people to focus on what truly drives change in supply chains. At the same time, compliance and sustainability are not problems that can be solved by automation alone. They require context and empathy. Context means understanding how regulations apply in practice, making decisions in areas that are not black and white, and weighing risks against opportunities. Empathy means recognising the realities suppliers face, from smallholder farmers navigating complex standards to businesses under pressure to make progress on multiple fronts.

AI should therefore be seen as an enabler rather than a replacement. It takes care of the repetitive and binary tasks, while people focus on building trust, supporting suppliers and advancing sustainable sourcing. Together, this combination allows the industry to move faster, become more resilient, and ensure that the fresh produce supply chains of the future are not only compliant, but also fair and sustainable. — ●

Internal insights

David Kat
VP business development
Neolithics

Can you summarise how your technology works, and who it is aimed at?

DK: Neolithics offers a non-destructive produce quality inspection solution that is fast, high-throughput, and accurate. Providing unique internal quality insights (Brix, acidity, firmness, defects) with external imaging, the scanning device assesses fruit quality and defects at production scale. These insights, for the entire supply chain, power consistent product quality, an improved user experience, and increased yield. Applying accurate, AI-powered quality insights across the supply chain – from farming decisions to QC, grading, sorting, packing, and customer experience – can significantly improve business outcomes. Internal insights are crucial for the future of supply chains.



David Kat at Fruitnet Berry Congress

Where in the business is the tech being used? In which countries, and in which products?

DK: It is being used by avocado growers at source (Israel) and packers at destination (the UK and the Netherlands); and by blueberry growers at source (Peru) and packers at destination (the US); as well as by a dried fig processor in Spain and a garlic packer in Germany. Neolithics has working models for over 20 crops, with rapid model development making use cases highly attractive for production volume and hyperspectral analysis. Applying accurate quality insights across the supply chain – from farming decisions to QC, grading, sorting, and packing – can significantly improve business outcomes and help ensure a consistent customer experience. Granular quality insights are crucial for the future of supply chains.

What have been the biggest technical challenges in terms of deploying your technology? How have you overcome these challenges?

DK: The food system depends on high-level quality data, yet this is typically gathered from small, manual and destructive samples that are extrapolated to represent entire batches. These inspections – while practical given the sheer volume and low unit cost of produce – often result in significant quality-related losses throughout the value chain. For example, apple storage can see losses of 10 per cent or more of total volume. And in crops like avocados and soft fruits, we see preventable downcycling, retail claims, and inconsistent quality. The food system accepts that and pays dearly: 40 per cent of all produce is never consumed, seriously affecting margins and availability. A paradigm shift to a more efficient, data-driven food value chain is needed. And as the International Fresh Produce Association calls for a ‘Supply Chain of the Future’, we are seeing more and more industry leaders getting on board with this.

What impact is your technology having on fresh produce supply chains? What advantages and ROI can users expect if they adopt your tools?

DK: In September, The World Economic Forum published an end-to-end supply chain analysis using a digital twin of an individual fruit in a container. The research showed a 17 per cent reduction in food loss, a 17 per cent reduction in greenhouse gas emissions, and 15 per cent faster quality inspections. And since the packer is able to grade more fruit as premium and reduce under-classification (with fewer false negatives), revenue per batch increases significantly.

How can AI help the fresh produce business achieve its sustainability goals?

DK: The broader adoption of Neolithics’ technology offers significant opportunities for the food system. Enhanced traceability is achieved by testing every batch, making it easier to track produce from farm to consumer and ensuring food safety compliance. The comprehensive digital data feedback loop enables ongoing analysis, helping producers and distributors make data-driven decisions that improve long-term quality and sustainability. By preventing unnecessary food waste – through both more efficient sorting and by matching produce to its optimal end-use – Neolithics supports a circular food system that prioritises resource optimisation and waste prevention. This not only addresses environmental concerns, but also aligns with consumer demand for sustainable products, ultimately driving profitability and resilience across the food value chain. ●

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FRUIT LOGISTICA is the world's leading trade show for the fresh fruit and vegetable business. The event covers every single sector of that business and provides a complete picture of the latest innovations, products and services at every link in the international supply chain. It also offers superb networking and contact opportunities to key decision-makers in every area of the industry.

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FRUITNET is the world's leading publisher and congress organiser for the global fresh fruit and vegetable business. As the only media provider that can deliver informed coverage of the entire industry, its aim is to help the fresh produce business to grow worldwide by providing useful information and insight via a range of media channels. It is the official cooperation partner of FRUIT LOGISTICA and ASIA FRUIT LOGISTICA.

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